

# NEW LIGHTS ON PARTICIPATORY PLANT BREEDING IN CUBA

H. Ríos<sup>✉</sup>

## CONTEXT FOR PPB APPEARANCE IN CUBA

The socialist field standstill caused a significant depression in our national economy and substantial conception changes in food production. Over the 90's Cuba changed from a depending agriculture with high doses of agrochemicals and monoculture to a low-input agriculture. Today, we often observe huge homogeneous areas on polyculture using high biological controls, organic fertilization and horse-drawn vehicles.

Likewise, new marketing forms emerged with different arrangements, in parallel developing a higher production decentralization. Within this context, two big movements established important steps: Urban Agriculture and Popular Rice, both rose with a strong popular support.

Faced with the new situation characterized by the lack of inputs, environmental and socioeconomic variations among farms significantly intensified in Cuba. The conventional breeding system and the one of varietal spreading confronted serious limitations to accomplish its goal in front of the new and diverse agricultural situation in our nation.

Over this context, Participatory Plant Breeding (PPB) as a complementary strategy in Cuba introduces the concepts of participation and decentralized management of plant genetic resources, reevaluating local learning as a developing choice. In our country, PPB emerges as an alternative to relieve the hard economical situation.

## 2000-2003: FIRST STAGE OF THE CUBAN PARTICIPATORY PLANT BREEDING PROJECT

The first stage focused on evaluating the possibility of increasing yield based on diversification and formation of Farmer Research Groups. Thus, two contrasting environments were selected:

- a) "El Tejar-La Jocuma" community, La Palma, Pinar del Río, with a heterogeneous environment of low productive potential. Participants were not dependent on formal seed systems.

- b) "Jorge Dimitrov" and "Gilberto León" Agricultural Production Cooperatives (APC) and a farmer from "Deris García" Service and Credit Cooperative (CSC) from San Antonio de los Baños and Batabanó, in south Havana, that depended on formal seed system.

The first phase went through different periods: community diagnosis, diversity fair development and farmer experimentation.

Through diagnosis of involved communities, a more accurate farmers' demand, flow and leadership relations of local seed systems were achieved.

Diversity fairs on maize, bean and rice<sup>1</sup> crops were successful and farmers selected in demonstrative plots those varieties responding to their biophysical and socio-economical reality. This action started at the experimental stations of INCA afterwards and farmers decided to multiply the experience under their own direction.

In the case of bean and rice crops, it is notable how genetic diversity at the first phase of two to three varieties surpassed 34 in homogeneous high-productive potential areas, whereas in low-potential zones, at present, diversity of five to six varieties surpassed 70 before starting the project.

Varieties derived from both the formal and informal seed systems filled a successful space among farmers. The germplasm banks from official institutions in charge of *in situ* preservation, which had phased some seed-refreshing difficulties, found a seed-multiplying space in farmers' lands and genetic diversity fairs. Today, dozens of varieties coming from conventional germplasm banks form part of the participants' genetic heritage, who in turn have supplied new materials to their own collections.

Besides, farmer experimentation attained unforeseen efficiency levels with regard to comparing experimental variants and differing the selection criteria determined by gender relationships.

Likewise, farmers organized in Farmer Research Groups (FRG), Agricultural Production Cooperatives (APC) and Credit & Service Cooperatives (CSC) found new reasons to get together and discuss their results according to experimentation results.

It is also notable how women's attendance and participation gradually raised at the meetings to discuss results and plan new strategies. Women showed a sharpened enterprise sense compared to men, since they

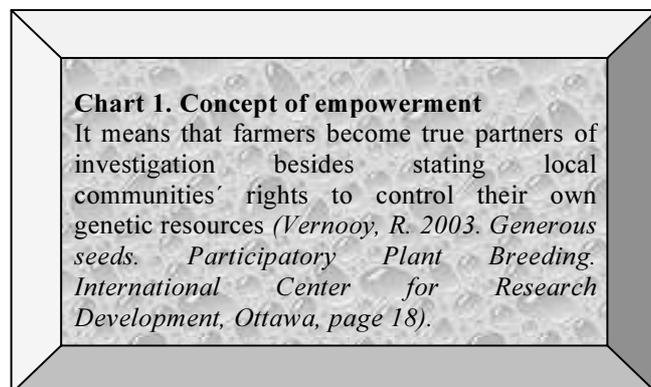
Dr. H. Ríos, Senior Research Assistant, Chief from the Participatory Plant Breeding Group, pertaining to Crop Genetics and Breeding Department, National Institute of Agricultural Sciences, PO Box 1, San José de las Lajas, Havana, Cuba, CP 32700

✉ burumbun@yahoo.es

<sup>1</sup> A PPB rice project was sponsored in parallel by the embassy of Canada (ACDI)

were willing to convert PPB into an income-generating initiative for the family and community.

Farmers' empowerment became a reality (Chart 1). Their attitude changed, as shown by their interest in managing diversity, which called the attention of the scientific community, local and national actors.



In the same way, a considerable philosophical work change happened in the multidisciplinary research team (scientists of social and biological sciences, plant breeders and professors), which enabled a broader-spectrum analysis on team strategy. The research-action approach helped reach interesting results regarding their modified attitudes, target populations and local actors, which merged social and biological sciences with local knowledge.

