CHARACTERIZATION OF LOCAL RICE SYSTEMS OF LA PALMA, PINAR DEL RÍO

Irene Moreno✉, H. Ríos and Conny Almekinders

ABSTRACT. A characterization of local rice seed systems was done in «El Tejar-La Jocuma» community. Data was obtained by farmers' surveys. It was shown that farmers produce, exchange, select and conserve seeds dynamics. In this way, they can maintain and conserve rice diversity. Results showed a low access to seeds of formal crop improvement. That is why, most farmers exchange their seeds only with other farmers inside the community. Concerning rice crop, most farmers only have traditional varieties, which have been selected and maintained for many years and produce moderate yields under low input conditions. They have also shown resistance to the main diseases and pests of rice. The paper pointed out the need of providing the farmers with continuous access to new varieties, allowing a continuous gene flow for incorporating disease resistance genes into the system.

Key words: rapid rural appraisal, plant breeding, rice

RESUMEN. Como parte de la etapa de diagnóstico del programa de fitomejoramiento participativo, se realizó una caracterización de los sistemas locales de semillas de arroz de la comunidad El Tejar- La Jocuma. La información se obtuvo por medio de encuestas a los agricultores. El estudio mostró que el acceso de la comunidad a semillas provenientes del sistema formal es escaso, por lo que la producción, selección y conservación de semillas es realizada por los propios campesinos en sus fincas y el intercambio ocurre fundamentalmente entre campesinos y con variedades de la propia comunidad. En el cultivo del arroz, los campesinos siembran fundamentalmente variedades tradicionales, que han mostrado según su criterio ser más resistentes a plagas y enfermedades a través del tiempo y más productivas en condiciones de bajos insumos. Este estudio mostró la necesidad de facilitarles a los campesinos de esta comunidad un acceso regular a nuevas variedades, que garanticen un flujo constante de genes que permitan el acceso a genes relacionados con la resistencia a enfermedades.

Palabras clave: diagnóstico rural rápido, fitomejoramiento, arroz

INTRODUCTION

An exponential growth has been seen in rice crop, which is a basic element in Cuban nutrition. Currently, 69 % of the national production, regarding the so-called rice popularization, corresponds to smallholders. Rice sowing system in Cuba has reached a total of 117 786 ha in the year 2001, 50 % of these areas being planted with upland and irrigated upland rice (1).

The preceding arguments lead to the necessity of developing decentralized strategies (decentralization is understood as the act of taking decisions on the local level) for managing seeds, in order to stimulate access to varieties, innovation, experimentation and collaboration between growers and breeders for developing such crop under different edaphoclimatic conditions. This constitutes a way of strengthening local seed systems (LSS).

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Local seed systems are those in which farmers, as main actors when managing phytogenetic resources, preserve, produce, select and exchange seeds either from improved or local varieties of different agricultural crops. Varietal diversity of these systems is usually high and activities related to seed production, selection and exchange are linked to agricultural production, as well as to socioeconomic processes in farmers' communities (2).

Participatory plant breeding (PPB) is the activity involving the role of breeders and growers, who cooperatively work on breeding (3, 4), they being also in charge of making a single seed system by joining the local and formal ones. This facilitates the continuous access to varieties of both agroecosystems, favoring specific adaptation of varieties as a way of increasing yield and participants' comfort based on a higher diversification in the agroecosystems (5).

In Latin America, more than 70 % of the seed managed by growers comes from informal seed systems, which have limited access to diversity generated by the breeding formal ones. However, there are few reports on the functioning of informal systems, as well as on their main advantages and disadvantages (6).

The diagnosis or characterization of LSS, regarding management of phytogenetic resources in the participating communities, is included within the most common stages

of PPB. This allows determining local problems before applying PPB and the points where such technique should be applied, as well as making an inventory of phytogenetic resources managed by local seed systems (7).

The present work aims to characterize LSS, as part of the diagnosis, regarding management and conditions of rice phytogenetic resources, before applying PPB in El Tejar-La Jocuma, La Palma, Pinar del Río.

