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THE FAIRS OF AGROBIODIVERSITY IN THE CONTEXT OF PARTICIPATORY PLANT BREEDING-LOCAL AGRICULTURAL INNOVATION PROGRAM IN CUBA. MEANING AND IMPACT

Las Ferias de Agrodiversidad en el contexto del Fitomejoramiento Participativo-Programa de Innovación Agropecuaria Local en Cuba. Significado y repercusión

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ABSTRACT. Participatory Plant Breeding Project (FP) first was developed into the Program of Local Agricultural Innovation (PIAL). Later, it was characterized for possessing a common and central element the constant, real and active participation of the peasantry in strengthening agricultural innovation, promoting free access to their agrobiodiversity with a concept of sustainable agricultural production, based on agroecological principles. The FP-PIAL potential as an alternative capable of stimulating the diversification of production, the better management of the agricultural biodiversity and the increase of the yields have been demonstrated from the evidences provided in the last years. At the end of 2011, the PIAL has supported the holding of more than 680 fairs. It can be said that through Agrobiodiversity Fairs, the creation of a farmers' wide solidary network for the environmental, social and economic benefit of the productive units has been facilitated. This affected strongly in the availability and autonomy of seeds and in the safety and food sovereignty at the Community level. According to existing records, more than 19 500 people including producers and technicians have attended, evaluated and contributed with the dissemination of the diversity of species and varieties exposed in the fairs celebrated to 45 municipalities of ten provinces. Considering the number of participants in the markets and taking into account that the average of varieties selected per participant was five, it can be concluded that 97,500 seed samples of approximately 2 000 accessions.

Key words: biodiversity, seed dissemination, participation of farmers

RESUMEN. El proyecto de Fitomejoramiento Participativo (FP) primero, devenido en el Programa de Innovación Agropecuaria Local (PIAL), se ha caracterizado por contar con un elemento común, centro de su accionar: la permanente, real y activa participación del campesinado en el fortalecimiento de la innovación agropecuaria, propiciando el libre acceso de estos a la agro-biodiversidad. Las potencialidades del FP-PIAL como una alternativa capaz de estimular la diversificación de la producción, el mejor manejo de la biodiversidad agrícola y el aumento de los rendimientos han sido demostradas a partir de las evidencias aportadas durante los últimos años. Al cierre del año 2011, el PIAL ha apoyado la celebración de más de 680 ferias. Puede decirse que, a través de las Ferias de Agrobiodiversidad, se ha facilitado la creación de una amplia red solidaria de agricultores para el beneficio ambiental, social y económico de las unidades productivas, incidiendo fuertemente en la disponibilidad y autonomía de las semillas y en la seguridad y soberanía alimentaria a nivel comunitario. Se conoce que más de 19,500 personas, entre ellos productores y técnicos, han asistido evaluado y contribuido con la diseminación de la diversidad de especies y variedades expuestas en las ferias celebradas en 45 municipios de diez provincias. Considerando el número de participantes en las ferias y tomando en cuenta que el promedio de variedades seleccionadas por participante en las mismas ha sido de cinco, puede concluirse que han sido distribuidas más de 97 500 muestras de semillas.

Palabras clave: biodiversidad, diseminación de semillas, participación de agricultores

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INTRODUCTION

The Participative Plant Breeding Project (FP) developed first (2001 - 2006), turned into the Program of Local Agricultural Innovation (PIAL) later on (2007 - 2011); characterized for having a common and central element: the constant, real and active participation of the peasantry in strengthening agricultural innovation, promoting free access to their agrobiodiversity with a concept of sustainable agricultural production, based on agroecological principles. The potential of both projects (FP-PIAL) as an alternative capable of stimulating the diversification of production, the better management of agricultural biodiversity and yields increase have been proven from the evidences of the 11 years of execution (1).

According to studies, it has been proven that the areas of intervention of the project, over 90% of the farmers did not use seeds of the Formal System on a regular basis, which aims to the importance of strengthening the Local Seeds Supply System in the current Cuban situation.

In order to have diversity of species and crop varieties of economic importance for the country and making them available to Cuban growers, plant materials from different places included in the implementation process of the project have been collected. These collections in addition to donations from different Cuban and Foreign Research Centers, have allowed having wide collections to work with.