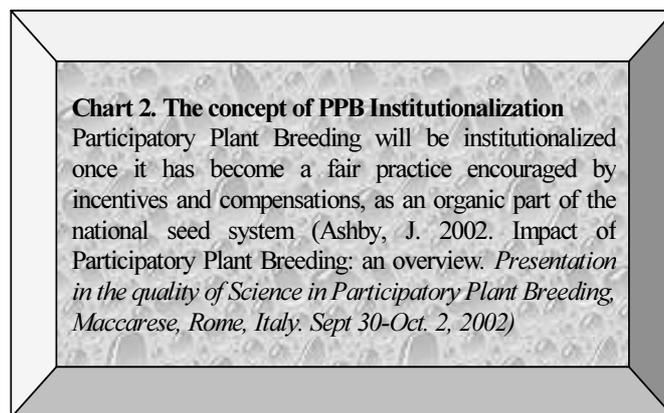
The first stage of the project provided an excellent scene of learning to farmers, scientists, employees, national and international donors as well as local and national politicians, giving them a better understanding of several alternatives to encourage agrobiodiversity as well as participation, local knowledge and plant breeding with a multisectorial approach.

The methodological principles acquired by the Cuban PPB team coordinated by INCA through "learning by doing" have let young scientists join the group to implement this initiative in Cuba and to develop others in Oaxaca, Veracruz and Chiapas (Mexico) with interesting impacts.

## NEW DIRECTIONS: CREATING THE BASES FOR PARTICIPATORY PLANT BREEDING INSTITUTIONALIZATION IN CUBA

PPB institutionalization (Chart 2) is a mid-long term complex process that requires a fine articulation of different actors and a gradual change of attitude on behalf of farmers with the help of scientists, so that they can design and implement their breeding strategies.

Within the first stage of PPB project in Cuba, it was proved that as soon as farmers do experiments, they have access to a wide genetic diversity and decide their varietal diversity whereas plant breeders enable local crop breeding process; thus, crop yields and diversity are significantly higher. Farmers' empowerment gets unforeseen measures and substantially strengthens local seed systems.



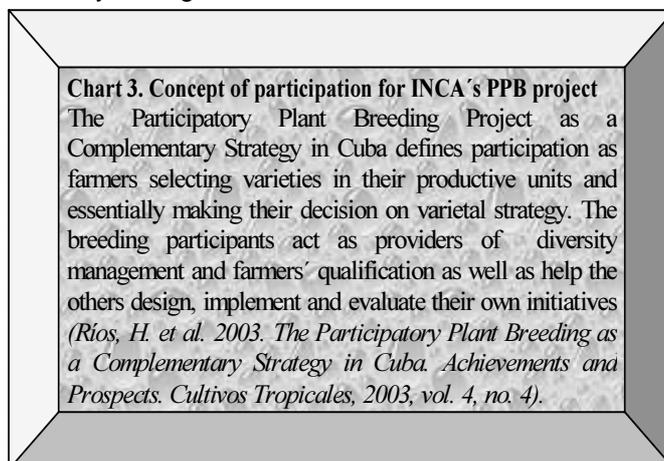
According to what is said above, the following **methodological principles** will be taken into account at the second stage: **decision making will be essentially of farmers and local actors, the selection methods applied have to do with Cuban rural reality, and the access of local seed systems to genetic diversity will be constantly feasible.**

These methodological principles should be gradually adopted and spread, counting on a growing participation of local and national actors to implement initiatives in Cuba. Overemphasizing the process of PPB spreading may be a risk for aborting the elemental principles.

Even though the national and international impact of PPB in the first stage is significant, this initiative is still young in Cuba and lacks the socio-economic, institutional and legislation mechanisms to support a continuous development without the need of a national and international economic base.

Thus, national and local actors should gradually "learn" and practice several politics supporting this procedure. Then, an uninterrupted qualification is very important as part of institutionalization.

The second stage will pretend local and national actors in general and politics decision-makers in particular to adequately interpret the sense of participation (Chart 3) and gradually implement the principles of participation and decentralization to their daily working life as well as reevaluate the local knowledge of experimentation and diversity management.



Due to the reasons above mentioned, the second stage is focused on:

#### General goal:

Institutionalizing Participatory Plant Breeding in Cuba in order to reapproach breeding methods, qualification and institutional changes including the collaboration of farmers, plant breeders and other local actors on behalf of agrobiodiversity, revaluation of local knowledge and participation.

#### Specific goals:

1. Qualifying national and local actors to include PPB as an alternative in the Cuban breeding and seed multiplication system.
2. Reapproaching selection and varietal seed multiplication methods, segregating populations and hybrids with local actors participating as an alternative of investigation-development in Cuba.
3. Developing breeding associations between farmers and breeders, so as to implement sustainable breeding alternatives from the biological, economic and social point of view.

The search for horizontal discussion spaces and the continuous qualification will condition a favorable environment to induce the desirable changes in the national seed system strategy.

Taking into account the national and international workshops celebrated to formulate the second stage and even the results from the first one for the institutionalization process, the following aspects are suggested:

- ↳ promoting a critical mass of PPB followers
- ↳ providing more scientific evidence with higher quality that enables PPB to form part of the national academic discussion
- ↳ developing associations between scientists and farmers to encourage diversity, participation and profit distribution.

Table I presents the main results, research quiz and foreseen goals for the second stage of PPB in Cuba.

## CUBAN PPB PLATFORM

As a result of the impact from the first PPB stage in Cuba, new actor and donor projects are working to be

implemented. In this way emerges the need to develop a national PPB experimental platform for spreading experiences, also to form a critical mass of followers based on local and national actors' participation. The platform will let them get involved to formulate, implement and evaluate PPB strategies. Then, the following hypothesis is presented: "national and local actors' participation to design PPB strategies of qualification, investigation and institutional changes will notably enable to adopt PPB methodology".