MATERIALS AND METHODS

The present research was made in El Tejar-La Jocuma, located in the northern part of La Palma, 60 m above sea level, in the hill massif of Pinar del Río. Approaching to farms belonging to such community is relatively difficult, due to its narrow roads between the slopes of Sierra de los Órganos elevations.

The community embraces about 10 km^2 and is characterized by a very irregular topography, presenting wavy flat relieves and naked-accumulative dissections, with slates and sandstone. The relief is relatively young and the representative soils are brown and fersialitic (8). Forty-nine peasant families live in such community and work mainly in agriculture, crops being sown in hillsides and hill-land. Among the basic crops for family nutrition are rice, bean, cassava, dasheen and maize. This genetic diversity has been a contribution for nutrition of those families, amidst of climatic and socioeconomic changes experimented in Cuba in recent years.

The diagnosis was elaborated after visiting the community twice for an inspection and after consulting secondary information available in the municipality, as well as at the library of the National Institute of Agricultural Sciences. The information provided in this work was mainly obtained by applying a survey of 45 questions, elaborated by a multidisciplinary team (growers, breeders, sociologists, biologists and biochemists). The survey design was based on inspection visits and interviews applied to individuals, and previously elaborated reports on agrobiodiversity management.

Questions in the survey mainly focused on flow characterization and rice seed management, concerning the following elements: a) seed origin, b) frequency for introducing seeds from other farms, c) seed selection times, d) methods for preserving seeds, e) average of varieties grown by farmers during the last six years, f) farmers' estimation of disease attacks in recent years.

The survey was applied on May, 2001 to 34 rice growers: 25 men and nine women coming from different credit and service cooperatives (CSC).

RESULTS AND DISCUSSION

About 725 ha in La Palma are used for growing rice crop, having a total estimated production of 25 000 qq for an average 1.6 $t.ha^{-1}$ yield, under low agrochemical input conditions (9).

An exponential growth has been seen in the community, in the particular case of rice crop; for instance, at the end of the 80's, only 10 families used to sow rice; nowadays, this cereal is sown by the 49 families living in the zone, taking advantage of the several rice sowing conditions. Therefore, it is interesting to know features of the production systems, to which rice is included in this zone as a crop.

The surveyed peasants are between 24 and 75 years old, who constitute a high representation of growers living in this zone, as well as of different degrees of experiences for sowing rice. Farmer's educational level ranges from elementary to preuniversity, no case of illiteracy being reported.

The total average rice-growing area, belonging to 34 growers in the zone, embraces 15.77 ha. Growers who produce the most cultivated 26.8 ha, whereas those achieving lower production only cultivate 2.7 ha, showing differences as to rice production systems. In all cases, the resulting production is used for family nutrition.

Most of the growers seed rice twice a year; whereas a small group sows only once annually and a very reduced part of the farmers develop three rice sowings a year (Figure 1). The most favorable months for growing rice, in a decreasing order, are the following: July, June, March, February and April, indicating that rice is planted in spring-summer season rather than in winter. This could be owing to the fact that good advantage could be taken of rainfall influence in spring.

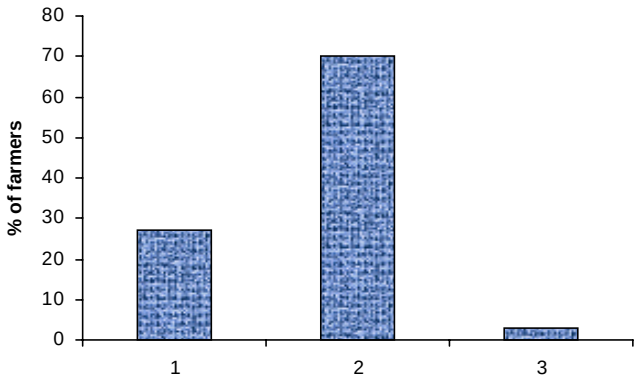

Figure 1. Sowing times per year

A range of crops, together with their varieties, is required in order to supply the need for consumption and sale, among others (10). Figure 2 shows that a high percentage of growers work with more than three varieties in relatively small areas, differently from rice conventional systems, through which only one variety is sown in large extensions. Growers' preference for sowing more than one variety in their farms constitutes a valuable variant to be considered within the strategies for preserving agrobiodiversity. Farmers can keep such diversity since ¾, «Valentín» and «Bolito» traditional varieties are well adapted to sowing conditions in their farms; in addition, they are produced by using low inputs. Some of them, such as ¾, are preferred due to their culinary quality.

