Farmer engagement in variety testing and evaluations provides crucial information for breeding strategies in Mali

Krista Isaacs, Eva Weltzien, Mamarou Sidibe, Baloua Nebie, Samuel Guindo, Fred Rattunde; Ibrahima Sissoko
ICRISAT

The objective of participatory plant breeding is genetic plant improvement with close farmer to researcher collaboration. Despite this intentional process of creating and learning with farmers, different actors in the process may be marginalized or left out of trait targeting due to the cultural context and depending on the methodologies used. In Mali, men and women play different roles in sorghum production, and their responsibilities depend on if it is planted on family land or women’s individual plots, and on household responsibilities such as food preparation. As such, the sorghum breeding program at ICRISAT has incorporated end-users at multiple stages through an iterative process of setting breeding objectives and generating and assembling new variability for relevant and preferred traits based on farmer feedback and evaluation sessions. In order to ensure that various end-users preferences and needs are met in the breeding program, specific activities were designed to include men and women. At the testing and evaluation stage, replicated on-farm variety trials are conducted each year across multiple environments and gender disaggregated discussion groups on selection criteria and in-field evaluations are conducted. Yield and evaluation results are presented to farmers, and varieties are selected for culinary tests. These culinary tests were designed with women to identify key grain quality attributes necessary for To (a traditional food). The ease of decortication, flour and grit yield, consistency, taste, and the color of the To is evaluated each year. Culinary test results from 2007-08 with the same varieties indicated that improved varieties varied greatly in the ratings tasters gave them, and these ratings are not the same across different locations. Three qualities, taste, consistency, and color were of essential importance, although taste was the best predictor (91%) of the global score. Based on these differences, culinary tests continue to take place each year and grain quality is a key selection criteria. An additional stage, in which individual farmers compare multiple varieties with a local check, provides increased opportunities for identifying production constraints, as well as sharing and diffusion of seed. An analysis of 256 on-farm trials (2016 plots) conducted in 2011-12 with fertilizer and without, showed challenges in the variety needs of men and women. Comparing hybrid varieties to local varieties with no fertilizer, men and women’s plots had similar yields. But with hybrids and fertilizer, 85% of men benefited from fertilizer use compared to only 55% of women, and 65% of men had 500 kg higher yield than women. Only at the high end of production did men and women benefit equally from hybrid varieties while 100% of women had increased yields from a local variety and fertilizer. These findings clearly show men and women have different production constraints and needs and this information feeds back into future breeding and research objectives. These gender-focused ongoing evaluations generate evolving information for breeding objectives and have contributed to increased adoption of improved varieties in Mali.
**Mola case study: the genetics of a nutritious small fish in Bangladesh**

Cynthia McDougall, Shakuntala H. Thilsted and John A. H. Benzie

*WorldFish, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia*

Mola is a small indigenous fish found in South Asia that has high levels of micronutrients (calcium, iron, zinc and vitamin A). In Bangladesh, the fish is raised in ponds that are used to produce cash crops of large carp over one to two years, and the small mola, with an age of maturity of three months are cropped throughout the year for consumption by the family. Although the fish are often maintained over several years in culture, they are common in seasonal ponds and are introduced by floodwater or by humans to isolated water bodies.

A gender-disaggregated study by the University of Copenhagen in 2001 highlighted fish preferences of women in Bangladesh in relation to health outcomes and indicated a strong interest of women in mola, in particular for its ability to protect eye health. A further study indicated that despite a high household preference for mola, availability, accessibility and intra-household dynamics were barriers to consumption. Research by WorldFish and others demonstrated that mola survive in a different ecological niche than carp, and that carp-mola polyculture can enable higher total production as well as a high nutritional quality. Responding to these insights, since 2011, a focus of WorldFish work in Bangladesh was on scaling of these carp-mola polyculture systems and on the enhanced stocking of mola in wetlands to increase the availability of mola.