The platform pretends to make national and international actors' integration easy and create a favorable environment for a change induction in the seed sector of Cuba.

This platform will be conformed by the main actors involved to breeding and seed production area, such as the Fundamental Research Institute on Tropical Agriculture (INIFAT), Research Institute on Tropical Vegetables (INIVIT), "Liliana Dimitrova" Horticultural Research Institute (IIHLD), National Seed Enterprise, Provincial Agriculture Delegations, Seed Certification System, Agricultural University of Havana (UNAH), Central University of Las Villas and Rice Research Institute (IIA).

Local project executors related to participatory methods (Tabla II) will be also represented, who are going to supply positive and negative PPB evidence in a dynamic manner. Due to farmers' active participation, some ways to introduce PPB methodological principles in the farmer-to-farmer movement have to be explored, guided by the National Smallholder's Association (ANAP).

The National PPB Platform is foreseen not to be a living discussion organ. This initiative pretends that concepts of participation, decentralization and revaluation of local knowledge are dissolved among participants, so that they can form part of the strategies and their organizers' modes of action.

This platform developed a dynamic exchange net of information and seed through a virtual discussion forum, seed fairs, study tour, meetings, etc. Officially, the members of this platform pretend to meet each other once or twice a year.

**Table I. Results, research quiz and goals for the second project stage**

Results	Research quiz	Goals
Critical mass of local and national actors involved to PPB alternatives	How can PPB form part of the national seed system? How can different selection criteria of men and women from local seed systems join the national seed system?	To qualify national and local actors to make up a national PPB strategy
Work methodology with segregating populations, varieties and hybrids applied to heterogeneous and homogeneous environments by taking part local actors	What is the efficiency in adopting and spreading bean and rice varieties released through participatory varietal selection? In what way can segregating populations and hybrids be inserted to local seed systems? What are the differences of varieties and segregating populations selected by men and women at a local level?	To approach selection and multiplying methods of varietal seeds, segregating populations and hybrids by taking part local actors
More understanding of arranging manners on behalf of a greater diversification and actors' welfare	What is the balance of cost/benefit relationships from the collaborative work between growers and plant breeders? How relevant will women's role be in PBA?	To develop PPB associations among farmers and plant breeders to implement alternatives of sustainable agriculture, from the biological, economic and social point of view

**Table II. Characterization of platform projects linked to PPB**

PPB project-implementing organizations	Projects	Implementation zones	National donors	International donors
INCA-Mountain University and Farmer Research Groups, "Gilberto León", "Jorge Dimitrov", "28 de Septiembre" APC and a farmer from "Deris García" SCC	Participatory Plant Breeding as a Complementary Strategy in Cuba	"La Palma" in Pinar del Río, "Batabanó" and "San Antonio de los Baños" in Havana	Ministry of Higher Education (MES)	International Development Research Center (CIID)
INCA-Mountain University	Local seed systems strengthening	"La Palma" municipality	MES	The Embassy of Canada, Canadian Agency for the International Development (ACDI)
INCA-INIVIT, "La Palma" Mountain University and Farmer Research Groups	Tropical tubers and roots Recovered through biotechnology under rural development conditions in Cuba	"Santo Domingo in Villa Clara and "La Palma" in Pinar del Río	MES	Cassava Net (CIAT)
INCA-Urban Agriculture and Farmer Research Groups	Participatory Plant Breeding in Urban Agriculture	"San José de las Lajas" in Havana and "Arroyo Naranjo" in Havana City	MES	CIID
INCA-"La Palma" Mountain University and Farmer Research Groups	Local development of Fodder Production	"Batabanó" in Havana and "La Palma" in Pinar del Río	MES	COSUDE
INCA-"Gilberto León" and "Jorge Dimitrov" APC	Metal silo built for basic grain preservation	"La Palma" in Pinar del Río, "Batabanó", "Batabanó", "San Antonio de los Baños" and "San José de las Lajas" in Havana	MES	COSUDE
INCA-ETIAH-University of Las Villas	Local seed systems strengthened in Villa Clara and Holguin	"Santo Domingo", "Corralillo" and "Manicaragua" in Villa Clara "Gibara", "Holguin" and "Calixto García" in Holguin	Ministry of Agriculture (MINAGRI) Ministry of Science, Technology and Environment (CITMA)	COSUDE
INCA-MINAZ	Participatory Plant Breeding supporting food production in the former sugarcane-growing areas of Cuba	"Pilón", "Yara" and "Río Cauto" in Granma, "Cabaiguán" and "Jatibonico" in Sancti Spiritus, "Aguada de Pasajeros" in Cienfuegos and "Aguacate in Havana	Ministry of Sugar (MINAZ) and CITMA	World Food Organization (FAO)

The national PPB platform will condition a gradual change of actors towards politics including participation and decentralization as alternatives for a more sustainable use of local capacities and specific adaptation of varieties. The participation of political decision makers (essentially potential) would be very important to attain the proposed goals.

This platform pretends the members can design, implement and evaluate projects related to participation and decentralization, as alternatives for a sustainable use of agrobiodiversity. Results from discussing the platform will bring valuable inputs to seed legislation as well as PPB cost/benefit distribution.

Even though decentralization and participation constitute the essential part of the national political frame in Cuba, there are limitations to implement it at a local level. The PPB platform will be an important vehicle to carry participation and decentralization to discuss the national seed politics. In this way, the national PPB platform will provide particular examples of interaction between local and national decisions, that will be evaluated under its multisectorial point of view (Table III).