Late in 2011, the PIAL had supported more than 680 fairs in project areas. Growers did not use seeds from the formal system, from where it is evident that varieties coming out from different breeding programs did not reach growers (2). Therefore, the procedure for thousands of growers living within project areas have access to agricultural diversity has been, among other tools, the Fairs of Agrobiodiversity executed by the project[A].

The meaning of Agrobiodiversity Fairs executed, its impact and echo within agricultural innovation is presented.

MATERIALS AND METHODS

Agrobiodiversity Fairs in Cuba: meetings of growers, plant breeders, decision makers and others held in the field, right in front diversity in physiological maturity, previously prepared for such objectives. They look forward to essentially contribute through the participative selection of varieties, lines, seggregants, etc, to the maintenance and increase of biodiversity of species and crop varieties of economic interest to growers (3).

The Participative Selection of Varieties (SPV) in Agrobiodiversity Fairs was executed at the beginning in the experimental areas of INCA: in April 1999 with the First Corn Fair and in April 2001 with the First Bean Fair. From that time on, all fairs have been held in farms and cooperatives out of INCA, among them the Second Corn Fair, held in May 2001 and in the Agricultural Production Cooperative “Gilberto León” from San Antonio de los Baños, Havana and the Second Bean Fair, held in December 2001, at the farm of Pedro Felipe González (Coco) in La Palma, Pinar del Río province. In total, between 1999 and 2011, 680 fairs of more than 40 species were held in 97 localities of 45 municipalities. These fairs helped to determine the type of species offered the assistant coaches and the number of varieties selected by them.

A follow-up was made, as study cases of farmers that took part in the first bean fair from La Palma, as well as two Agricultural Production Cooperatives from San Antonio de los Baños, asking them annually a declaration of the existing diversity and the yield reached in beans in their productive units.

Participants at the different fairs and persons that had indirectly received diversity were surveyed to know the dissemination index of such diversity; in some locations, the existing diversity before and after the holding of fairs in 2001, 2007 and 2011 was evaluated.

Farmers from 37 municipalities of seven participating provinces at FP-PIAL projects were surveyed to evaluate the effect of the project in 25 indicators of five general aspects related to grower’s family life (Table I) by using a scale from 1 to 10. Farmers could classify the development achieved in each of those aspects, before the project and at present (emerged from the active participation for some years on an innovative basis with the farmers and their families).

With the information from surveys, mean values for each specific indicator were calculated. In all cases, the non-parametric test of Kruskal–Wallis [B] was applied to determine the difference among means of each indicator before and at present.

[A] Calves, E. *PIAL COMUNITARIO*, 2013, [Las Ferias de Diversidad devinieron en sucesos comunitarios de gran capacidad para unir a actores locales alrededor de la diversificación varietal de cultivos y crear espacios de aprendizaje colectivo y comunicación multipersonal].

[B] Kruskal, W., 2001, [Paquete estadístico MINITAB por el análisis no paramétrico de diferencias de medianas].

Table I. Indicators used in the self-evaluation of farmers and the impact of PIAL on their farm and family

Indicator	Specific aspects
Productive system	Crop yields; animal yields; incomes; participation in the market; working means; inputs - production; greater diversity; the use of seeds in the farm and/or locality; the use of certified seeds or from local seed collections.
Well-being	Status of the house, daily diet / consumption
Equity	Men take part in household affairs and the education of children; women taking part in income-generating activities; women taking part in activities of added value; women managing diversity and seeds; women taking part in trading and women leaders of organizations.
Influence on the community	Influence of farmers in the productive systems of the locality; interaction and grower capacity of transmitting knowledge.
Agroecological management	Soil conservation activities; agroecological management of crops; ecological management of pests and soil preparation methods.

RESULTS AND DISCUSSION

Participants and benefitted persons by the execution of fairs: over 19 500 growers have taken part in 680 fairs held in more than 97 localities of 45 municipalities of 10 provinces. Participants account nearly 13 000 productive organization structures; they contributed to make the fairs a sort of community facts with a great capability of putting local actors together, around the varietal diversification of crops and create collective learning spaces and multipersonal communication thus boosting the innovative environment of such communities. The participative process, through which local actors transform knowledge into value, is adopted as innovation in this project (4); interactive work as the basis of learning in the communities makes possible the value creation by finding successful solutions to problems. This process is complex and the negotiation and commitment of all actors is necessary.