Growers need crop genetic diversity for dealing with climatic and soil variations in plots and sowing seasons (11).

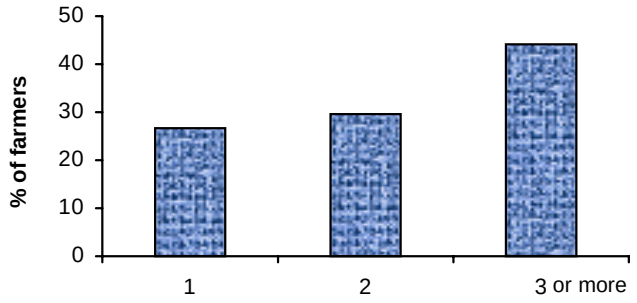

Figure 2. Number of varieties per grower

Regarding varieties sown by growers in the last six years (1996-2001), ¾ stands out showing the highest sowing percentage, as well as 220, «Bolito» and «Valentín» varieties during the last three years. These results show that, the traditional rice varieties are mostly sown whereas, recently, from varieties obtained in research centers, only the one known as «Llenasaco» (INCA-LP-1) is sown. However, its sowing area reduced gradually through the years, dropping to 5 % in the year 2000 because of its low industrial quality as to percentage of whole grains. Such decrease could be owing to the fact that traditional varieties require lower inputs and have shown higher resistance to pests and diseases, present in the zone in recent years (Figure 3).

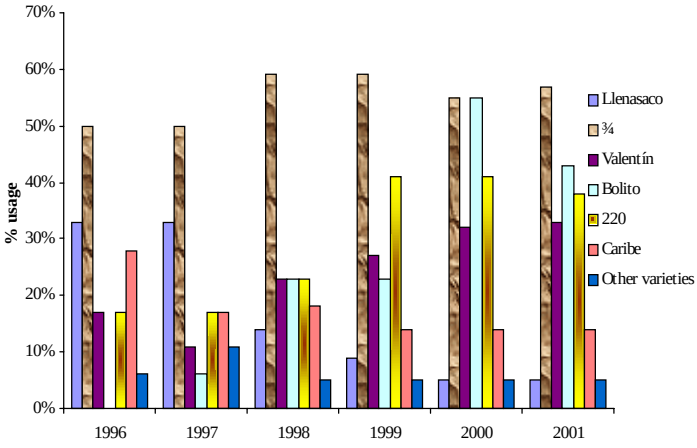

Figure 3. Varieties used by growers in the latest six years

What was formerly expressed shows that local varieties are generally characterized by fulfilling growers' expectations, as well as by presenting good adaptation to local stress conditions. Such adaptation is the result of genetic diversity (in the variety) and local crop development through time, in addition to the combination of grower's seed selection and the environmental pressure (7).

Currently, one of the weakest aspects when managing seeds in the community seems to be the lack of resistant genes to diseases. Introducing tolerant varieties to the most important diseases in the region could be a noticeable contribution for increasing yield and, therefore, achieving growers' wellbeing.

As to pest and disease attacks in the last 10 years, 50 % of the growers consider it has been always low, whereas 32.4 % reported an increase in such attacks, starting from 1993 on 17.6 % recorded an increase in pest and disease attacks during 1993 and 1994, which decreased by 1995 up to 1997, when average values were obtained in this regard, then few attacks were reported from that last year on. This could be related to the appearance of mite-fungus (*Steneotarsonemus spinky* and *Sarocladium oryzae*) complex in rice crop, affecting varieties mainly coming from the formal system (research centers), such as INCA LP-1 variety. That is why 50 % of farmers reported poor damage, since they mostly use traditional varieties.