## DEVELOPMENT OF SELECTION AND VARIETAL SEED MULTIPLICATION METHODS, SEGREGATING POPULATIONS AND HYBRIDS WITH THE PARTICIPATION OF LOCAL ACTORS

*Evaluation of varietal critical route.* The first phase gave evidences on the efficiency of selection and distribution of varieties selected by farmers; however, more time is required to evaluate the effects of an exponential increment of diversity at a farm level, varietal selection and spreading as well as the adoption rate of all materials experimented by farmers, due to the role of popular rice<sup>2</sup> in Cuban's feeding, also because of the accumulated experience at the participatory varietal selection<sup>3</sup> and the will of political decision makers to implement PPB as a breeding strategy in this cereal at the national level.

<sup>2</sup> At the early 90's, due to the lack of food provoked by the socialist field standstill, a rice popularizing movement was developed in Cuba. This farmers' movement supported by the Association of Organic Agriculture of Cuba promoted rice seeding in every environment. At present, this popular crop represents more than 54 % of the national production.

**Table III. Logical frame to develop Cuban PPB Platform**

Results	Research quiz	Activities
1. Critical mass of local and national actors involved to PPB alternatives	1.1. In what way can PPB organically form part of the national seed system? 1.2. In what manner can different men and women's selection criteria from local seed systems integrate the national seed system?	<ul style="list-style-type: none"> <li>• Workshop at the beginning of the second phase</li> <li>• Creation of the national PPB net</li> <li>• Development of PPB farmer school "Learning about diversity" (see Qualification: central axis of the project)</li> <li>• A study tour to CIAL in Honduras</li> <li>• Workshop to evaluate and discuss the advances and limitations of 2004*</li> <li>• National forum of farmers involved into PPB</li> <li>• Video production on plant breeding, participation and decentralization</li> <li>• Workshop to evaluate and discuss the advances and limitations of 2005</li> <li>• A study tour to national project prototypes</li> <li>• Last workshop to discuss and elaborate a national operating plan of PPB implementation</li> </ul>

\*It will be developed at the Congress INCA, 2004

Rice crop has become an important entry point for spreading PPB as a national breeding strategy. When actors related to this crop are included, the main PPB concepts will be disseminated and exponentially enriched along the country.

For the second stage, it is very important to evaluate the durability of resistance in varieties selected by farmers under low agrochemical input conditions. The continuous evaluation of varieties derived from formal and informal seed systems, forming part of the community through diversity fairs, will enable to understand the resistance durability. It will permit to estimate the frequency, amount and kind of genetic diversity that should be introduced at the local seed systems, to keep yield and genetic resistance levels. Thus, pests and diseases will be systematically evaluated by means of a graduated scale besides designing figures about damage frequency. The relationship between leaf damage, genetic diversity and yield should be investigated.

Likewise, the idea of knowing the true level of adopting local and improved varieties in the context of Cuba is really interesting, which is not a genetic diversity origin center. *Incorporation of segregating populations.* Even though the work with segregating populations was planned at the first phase, it could not be done, since the access of conventional breeding programs to them was very limited. Today, within the first phase results, there is a greater understanding for the national and international PPB programs as well as a broader will of cooperation in this sense.

Regarding the diversity fairs organized by farmers, access will be given to F3 and F4; later on, the genetic advance per selection and their impact at the community level will be evaluated. It is attractive to know what will be the impact of these segregating populations in communities that have been managing a wide genetic diversity at the first phase of the project.

Including these segregating populations into local seed systems will encourage an interesting discussion at the Cuban community of scientists and growers about the rights of property and share of profits from breeding programs with growers' participations.

The first phase showed how growers having neither population nor varieties under new low agrochemical input conditions, were very interested in the genetic diversity of maize exposed in fairs, where they selected essentially those desirable cobs and mixed them and, through different bulk selection cycles, they achieved a relatively homogeneous population adaptable to low input conditions.

Even though results were striking with regard to the broad genetic base of varieties, resistance and yield, there are still multiple questions concerning result repeatability which demands more evidence and a more complete systematization of selection methods from the national and international scientific community.

Regarding specialized literature, there are not enough data proving growers' selection efficiency on the genetic advance per selection, in complex inheritance characters such as yield. Likewise, it is rare to find a possible phenotypic variation range to manage maize populations under PPB. Therefore, at present, the relationship between genetic diversity-yield increment and selection method is not clear for the low-input conditions of maize crop in Cuba.

In principle, two selection models will be used:

- 1) Participatory selection of open-pollinated varieties
  - 2) Local simple hybrid formation.
- 1) *Participatory selection of open-pollinated variety.* It is performed through workshops: a) the basic principles of heterosis and inbred depression are explained to farmers, b) they will select maize populations in diversity fairs, c) after seed multiplication on farms, they will select the best cobs from the best varieties, each cob is a half-sib family, d) they will decide if the best half-sib-families are chosen as female parents (base population), male parents to pollinate local ones or both, f) selected products will be compared with local checks

<sup>3</sup>In parallel to Participatory Plant Breeding as a Complementary Strategy in Cuba funded by IDRC, an initiative of participatory varietal selection supported by the Embassy of Canada in Cuba started to be implemented.

by the same farmers and g) according to the result, varieties will form part of the local seed multiplication system.