Adding up the participation of coaches in fairs, the figure of 19.500 persons is reached in these 11 years, out of which, nearly 40 % (7 800 persons) repeat their participation twice. Thus, it could be established that 15 600 persons that received as donation the requested diversity attended the fairs.

According to surveys, the first level of seed dissemination donated to coaches, is made up of four persons per coach (each grower coach delivered part of the diversity to four growers that did not take part in the fairs), over 62 000 growers had access to varieties directly selected by participants in the Fairs. So at this level, 78,000 growers were involved (15,600+62,400).

According to surveyed persons, those that indirectly received part of the donated diversity, considered the second dissemination level, have given seeds to one of two more persons, considering only the minimum. That is, there are 62.400 new growers. Up to the second dissemination level, there are over 140.400 growers, which receive selected introductions in the hundreds of held fairs.

This total of 140.400 growers with direct or indirect access to the diversity of varieties exhibited in the fairs (15.600+62.400+62.400) determine that more than 500.000 persons in Cuba's fields have been favored by the diversity of FP-PIAL projects (5), (the average family of participants is estimated at five members).

Dissemination of diversity by the holding of fairs: direct and indirect executers have managed over 85 000 samples (680 fairs with 28 coaches as average and 4,5 samples delivered to each coach) of more than 2 000 different introductions of tens of species and crops.

Among the crops involved: beans, corn, rice, cassava, sweet potato, tomato, onion, chick pea, sorghum, pastures, soybean, wheat, barley, lentil, triticale, carita bean, papaya, green manure (canavalia, crotolaria and mocuna) and fodder species (mulberry and leucaena) among others.

Example, the total of collected accessions made available to growers in the case of beans, corn and rice, amounts to 243 accessions from collections made in farms, 290 accessions from different collections "ex sito" of national Research Centers (INIFAT, IIA, IIS, INCA, CIAP, UEICAH, EEPFIH, IIAJD) and 226 from foreign institutions (Zamorano and CIAT), equivalent to a total of 759 introductions maintained by the project and made available to growers in the Fairs of Agrobiodiversity in these three species (beans, rice and corn).

95 local seed collections have been created in 28 municipalities of the 10 participating provinces in the PIAL that has received the diversity through the fairs. The FP is defined[C] as a way to decentralization, participation in the promotion of biodiversity in poor rural communities; participative plant breeding consists in the dynamic collaboration among specialized institutions (national and international) and growers to use their competitive advantages. In this flexible method, that permits experimenting with different types of agriculture and crop varieties, growers play an active role and decide over selection, exchange, conservation and multiplication of seeds of locally improved varieties that are taken by teams, unlike the classical method where decisions come from scientists.

These local collections guarantee that food genetic resources present in localities and the replicate in agrobiodiversity fairs with the genetic resources are maintained in such localities (6). The process of rating local seeds and the creation of local seed collections have taken place from two opposing logics and fed back worldwide (7,8): on one hand, the economic interest of multinationals over biodiversity and knowledge linked to it, has led to a process of patrimony of what these enterprises consider as genetic resources from the idea of "profit". Paradoxically, the dependence that multinationals have on biodiversity has made that some of them create local seed collections with "industrial growers" confederations which account for a face-lift to public opinion. On the other hand, the creation of local seed collections and the initiatives of preserving indigenous communities and local growers, take place through process of valuing seeds from the idea of "loss". The awareness of loss and seizure of this patrimony triggers off its evaluation as such. Both processes take place amidst opposing legitimation speeches recreated towards notions of sustainability, intellectual property, biodiversity preservation, these latter support the concepts applied by the PIAL.

Influence on farm yields: farmers have been able to evaluate biodiversity in their farms in order to decide what part of it to use. The process of farmers innovation is discussed because it is perceived as part of a similar one carried out by technicians of experimental stations. What farmers have done has specific features and is different from what professional researchers do without radical differences between them. This supposition is discussed (9) based on the principle of comparing the vision farmers and professional researchers have on the world. It is true that the way both groups look at Nature is different. Farmers from original agricultural cultures or far from high-technological systems do not ask Nature what its secrets are, but talk to it.