With this foundation laid, in 2013, discussions between a WorldFish senior nutritionist and senior geneticist raised the issue of genetic improvement of mola to further enhance availability and potentially improve the nutritional value of the fish. The interdisciplinary discussions identified that the manner in which mola is reared in the farming systems (e.g. annual introductions, and enhanced fishery for large parts of production) does not lend itself particularly to an application of a pedigreed breeding program, but would require genetic management (i.e. to maintain diversity). As such, in 2014, the Livestock & Fish and CCAFS CRPS began work to characterize this important genetic resource in Bangladesh to understand what management may be required and to develop tools to assess whether mola is adapting to climate change and the farming systems in which they are being used. This project will assess the genetic constitution of mola in different places and at different times using molecular markers and analyse the association of these with measures of nutritional value (i.e., the variation in nutritional value in relation to the genotype of the fish). This will provide the basic information needed to establish the nature of genetic variation present in the farming systems, and allow the development of strategies for its maintenance and the possible utility of introducing breeding programs. The principle output will be a strategy for the genetic management and future utilization of mola genetic resources.
Cooking banana (Matooke) is a valuable crop in the livelihoods of many smallholder farmers in Uganda as a major food staple and cash crop. However, banana productivity has been on a decline due to many factors including pests, diseases and weevils. Breeding new varieties is generally considered as a feasible strategy to such constraints and contributing to the current global discourse on food and income security and overall agricultural development. The Banana research programme in Uganda initiated breeding activities for new matooke varieties that largely followed a conventional approach. During the planning stage, gender analysis was not done to gain a complete picture of who was most affected by the observed problems and identify gender needs, preferences and opportunities as a necessary step to address potential constraints to adoption. The focus was mainly on technical aspects of high yield (measured by big bunch) and resistance to pest and disease. With early maturing, drought tolerant and high yielding varieties, breeding aimed at addressing food security challenges that remains more of a woman’s role in most households. However, pertinent gender-differentiated preferences and needs become more visible during participatory on-farm evaluation and selection. Sensory and consumer acceptability evaluations were conducted with both men and women to identify their preferences. Though men were interested in a big bunch that they could easily sell in market, women preferred a new matooke variety with rich flavor, soft texture and deep yellow colour when steamed. In addition, 78% of the matooke hybrids were observed to have low heat retaining capacity which made the food harden very fast when served. The hybrids required prolonged cooking time to soften the texture hence need for more labour time to gather fuelwood which became an additional challenge to the already overburdened women. As a result of the gender-specific needs that emerged, only one matooke hybrid out of 18 promising hybrids evaluated was released in 2010 and this has been promoted country-wide. Although men are reluctant to produce matooke hybrids due to low market demand, women who take primary responsibility for food provision in their households are gaining interest in the variety by tailoring it to their conditions. Women continue to innovative on its diverse utilization especially on preparation and cooking methods that enrich texture and flavour. The gender-differentiated preferences have led breeding efforts to refocus on integrating traits that meet men and women specific needs in the characterization and prioritization of new matooke varieties. For instance, new matooke hybrids are currently evaluated for sensory attributes before yield, pest and disease evaluations are conducted. Also, women panelists are involved in the preparation of the samples for sensory evaluation to capture attributes like ease of peeling, colour changes before cooking and stickness of the sap after peeling. This is expected to serve as a motivating factor to enhance uptake by end-users. There are prospects for the application of genomic selection in matooke breeding however, the tools like QTL mapping and models for predicting the breeding value of the parents are under development.
Participatory breeding and gender role in cañahua, a NUS Andean Grain crop in Bolivia
Juan Pablo Rodriguez a, PhD, Felix Mamani b, PhD
a University of Copenhagen, Denmark, jprodriguezcalle@yahoo.fr
b Universidad Mayor de San Andrés, Facultad de Agronomía, Bolivia, prograno@yahoo.es

This case study is based on the development and achievements of a participatory plant-breeding (PPB) program in Andean Grains, specifically in cañahua (quinoa cousin plant species) that was implemented in Bolivia from 2002 to 2007 by Programa de Granos Andinos (PROGRANO) of the Faculty of Agronomy, UMSA. The breeding process worked successfully through Participatory Breeding. Cañahua is a not well promoted like quinoa. Albeit is an environmental resilient and high nutritious plant. It is grown in traditional cropping systems in the Bolivian Altiplano. Farmers cultivate their own cañahua landraces with low seed yield. Consumption of cañahua seed is part of nutritional food security and can contribute with incomes for rural households. PPB was carried out to improve seed yield by selection and participatory evaluation in two plant type of cañahua (semi-prostrate ‘Lasta’ and erect ‘Saihuá’). The process of breeding started with selection of best seven cañahua selected lines (3 Lasta and 4 Saihuá types) from the Germplasm Bank conserved by PROGRANO. Gender participation (women and men in any cases young) was worth to evaluate the performance of cañahua lines. Gender differentiated preferences were for women in flowering (i.e. plant shape and plant colour) and physiological maturity (i.e. seed setting, seed colour, seed size) phases and post-harvest activities. In contrast, men only identified and preferred cañahua according to plant shape (i.e. erect growth type) because were easier to make weeding. Women preferences were seed appearance and this option were included during the participatory evaluation of the seven cañahua lines. Women were interested in gastronomy and pastry, because they can use the cañahua seed flour ‘pito de cañahua’ in cakes and sell them. Improved cañahua cultivars and advanced lines with high seed yields are prospective to foster and improve: incomes in rural households, nutritional community food security and benefit by extra incomes. PPB in cañahua included mainly women in the amelioration of cañahua due their interest in food products. Women could be benefited with improved cañahua and food products (i.e. cakes) using cañahua flour. Besides, it helped in the income of rural household. Furthermore nutritional community food security was strengthened by participatory workshops on the use of cañahua flour in 38 rural communities of Bolivian Altiplano.
Towards improved gender-responsive bean breeding: Lessons from bean improvement
Enid Katungi, Stanley Nkalubo, Clare Mukankusi, Paul Aseete
International Centre for Tropical Agriculture, Ugandan National Agriculture Research Organisation