2) *Local simple hybrid formation*. In parallel, a methodology for obtaining local simple hybrids will be developed; thus, a) growers will select parents in diversity fairs, b) plant breeders will develop lines and perform general and specific combining ability trials, c) farmers will evaluate results from the best crossings and implement a local multiplying strategy of crossing lines and simple hybrid exchange.

For methods 1 and 2, a nutrient quality analysis will be done to the varieties obtained through a collaborative work, as well as cost/benefit relationship.

A PPB experimentation on maize will support PB associations that are going to be celebrated in Batabanó, San Antonio de los Baños and La Palma, Pinar del Río (see the next heading in the text).

It is interesting the idea that in most of the proposed combining schemes, local materials are included as well as the varieties potentially acceding to improved seed production on a large scale by the community. In this way, a higher aggregate value is pretended to give to those populations historically kept by farmers.

The whole process will be systematized essentially through doctoral students' work of the project; this experiment documentation will constitute the first PhD thesis on this subject in Cuba and it will encourage an interesting academic discussion on PB scientific potentialities.

The fact that this experiment is conducted under low input conditions with a strong participatory component can provide important results to breeding methods developed in organic agriculture here in Cuba and abroad.

## ESTABLISHMENT OF PLANT BREEDING ASSOCIATIONS (PBA)

Among the events found at the first phase emerged the huge capacity of PB research institutes to generate

genetic diversity through crossing, somaclonal variation and mutation induction. However, considering its main weaknesses are the limited capacity of spreading and experimenting with varieties under contrasting environments. On the other hand, farmers working on PB for three years have proved abilities in selecting, multiplying and spreading improved seeds.

Over 2000-2003 PB period, there was a tendency to integrate functions of selection, preservation, delivery and commercialization at the levels of CSC, APC and FRG; results on diversity, disease resistance yield increment and agrochemical input reduction make farmers' tested varieties have a growing attraction from other farmers of the town, even the province.

At present, bank and credit system restrictions slow down a fluid commercialization of seeds from PB. This PBA will permit to use, from an experimental point of view, bank facilities from plant breeders involved to the project, in order to study its potential to generate income for breeders and farmers. This initiative gives «edible» evidence for future arrangement of the bank system at the new Cuban rurality.

The establishment of PBA, in which farmers and breeders complement each other, would be an interesting manner for studying alternatives of new organizing forms that enable to spread diversity, selection, multiplication and negotiation of improved seeds on the farm.

Among the potential advantages of these associations figure out:

- ★ Greater integration of national and local actors on behalf of a sustainable increase of diversity, yield and participation
- ★ More facilities for negotiating seeds, inputs and property rights from PB profits
- ★ Strengthening FRG, APC and CSC with regard to feeding, economic and political terms
- ★ Obtaining inputs for the analysis of an improved seed certification system by farmers
- ★ Promoting a closer relationship between PB scientist community and concrete field problems

**Table IV. Logical frame to develop multiplication and selection methods of seeds from varieties, segregating populations and hybrids with local actors' participation**

Results	Research quiz	Activities
Work methodology with segregating populations, varieties and hybrids, which is applied to heterogeneous and homogeneous environments with local actors' participation	<ol style="list-style-type: none"> <li>1. What has been the critical route of bean and rice varieties released through participatory varietal selection?</li> <li>2. In what manner can segregating populations and hybrids be inserted to local seed systems?</li> <li>3. What will be the differences between varieties and segregating populations selected by local men and women?</li> </ol>	<ul style="list-style-type: none"> <li>• Mapping the genetic flow by taking part PB</li> <li>• Profit estimates for introducing varieties derived from PB</li> <li>• Developing a methodology to make rice and bean varieties popular</li> <li>• Developing diversity fairs or segregating populations</li> <li>• Estimation of the genetic advance per selection and pest tolerance, diseases, crop cycle and cooking qualities</li> <li>• Registration and exchange of varieties obtained by farmers</li> </ul>

- ★ Evaluating more sustainable PB forms to mitigate subsidies from the actors involved
- ★ Strengthening farmers' productive systems through alternative diversification
- ★ Greater spreading of varieties derived from conventional PB systems
- ★ Providing inputs to develop alternatives towards plant breeding with economic, environmental and social incentives
- ★ Recognizing women for preserving, selecting, certifying and spreading improved varieties by the community
- ★ Enabling to implement farmers' and breeders' decision at a local level.

In principle, PBA will develop at "28 de Septiembre" APC, the private farmer from "Deris García" CSC (Batabanó, Havana), "Jorge Dimitrov" and "Gilberto León" APCs (San Antonio de Los Baños, Havana) and FRG "El Tejar-La Jocuma" (La Palma, Pinar del Río), as participants in the first phase, each one constituting an association, so each entity will have an associated plant breeder from the project. Every association with its respective plant breeder will have in mind the following aspects:

- a) Outlining breeding objectives
- b) Developing strategies of certification and registration of improved varieties
- c) Developing strategies of commercialization and dissemination of varieties
- d) Economic evaluation, social and private benefits
- e) Environmental impact of enterprises.

At the beginning, every association will select its own direction committee and responsibilities are distributed according to biophysical and socioeconomic environment of every community.

Experiments on segregating populations, formation of open-pollinated varieties and local hybrids will make up a breeding strategy that will be implemented and implemented by PBA.

Every locality where these associations are implemented will have a document containing local and national actors' perception related to PBA advances and limitations.