The relationship between selection environment and target environment constitutes a key problem in PPB and is divided into two phases: the number of target environments surpasses to the number of selection environments and, on the other hand, the relationship between selection and target environments as to climate, soil, agronomic management, socioeconomic conditions, among others. The most efficient method is that of performing a direct selection in the target environment, or in another one presenting identical conditions (12).

In practice, growers involved in the popular rice system face two main limitations. Firstly, there is a restricted systematic access to varieties coming from breeding programs, implemented by scientific institutions.On the other hand, the second restriction is constituted by the varieties obtained through such conventional systems, which sometimes do not supply demands of the technological and agroclimatic reality of growers involved in the popular rice movement.

Considering that popular rice movement is important for the national nutrition security, it would be interesting to develop breeding programs, which respond to the edaphoclimatic, technological and socioeconomic reality of rice promoters. This would be an alternative for increasing yield, based on a higher access to varieties with good adaptation to the specific conditions of rice promoters.

Most of the growers perform seed selection in two times (Figure 4): previous or during field harvest through the method of positive selection, searching for the most homogeneous part of the field, or after harvest at home, selecting part of the seeds intended for nutrition. Something similar occurs to bean crop in the zone, where field homogeneity is also considered. However, selection on maize crop is performed after harvest and, in some cases, right before seeding (13).

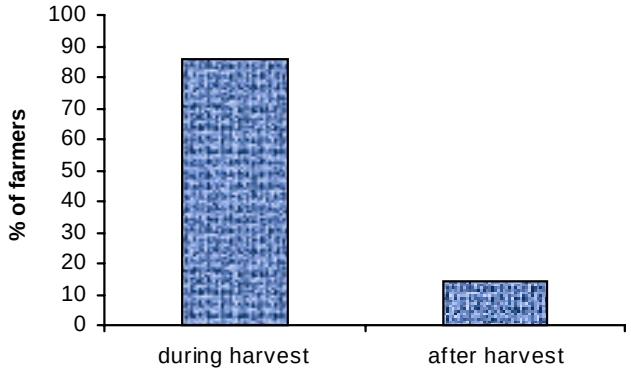

Figure 4. Time for selecting rice seeds

As to introducing a new seed or variety, the intervals vary among growers, its average ranging from two to four years. Differences are also seen in many factors, such as yield, resistance to diseases and varietal quality, among others (Figure 5). The decision of adopting a new variety or seed is taken by the man, head of the family, although taking into account the remaining members' criteria.

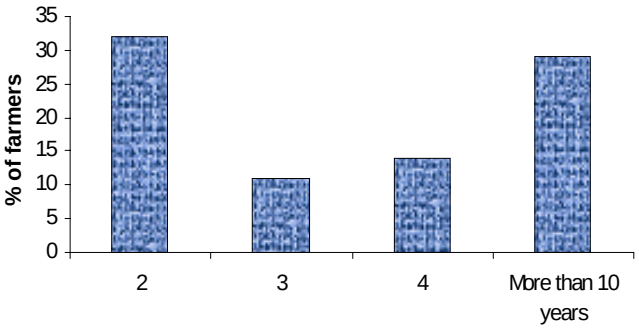

Figure 5. Frequency for introducing new varieties or seeds to farms

Seed exchange is a common practice in the zone, and reasons why this activity is carried out vary, depending on the crop. In the case of bean, the exchange is reported to be performed due to loss of seeds or their quality, as a result of a decrease in yield and/or because of changes in other morphoagronomic features, a phenomenon that is called «variety degeneration» (12). This is also applied to rice and constitutes another reason why new varieties are introduced to farms.

Most of the times, when a new seed or variety is adopted, it is sown together with the others existing on the farm (Figure 6) and it is rarely introduced to substitute such existing varieties. Why new varieties are sown together with the old ones depend on their behavior as to yield, quality and resistance, compared to those varieties commonly cultivated by farmers.