As shown in the figure, the group of case study, either that of the eight farms in La Palma, Pinar del Río province or the two CPA in San Antonio de los Baños, Artemisa province (Figure 1) have achieved, after taking part in fairs, to keep satisfactory yields in beans. These results are not only affected by the new genotypes used, but for sophisticated production practices taken up by growers from the learning process used in the interactive meetings they have attended.

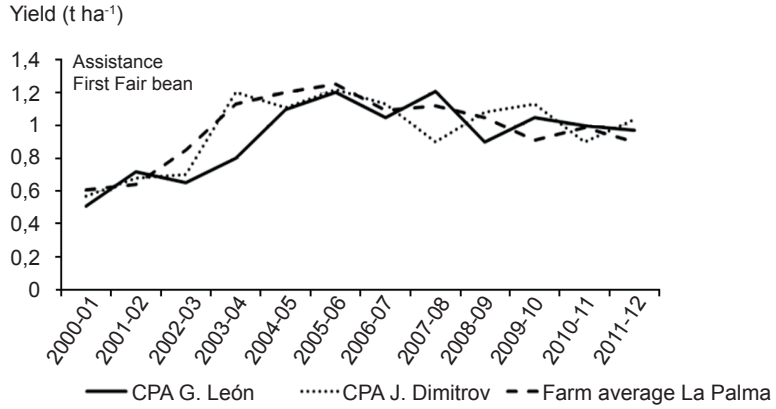

Figure 1. FP effect on bean yield at farm level in La Palma and the Agricultural Production Cooperatives in San Antonio de los Baños

[C] Fernanda, M.M. *Fitomejoramiento Participativo, biodiversidad, y recursos genéticos* [en línea], *CIAT Blog*, 2011, [Consultado: 25 de agosto de 2015], Disponible en: <http://www.ciatnews.cgiar.org/es/2011/02/03/fitomejoramiento-participativo-un-camino-hacia-la-biodiversidad/#sthash.gsYKtP4v.dpuf>.

Incidence of agrodiversity on farms and localities: it is noticeable that in the same cases of the above-mentioned study, it was possible to increase diversity at farm and CPA levels which has been maintained for a decade. Almost half of new varieties come from other bean fairs that growers have selected in further years (Figure 2).

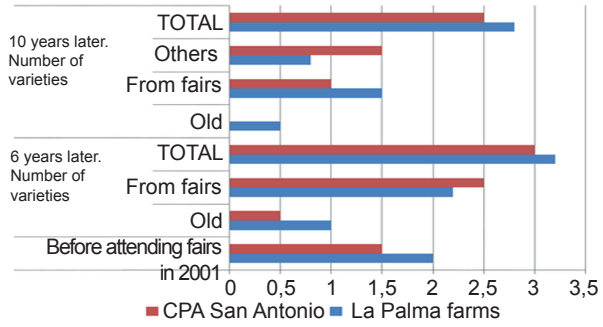

Figure 2. Effect of FP on the average managed biodiversity at farm level in La Palma and CPA in San Antonio de los Baños (beans)

As shown in Figure 3, after the FP-PIAL projects in favor of diversity in beans, all evaluated communities increased the number of varieties used by growers. This far-reaching tendency has decreased but it is still more than double of what was found before starting holding fairs. After 10 years, the multiplying effect of fairs is proven as well as experiments done in farms to favor local diversity(10) the importance of agrobiodiversity maintained and produced agroecologically wise is quoted. In so doing, it is important that public policies promote the sustainable use of the components of agricultural biological diversity, it's *in situ* preservation, the agroecological principles and processes in the participative genetic breeding. Thus, local agrobiodiversity preservation assures the continuous evolution of plants in crop systems and also the adaptation process to different environments.

Evaluation of the effect by direct beneficiaries: Table II shows the significance of differences between values provided by farmers before the project and after 10 years; indicators like: Productive System with ten specific indicators, out of them, the only that is not significant is the use of certified seeds. Both specific indicators are highly significant on the well-being of the farmers which suggests that the present situation is positive as compared to that of 2001.