This experimental evidence will enable PPB introduction into discussion of local politics from municipi-

pal governments, which will make the way for PPB be introduced into provincial and national levels, as an alternative to sustainable local seed systems in Cuba. *Analysis of cost/benefit relationships in PPB.* It is a controversial subject due to its contextual nature. Considering it is a complex subject, this proposal will focus it taking into account PBA as an analysis cell; thus, cost/benefit relationship analysis will be performed in three stages:

- A) Establishment of PBA: The members from the farmer research group along with plant breeders will outline short and mid-term goals as well as the main indicators to be evaluated and PPB activities for the town. Both, market and inversion strategy will be discussed. As a result of this phase, a three-year-action plan will be prepared.
- B) Partial evaluation of results: After a year and a half of starting the project (first evaluative section), PBA will regard the amount of economic income, varietal spreading, local certification system recognition and community opinion.
- C) Another evaluative section will be the last year of the project to appraise economic, social and environmental feasibility resulting from PPB in town, besides discussing how benefits from PPB activities will be shared in terms of economic incomes and recognizing farmers' and plant breeders' intellectual rights. The participation of the Communist Party of Cuba, Popular Power, Women's Federation of Cuba, among other local actors, will be very relevant and their contribution could be related to project profits in terms of social equity.

## GENDER APPROACH

The first stage was decisive to prove men/women differences regarding varietal selection criteria; thus, varieties studied at a farm level will be those selected by men and women in diversity fairs or any other source of seed accession. Consequently, gender difference enabled to improve genetic diversity. With regard to the second stage, it would be interesting to identify the selection spectrum of men and women so as to evaluate other

**Table V. Logical frame to establish PBA**

Results	Research quiz	Activities
Better understanding of organizing forms on behalf of a wider diversification and actors' welfare	What is the balance of cost/benefit relationships when collaborating farmers with plant breeders' work? How relevant will PBA women's role be?	Introductory workshop to make up PBA; socioeconomic analysis to search for "business breaks"; workshops to make up a breeding, experimentation and commercialization strategies of improved seeds; a course on the establishment of agricultural microenterprises; cost/benefit analysis of diversity fairs regarding landraces, commercial varieties and segregating populations; cost/benefit analysis on farmer experimentation; development of strategies and implementation of seed commercial fairs in down town; seed commercialization and certification at local level; cost/benefit share analysis

alternatives to be organically inserted in the national seed system.

It is also interesting to point out that cooking quality is among the strong aspects of local seed systems, which is associated to female selection.

This second stage will establish a PPB evaluation system for women with the help of participants from APC, CSC and FRG, so that those materials testified by this committee will have their own distinctive stamp.

Regarding women's enterprise tendency besides converting PPB into an outcome-generating source, PBA should count on female farmers who are interested on it.

Likewise, women can state PPB advances and limitations through public discussions in town or any other official female organization (Women's Federation of Cuba). Some PBA will be guided by female farmers and this is a case study to know strategic differences related to men's outlines.

## QUALIFICATION: MAIN PROJECT AXIS

Participatory plant breeding in Cuba has been essentially considered a dynamic and continuous learning process. Through workshops to define local problems, genetic diversity fairs, farmer experimentation, exchange visits, experimental result discussion and strategic development for sharing benefits will constitute the basic learning elements for an attitude change on behalf of growers' diversity.

Local and national actors participating in the formulation implementation, monitoring and evaluation of PPB proposal will constitute the basic approach to consolidate this subject in Cuban organizations and persons involved to rural development.

Qualification will be focused on developing the learning approach entitled "*Learning from diversity*", which belongs to Farmers' School. At the first project phase, it was outlined and its principle is based on knowledge acquisition through a continuous experimentation, diversity evaluation and result discussion. Here, knowledge comes from variations detected by participants in local genetic diversity and other sources from the project. This method has the following stages:

- a. Local actors' definition of problems and crop selection
- b. Diversity fair development with the help of local plant genetic resources, germplasm bank resources from public institutions, segregating populations and commercial varieties
- c. Establishment of farmer research group
- d. Selection criteria discussion and actual demand analysis of plant genetic resources
- e. Farmers experimentation and result discussion
- f. Result promotion and redefinition of new problems.

INCA's<sup>4</sup> extension team along with PhD students related to the project collaborating with farmer-to-farmer

movement guided by ANAP (National Association of Small holders), University of Las Villas and the extension/plant breeding team from Holguin Research Station will validate this methodology in some areas from the central and eastern parts of Cuba, which will constitute the methodological support for spreading PPB in Las Villas and Holguin with the help of COSUDE. They will be the early examples for developing PPB in the country and will become the headlight for spreading it to other towns.

*Short courses to strengthen local seed systems.* These courses will be taught to researchers, employees and potential politics decision makers for as long as 15 days to introduce participatory techniques, methods to strengthen local seed systems and reevaluation of local knowledge in one unit. A second unit about community diagnosis, by means of which participants from multidisciplinary teams will live together in communities and apply research techniques on biological and social sciences. The third unit on proposal formulation will permit to summarize the knowledge acquired in previous units. This course also considers microscholarships according to participants' most competitive proposals of investigation-development to perform a local work. The most competitive proposals will be rewarded by a selection committee constituted on this concern.

This proposal will bring different qualification ways to directly transform local reality. The experiences acquired will serve to improve this way of teaching and bring inputs to other organizations linked to rural development, so that they can adopt it.

Short PPB courses are registered and accumulate credits for master and PhD students. A committee will evaluate the efficiency of PPB activities by participants to different environments and socioeconomic contexts. A complementary promotion proposal at present developed by the help of CIID will bring enough inputs to enrich the idea of short courses.