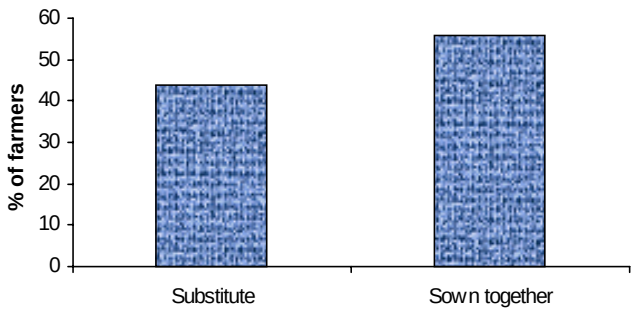

Figure 6. Surveyed growers' experimentation capacity

Even though farmers do not need to store high seed quantities, differences are seen regarding storage method, and seeds are kept mainly in bags and boxes (Table I). Men generally perform storage and, according to surveyed farmers, sometimes children and women take little part in the process. However, women's participation was higher than the one reported mainly regarding drying, selection and storage. Poor use of chemical products is made for preserving seeds; only 16 % of growers use Parathion.

Table I. Actors and methods for seed preservation

Seed storage methods	Bags	=55 %
	Boxes	=29 %
	Bags and boxes	=16 %
Seed storage treatments	Pesticide	=16 %
	None	=81 %
Storage actors	Men	=84 %
	Women	=39 %
	Children	=16 %

Concerning seed acquisition, growers are mostly looking for new seeds, they being sometimes helped by their children. Likewise, family members participate in the multiplication process of new seeds. On the survey applied, most of the farmers answered that the introduction of new varieties from other farms is performed for achieving yield increase, as well as for testing new varieties.

Seed exchange in the community is practiced in the urban area rather than in the countryside, since most growers live in town and go to farms only with the purpose of working. This coincides with other criteria on the fact that seed exchange is carried out within the community and through traditional mechanisms as a gift, so that growers can obtain either new seed varieties or fresh seeds (11, 13).

It was seen that 91 % of the surveyed growers use urea as extreme input, with an application of 15-25 kg.ha^{-1}, which represents 10 to 20 % of the amount employed in conventional systems. Likewise, such growers use Parathion (69 %) as only pesticide, showing low input dependency, compared to application levels used in rice agribusiness complexes.

After analyzing work division, it was observed that men mainly perform fieldwork on the farm. Women have a higher participation once rice is harvested, that is, drying

and threshing as well as evaluating culinary properties of the varieties, a very important aspect when selecting varieties to be sown in farms, since they will be used for family nutrition.

The analysis of local seed system in this community reveals the high variability existing in each component. This coincides with some criteria confirming that such systems are integrated and present high variability, where growers produce, preserve and exchange seeds belonging to local or improved varieties and to crops which are different in each place. Differences are also found among communities and their inhabitant families, as well as regarding crops and varieties (2, 11).

Finally, when the local systems are compared to specialized sectors, significant differences are found as to seed management and diversity, the first system being more dynamic in terms of exchange. Taking into account that continuous access to varieties is one of the existing limitations, thinking of alternatives is suggested, which favor the continuous flow of genetic diversity with good adaptation to conditions in the zone.

Particularities of local seed systems could demand different breeding strategies from conventional systems (Table II).

Table II. Comparison of local and conventional rice production systems (specialized sector)

Features	Local system	Conventional system
Input and modern technologies	Low	High
Yield ($t.ha^{-1}$)	1.6 (La Palma)	3.0 (Pinar del Río)
Frequency for introducing new varieties (varieties/year)	7 varieties	3 varieties (5 varieties in 30 years) 14
Diversity per area	High	Low
Seed exchange	High	Low
Variety management	Specific adaptation	General adaptation
Type of knowledge	Local	Industrial (green-revolution)

Characterizing local seed systems in El Tejar-La Jocuma has allowed determining crop local problems, the status of rice phytogenetic resources, as well as the possible points where PPB could be applied to this cereal.

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