Regarding equity, there is favorable development in farmers families relative to the six specific indicators, women leaders is still to be improved though it is significantly favorable compared to 2001.

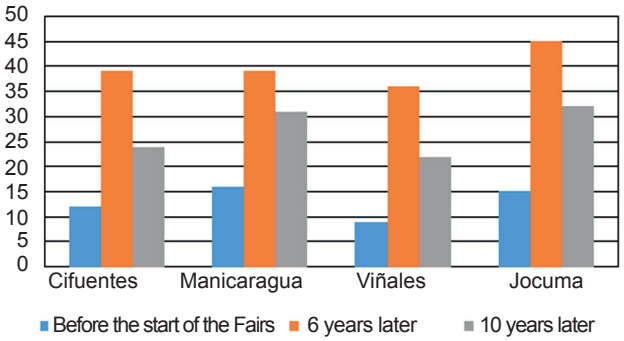

Figure 3. Effect of FP on the biodiversity in beans in some communities of Pinar del Río and Villa Clara provinces

Regarding the important indicator of the influence over the farmers community, the three specific aspects evaluated showed highly significant differences in the interaction with other farmers; there was a wide interaction among growers from the same community and other far-away communities, a great increase in the growers capability of transferring knowledge and an outstanding effect of farmers on the productive systems being applied mainly in the locality, which shows the leadership role of growers[D] (11). This author defines the leadership as a process in which social, political, cultural and/or economically alienated persons gradually acquire collective control over their lives, and over the processes and dynamics that determine the exclusion they are in. This control process grants them the power that permits them to adapt different contextual environments that kept them alienated or subordinated. All this coincides with FAO's contribution in this regard (10), where several benefits and advantages derived from the organized action of farmers are proposed: a) Participation in decision-making. b) Salary achievements. c) Access to produce markets. d) Access to input markets. e) Access to financial markets. f) Access to technology. g) Better use of the infrastructure; h) greater access to social services. i) Cooperation ways. j) Satisfied needs of collective relation and communication. k) Cultural presence.

[D] FAO *Empowering the rural poor. FAO experiences in participation rural development* [en línea], edit. ESHA, 1992, [Consultado: 24 de agosto de 2015], Disponible en: <http://www.fao.org/docrep/003/t3666s/t3666s09.htm>.

Table II. Significant differences of each indicator weight by growers before the FP project and at present

Indicators	Statistical significance Before-Now
Productive system	
Crop yields	XX
Animal yield	XX
Income	XX
Market share	XX
Working means	XX
Production inputs	X
Greater diversity	XX
Seeds from farm / locality	XX
Certified seed	**NS**
Use and/or interest on local seed collections	XX
Well-being	
Home status	XX
Daily diet / consumption	XX
Equity	
Men taking part in household affairs and the education of children	XX
Women taking part in income-generating activities	XX
Women taking part in activities of added value	XX
Women managing diversity and seeds	XX
Women taking part in trading	XX
Women leaders of organizations	
Influence on the community	X
Influence of farmers on the productive systems of the locality	
Interaction with other farmers	XX
Capability of the grower to transfer knowledge	XX
Agroecological management	
Soil conservation activities	XX
Agroecological crop management	XX
Agroecological pest management	XX
Soil preparation methods	XX

X Sig.=0.05, XX Sig.=0.01 NS No significant differences between mean values before and now

Participative evaluation is an indicator in which involved actors, from project team members to the members of the affected population, have the opportunity of providing comments and suggestions on the project and if possible, to influence on their development and/or future projects (12). Beyond this, the involvement level of actors in the project is evaluated and also the way the strategy has been implemented to achieve participation.

Regarding the four indicators related to the agroecological management, surveyed farmers considered it was wide. In the past almost no work was done on soil conservation actions, no agroecological crop management was mentioned, no agroecological pest management was practiced, most of pest and disease control was based on chemicals with great risks for life and the ecocystem, soil preparation methods were not adequate.

Figure 4 clearly shows aspects related to the effect on the community and the agroecological management nearly triple which is published in other articles[E].

[E] Flores, P.; Sotomayor, C.; Escobar, C.; Rodríguez, R. y Carrión, D. *Agricultura Familiar Agroecológica campesina en la comunidad andina. Una opción para mejorar la seguridad alimentaria y conservar la biodiversidad*, 2011, [Depósito legal biblioteca nacional de Perú No. 201106200].