*Master's degree, undergraduate and post graduate teaching.* As a result of the first stage of PPB in Cuba, the official master's program on Plant Breeding and Crop Biotechnology at INCA included a unit about Participatory Plant Breeding and Rural Development, which will be taught by the project staff to make three or four Master's theses.

In this same manner, this subject was included to the career of Agronomy at the Agrarian University of Havana; thus, professors involved will be trained and students' theses will result from the collaborative work between them and project researchers. Miniworkshops are pretended to be conducted with students and professors to analyze PPB advances and limitations.

Having in mind the need for introducing local knowledge, participation and decentralization to national academic discussion, it is important to help PhD students' theses involved to PPB since the first project stage.

Doctorate scholarship candidates are young students with relevant results at the first project phase (Irene More-

<sup>4</sup>At the first project phase, INCA's extension team was involved in most PPB activities. A PhD student will be linked to this kind of qualification.

no Moreno, Rosa Acosta Roca, Sandra Miranda Lorigados, Michel Martínez Cruz and Ernesto Valdés Ferro). They have to present and discuss their doctorate subjects at the Plant Genetics and Breeding Department, the Scientific Councils of this department and of INCA, that will give suggestion and finally approve the subjects.

Once they are proved, doctorate projects will be funded. PPB experience documentation in the second stage will constitute the basis for qualifying at least five PhD doctors, strengthening considerably PPB scientific credibility as well as INCA's reputation as a representative center for participatory and multisectorial approaches in agriculture.

PhD students will serve as PPB consultant instructors at the involved areas as well as peer coaching different projects that will be implemented at the center and eastern parts of the country. The methodological principles resulting from the first stage will be spread along different regions of Cuba as a teaching process whereas most staff people will keep on the second phase actions in the western part of our country, named «National Participatory Plant Breeding Laboratory», since they are the pioneers of PPB development besides the innovative character of ideas generated in this region. Western experience will serve to encourage the growing initiatives from the rest of the country.

*National PPB platform as a learning approach.* It expects to be the national frame for discussing PPB advances and limitations and will be an interesting medium to get PPB significance. Its participatory character along with the intense discussion promoted and the study of national and international experiences on PPB will lead to attitude changes among members and establish new performance on behalf of horizontal discussion, besides including local actors to national seed politics.

Either reapproaching selection methods, implementing national PPB platform or PPA will bring an interesting knowledge to every actor involved to the project or the rural environment in Cuba.

Evidences resulting from above will enable a better understanding to strengthen PPB as a science, farmers as users and main roles as well as political decision makers considered the key link for rural development.

## THE EVALUATION AS A MEANS TO BOOST THE ADVANCE

The three project results will develop different evaluative strategies. As a premise, the actors themselves will evaluate the process; besides, great efforts will be made to look for reflection times besides the noninterrupted feed back of implemented actions.

The evaluative system according to project results appears as follows:

### ✱ Result: Development of a critical group of local and national actors involved to PPB alternatives

The National PPB Platform will be mainly in charge of this result. Over its first workshop, the methodology of self-evaluation described by Duong & Vernooy<sup>5</sup> (2003) will be followed, so that once the goals become clear, all participants will define: a) how to prepare the evaluation, b) the bases for the evaluation and c) they will formulate an action plan to perform the proposed evaluation.

Since this participatory evaluative method is developed on a multisector platform, it will significantly encourage the actors to become the owners of this initiative; therefore, it is gradually adopted.

### ✱ Result: Work methodology with segregating populations, varieties and hybrids, applied to heterogeneous and homogeneous environments with the participation of local actors

Regarding this, PhD students will show «hard data» about the spreading of varieties released through diversity fairs and the effective management of bean and maize segregating populations as well as the impact of developing open-pollinated varieties and simple local hybrids.

Plant breeders and farmers themselves, by means of workshops for discussing PBA results, will bring specific efficiency tests of every method employed, which will serve as a thermometer for the working team to guide the project more adequately.

In Batabanó and San Antonio de los Baños, possible efforts will be directed to local political decision makers' participation in workshops for discussing PPB results.

Particularly in La Palma, local politics decision makers have to call for a meeting every three months with all actors related to agriculture, in order to analyze the advances and limitations of the project in town. Likewise, farmers want to call farmer community for a public debating forum on PPB in town. Both initiatives will be an excellent stage for a horizontal discussion; it will also provide important elements to evaluate the project.

### ✱ Result: Better understanding of organizing means on behalf of a wider diversification and actors' welfare

It is based on the strengthening of plant breeders and farmers' collaboration by means of establishing Plant Breeding Associations. Consequently, the evaluative procedure described in the first result can be helpful.

Since this is a new idea on Cuban agricultural view, it needs a specialized monitoring. The evaluation made by the actors related to PBA as well as the one from an economist and a sociologist can serve as reference for the project staff to define strategies and tactics in order to argue positive and negative aspects in terms of obtaining profits, social equity and gender in PBA.

<sup>5</sup>Duong Le Thanh y R. Vernooy.2003. Approaches for evaluating organizational capacity development. En: Advancing the Policy and Practice of Capacity Building in International Development Cooperation. Issue 17

Taking into account how complex the three results are, due to their innovation level and socioeconomic subject they are facing up, it would be recommendable to develop a monitoring labor making up these results and give the project staff and donors a full evaluation of project under way. Thus, a professional may be hired to perform this function.