In the context of changing climate, growing population pressure and urbanization, food supply is at risk. Plant breeding to enhance crop adaptation to the changing physical and social environment is part of the solutions to mitigate this risk and ensure food and nutrition security especially of the poorer households. Over the years, donors have been devoting resources to strengthening the capacity of the breeding programs in developing countries so as to enable them respond to these emerging challenges. The breeders have been equipped with tools for modern day breeding that offer them opportunities to speed up the process of developing new crop varieties. However, there has been low emphasis on the gender integration in most breeding programs, especially in early stages that greatly influence the kinds of crop varieties developed and their adoption by the target groups.

This case study shows strategies used in the bean breeding to enhance gender integration at various stages of the process. The inclusion of a participatory rural Appraisal (PRA) at the beginning of each breeding program has been promoted in the AGRA funded breeding scholarships that has so far produced more than 80 African breeders currently into the workforce. Most bean breeding programs have adopted farmer participatory variety selection (PVS) for integrating the formal and informal seed systems. This is implemented by involving men and women in relatively downstream selection of advanced lines or finished varieties. However, PVS is unable to detect preference for implicit traits or guide breeding on the levels of traits that meet the needs of users. A survey based ex-ante analysis of gender differentiated preferences and profiling of farmers is included to complement PVS especially in the early stages of process.

A choice experiment method was used to investigate men and women preferences related to common bean (such as yield, tolerance to environmental stresses, maturing period, cooking time, taste and seed price) and examine trade-offs between traits and heterogeneity in preferences among target users. The traits and their levels were selected by the social scientists and breeders in consultation with key informants from targeted communities to make choice sets as realistic as possible and minimize biases. Choice data was elicited from men and women respondents in 850 households selected through a stratified random sampling from the drought prone areas of Kenya and Tanzania in 2012.

The study revealed information on important traits (Katungi et al., 2015) that were never captured through PVS thus opening new frontiers for breeding and post-harvest research. It was found out that men and women farmers derive their highest utility from reduced cooking time and that there is significant heterogeneity in farmers’ preferences that justify targeted breeding. Younger and relatively more educated women are likely to derive higher utility from reduced cooking time than those that are older, less educated rural based women. Spin-off research is exploring reduced cooking time through industrial processing through private-public partnerships. Also on-going is the screening of popular varieties for cooking time to identify cooking time and investigate the reduced cooking time possible through breeding.
Case study of cassava trait preferences of men and women farmers in Nigeria: Implications for gender-responsive cassava variety development

Authors: Olaosebikan, Olamide1; Kulakow, Peter1; Bentley, Jeffery3; Tufan, Hale4; Madu, Tessy2; Egesi, Chiedozie2; Olanrewaju Tunji1; Rabbi, Ismail1; and Abdoulaye, Tahirou1

1International Institute of Tropical Agriculture, Ibadan, Nigeria, 2National Root Crops Research Institute, Umudike, Nigeria 3Agro-Insight, Cochabamba, Bolivia, 4Cornell University, USA

Abstract

Cassava farmers and end users are not homogeneous. This generates a need to breed for different sets of traits in cassava to match the range of end uses and users. Diverse groups of end users show varying preferences for production characteristics, processing needs, marketing demands and health/nutrient requirements. Women in particular play a critical role in cassava production, processing and marketing in Nigeria, necessitating a closer examination of how gender roles and responsibilities shape varietal choices. The aim of this study was to prioritize cassava breeding objectives to meet the diverse needs of farmers and other end users, with an emphasis on identifying and responding to the preferences of women farmers, processors and marketers.

Prior to selection of the communities for a gender study, questionnaires were administered to 2,500 households in 16 States of Nigeria during a cassava variety monitoring study. Heads of households only were surveyed in 70% of the households while the household head and spouse were interviewed in 30% of the households. Among the communities surveyed, 20 communities were selected for further gender research in Osun, Ondo and Ekiti (south-west), Akwa-Ibom, Cross-river (south-south), Kogi, Benue (north central), Imo, Enugu, and Anambra (south east) states. The study adopted mixed methods and tools. Sex-disaggregated information from adults and youth was obtained from forty focus group discussions. Data were curated and analysed using Microsoft Excel and content analysis.