They define that the promotion of agroecological production not only should reach a commercial target nor a social one, but to achieve the articulation of the social and economic dimensions to reach a sustainable development. And even achieving this articulation, it is necessary to accompany it with an incidence process on public policy by local authorities because it would not be worth if policies for its development do not exist.

From the project, the same participation of the farmer's community, in public rallies and mass meeting means their identification at local level thus opening favorable scenarios for their future participation in the project. Authorities have worked to see the role of farmers' communities in the local development process.

There is a high impact on the indicators related to productive systems; inputs do not record such a high growth like in other indicators which is positive if looking for a more sustainable system is concerned. As to the use of certified seeds, there is no impact because the formal system still does not reach localities. The impact on the well-being of the family has trippled according to surveyed farmers; also everything related to housing and the food consumption of the family. Out of the six aspects related to equity, the economic leadership and the presence of local women leaders still have potential to improve.

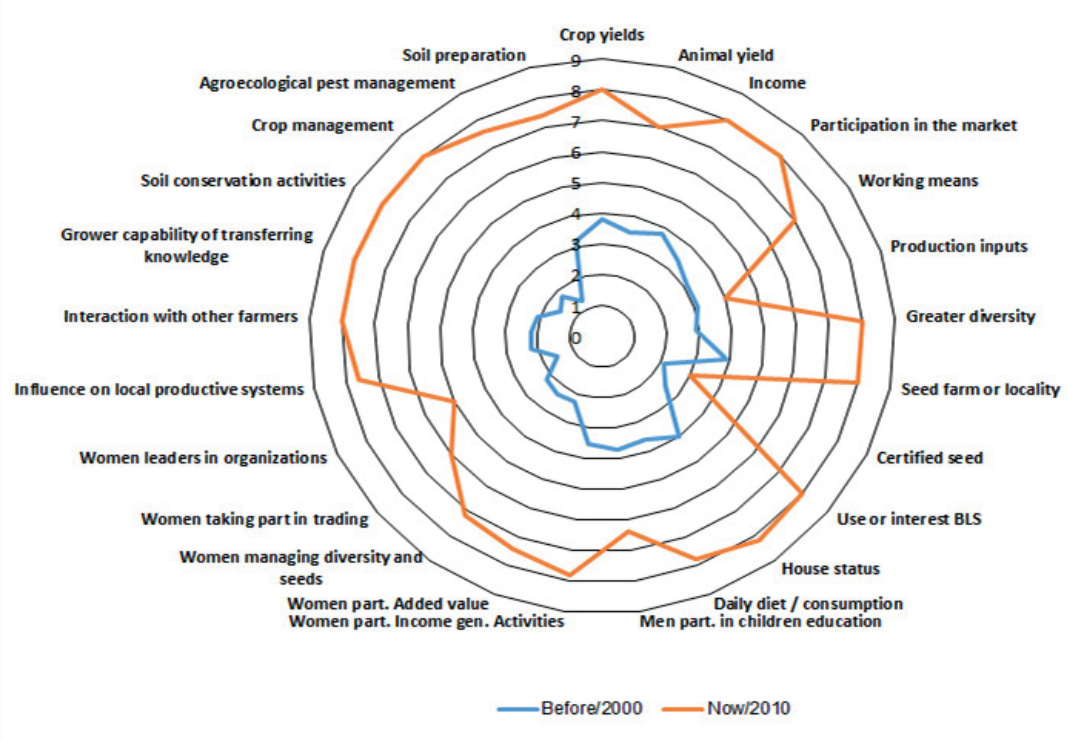

Figure 4. Evaluation of the process by participants. According to surveyed farmers in 21 municipalities of seven provinces

The procedure established by the PIAL, determines a new mode of local agricultural innovation, from a wide participation of the growers in decision-making that leads to a positive impact on the local agricultural innovation, to the creation of a multiactor platform coordinated by local governments with the participation of groups of farmers (13). The comprehensive evaluation shows that FP actions have strengthened food security of the target populations[F] (14). The benefits attained by farms show the effectiveness of the project (6, 15, 16, 17).

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