## ACTORS AND THEIR ROLES

### INCA (National Institute of Agricultural Sciences)

- ✦ Leader of the project
- ✦ It will define with farmers and organizers the strategy and methodology to institutionalize PPB in Cuba
- ✦ It will participate in establishing PBA with APC, SCC and FRG and make plant breeders from these associations available
- ✦ It will coordinate the national PPB platform
- ✦ It will bring valuable genetic materials to farmer communities for PPB purposes
- ✦ It will qualify technicians, researchers, employees, political decision makers and PPB farmers
- ✦ It will multiply seeds for strengthening PBA
- ✦ It will advise other PPB project implementation in Cuba
- ✦ It will advise PPB introduction to farmer-to-farmer movement
- ✦ It will advise PhD students with PPB.

### UNAH (Agrarian University of Havana)

- ✦ An economy professor will take place at the research team
- ✦ It will integrate PPB into study plans
- ✦ It will perform course and diploma studies with undergraduate and postgraduate students
- ✦ It will participate in PPB platform
- ✦ It will take place in qualification studies.

### CIPS (Psychological and Sociological Research Center)

- ✦ A sociology researcher will take place at the national PPB platform.

### ANAP (National Association of Smallholders)

- ✦ It will support the gradual PPB introduction into farmer-to-farmer movement through its infrastructure
- ✦ It will participate at the national PPB platform
- ✦ It will take part in qualification studies.

### Farmers

- ✦ They will keep/increase voluntarily the varietal diversity of its agroecosystems
- ✦ They will define selection criteria with the help of plant breeders
- ✦ They will evaluate and select varieties/segregating populations at the genetic materials of PPB project
- ✦ They will produce seeds from selected materials
- ✦ They will deliver improved seeds in the community
- ✦ They will offer maize and bean seed samples to target communities
- ✦ They will plan, conduct and evaluate trials on their farms

- ✦ They will form part of PBA together with INCA's scientists
- ✦ They will participate in qualification programs.

### SICS (National System of Seed Inspection and Certification)

- ✦ It will take place at the national PPB platform
- ✦ It will provide inputs to regulate PPB products
- ✦ It will participate in qualification programs.

### INIFAT (Fundamental Research Institute on Tropical Agriculture)

- ✦ It will participate at the national PPB platform
- ✦ It will provide germplasm to communities
- ✦ It will take place in qualification programs
- ✦ It will implement *in situ* preservation initiatives with farmers.

### INIVIT (Research Institute on Tropical Vegetables)

- ✦ It will participate at the national PPB platform
- ✦ It will provide germplasm to communities
- ✦ It will take place in qualification programs
- ✦ It will implement PPB initiatives in clon-propagated crops at different zones of Cuba.

### IIHLD ("Liliana Dimitrova" Horticultural Research Institute)

- ✦ It will participate at the national PPB platform
- ✦ It will provide germplasm of commercial varieties and segregating populations from international programs, to communities
- ✦ It will take place in qualification programs
- ✦ It will implement *in situ* preservation initiatives with farmers.

### ETIAH (Agricultural Research Station of Holguin)

- ✦ It will participate in the national PPB platform
- ✦ It will provide germplasm to communities
- ✦ It will take place in qualification programs
- ✦ It will implement PPB initiatives at the eastern region of Cuba.

### Agricultural Delegation

- ✦ Delegates from towns and provinces will participate on PPB projects
- ✦ They will take place in qualification studies.

### IIA (Rice Research Institute)

- ✦ It will participate at the national PPB program
- ✦ It will provide germplasm to communities
- ✦ It will take place in qualification studies
- ✦ It will implement PPB initiatives on popular rice system.

### MINAZ (Ministry of Sugar)

- ✦ It will participate at the national PPB program
- ✦ It will take place in qualification studies
- ✦ It will implement PPB initiatives in sugar mills converted into food-producing industries.

### CITMA (Ministry of Science, Technology and Environment)

- ✦ National PPB donor
- ✦ It will participate in qualification studies.

**COSUDE (Swiss Cooperation for Development)**

↗ International donor of PPB and metallic silo projects of Las Villas and Holguin.

**CIID (International Research Center for Development)**

↗ International donor of PPB in the western part of Cuba and of the national PPB platform.

**ACDI–Embassy of Canada (Canadian Embassy of International Development)**

↗ Codonor of IDRC related to rice PPB project.

**WORKING TEAM AND RELATIONSHIPS WITH OTHER INTERNATIONAL PROJECTS**

This proposal pertains to the Collaborative Mesoamerican Program of Participatory Plant Breeding conformed by Mexico, Honduras, Nicaragua, Costa Rica, Guatemala and Cuba, that encourages the exchange of experiences from nine PPB projects, qualification and monitoring of all projects developed in the area.

Regarding the experience acquired at the first phase of the project, Cuban PPB knowledge could be modified

and spread to different projects implemented in the region, also enabling PPB institutionalization process in Mesoamerica. The second stage constitute the necessary inputs to strengthen the role of Cuba over the region in terms of PPB qualification. At present, INCA's team advises PPB projects in Oaxaca, Veracruz and Chiapas.

Moreover, this proposal is directly linked to metallic silo construction project supported by COSUDE, which has proved to be a useful alternative for preserving PPB products.

The platform itself will give the possibility of linking multiple national and international donors, such as COSUDE, ACDI, FND, CITMA, MES, which will strengthen project multisectorial approach and enable to look for mid and long-term solutions to national funding.

Seemingly, the number of projects interacting with the present proposal will let it develop under favorable national and international environments, so strengthening the prestige of INCA and other participating institutions. The proposal will reinforce INCA leadership in participatory methodologies at the national and international level.