About 80 local varieties and 25 improved varieties were identified from the study communities. In naming cassava varieties, farmers (men and women) usually rename improved varieties with simple names in local languages or pidgin English. Sometimes memorable numbers like 419 are adopted. Cassava variety names sometimes refer to a preferred trait of the variety. Traits types mentioned included agronomic (78%), processing (13%), products and culinary traits (7%). Agronomic traits such as high yield and early maturity commonly reflect in both improved and local varietal names like Idileruwa, Oko-iyawo. Fewer varieties are named after processing traits such as color and taste.

Women and men farmers in all regions mostly prefer varieties with high-yielding traits. Seventy-four percent of participants refer to yield as many, big roots especially when the cassava tolerates poor soil. Men farmers want early maturing varieties (25%) for quick income, while women farmers want early maturity to reduce weeding costs and labor. The late maturing varieties are preferred because they can store well in the soil, for two years or more providing for food security and collateral for loans.

Men farmers have an idea that some processing traits such as color are important. For instance, both white and yellow colored roots serve different end uses, products and market niches. Unlike men, women are keenly aware of major processing and agronomic traits. Most of the women respondents believed that the cropping season and age of the crop largely determine processing traits rather than crop variety. For example young cassava roots are easier
to peel during the rainy season. Cassava processors (mainly women) need cassava that is easy to peel. This is by far the most important gender difference.

Women and men farmers in all regions may be looking for a basket of cassava varieties with different traits that may not be contradictory but complementary. For instance, both genders in all regions expressed a demand for non-bitter (poundable) cassava, but some communities (in all regions) are under pressure from Fulani cattle herders and might also want some bitter varieties that cattle will not eat. Varieties with yellow roots may find a place alongside white varieties, because a household or a community needs some different types of cassava. Farmers may need a mix of early and late maturing, durable varieties. Nigerian end users expect all or most of their varieties to be versatile, to serve for most of the food products made from cassava.

There is rapid uptake of improved varieties by men and women farmers for their agronomic qualities. Farmers in all regions are eager to adopt more improved varieties if planting material was more widely available for both genders. However, accessibility of planting material to women farmers is important as the majority cultivate smaller portions of land compared to men who have a stronger network to access planning material and inherit larger portions of land.

Involvement of farmers in naming a new improved variety prior to its release should be encouraged by breeders to sustain farmer’s interest in adoption of new varieties. Breeding for gender responsive cassava varieties that are easy to peel, should be considered as a cost-effective and appropriate alternative in addition to introduction of easier cassava peeling tools or mechanical peelers suited for women farmers. Genome assisted breeding methods with markers linked to peel thickness or ease of peeling can assist selection of new varieties.

Key Words: Breeding, Cassava varieties, Gender, Trait preferences, Nigeria
The current Chinese government policy discussions around "Eco-civilisation", or “Ecological and sustainable agriculture " are all part of the same thinking about transition. The green revolution model has reached to its limit and resulted in many problems! The rapid disappearance of biodiversity and landraces is one challenge. At same time, feminisation of agriculture is increasing and women is playing dominant roles in farming now. The key questions are, what are the key trends in farming and what are women farmers’ roles and interests. What are the ways to enhance biodiversity at same time the power of women farmers? This paper is based on the baseline study of a project “Smallholder Innovation for Resilience”, and related PPB action research aiming to present the key findings and suggestions in this area.

The baseline study conducted in Yunnan and Guangxi provinces in SW China from January 2013 to July 2014. It focused on two main areas: i) trends in livelihoods, biodiversity, social capital and climate Change in the last 20 or 30 years, and ii) innovations developed in response to these trends, and the people, institutions, networking and community factors that supported/enabled the innovations. The baseline study included two major parts, i.e. qualitative study and quantitative study.

The study revealed that despite considerable socio-economic challenges e.g. increasing biodiversity lose, male migration etc, in Southwest China, and despite climate change further exacerbating these challenges, farming communities and women farmers are finding coping strategies through the technical, institutional and market innovations. Communities, in which women are the leading force, are conserving and improving drought-tolerant landraces of maize, wheat and rice, and select varieties for a diversity of planting times. We further observe how farmers switch crops and change cropping patterns to remain resilient in the face of drought. Spurred by market demand for healthier chemical-free food production, farmers are reintroducing previously-abandoned traditional farming techniques and crops, as well as experimenting with new crops, for soil conservation and natural pest con

An important supporting structure for these technical innovations is the participatory plant breeding (PPB) mechanism for farmer-breeder collaboration on landrace conservation, seed selection and improvement and breeding as well as the farmer seed and traditional knowledge exchanges. Finally, farmers are linking with urban areas in news ways, finding new market channels for their goods through community support agriculture.

We argue that efforts to support climate resilience in these communities should prioritise strengthening their biocultural heritage system and women empowerment. More support is needed to biodiversity conservation and PPB for enhancing women’s roles, their interest and expertise and ultimately working towards a community-led, gender sensitive systematic collective innovation process.