

# DIVERSITY CHARACTERIZATION OF TWO RICE-GROWING COOPERATIVES ON CUENCA DEL PAPALOAPAN, MEXICO

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**ABSTRACT.** This survey was conducted in Cuenca del Papaloapan, with the purpose of knowing how to manage rice genetic resources. It was aimed at scanning the possible relationship existing between farmers' application of technological packages and their management of rice genetic resources in two cooperatives: "Héctor Montes Parra" and "Juan Pacheco Alemán" from Veracruz, Cuenca del Papaloapan. It was proved that by increasing the use of technology in rice, higher yields are recorded than when employing agrochemicals, which are not even related to farmers' profits. There was a poor crop diversity, since most growers use 'Milagro Filipino' as a single variety.

*Key words:* rice, biodiversity, rapid rural appraisal

**RESUMEN.** Con el objetivo de conocer el manejo de los recursos genéticos en el cultivo del arroz en la Cuenca del Papaloapan, se realizó el presente trabajo de diagnóstico, el cual se dirigió a explorar la posible relación existente entre la aplicación de los paquetes tecnológicos por los agricultores y el manejo que hacen estos de los recursos genéticos de arroz en los ejidos "Héctor Montes Parra" y "Juan Pacheco Alemán", pertenecientes al estado de Veracruz en la Cuenca del Papaloapan. Se constató que la tecnificación en el cultivo del arroz se caracteriza por la obtención de altos rendimientos sobre la base del empleo de altos insumos agroquímicos, lo cual no se asocia al aumento de las ganancias de los agricultores. Se evidenció la poca diversidad en este cultivo, ya que en la mayoría de los casos los agricultores emplean una sola variedad Milagro Filipino.

*Palabras clave:* arroz, biodiversidad, diagnóstico rural rápido

## INTRODUCTION

At present, Mexican agricultural sector is lacking the necessary inversions to support its development and decrease the effects provoked by the need of appropriate technologies, productive organization and insufficient infrastructure in general, in such a way that there are possibilities of obtaining high levels of production and productivity as well as an acceptable rentability of activities (1).

La Cuenca del Papaloapan has been classified as an eminently rich zone in terms of biodiversity, culture and water resources. As an agricultural technology development pattern, in such region predominates top-down technology transference, which has limited a rational exploitation of these natural resources (2).

The technological transference patterns implemented have pretended to apply homogeneous technological packages, even though farmers present serious restrictions in its adoption, as a result of its socioeconomic reality, diversity in living manners and cultural traditions. The use of technological packages in cooperatives has provoked a notable input dependency, reduction of innovation and growers' organization in terms of knowledge and technological development, as well as a growing agrobiodiversity erosion. Everything above said has encouraged certain cooperative sectors to demand more agrochemicals, as a unique choice to improve yields.

In this region, there is an alarming depression of basic grains seemingly conditioned by high volumes of importation, reduction of subsidies and lack of alternatives in the cooperatives, which allow to obtain basic grains at low cost with moderate yields.

In turn, improved seed-producing enterprises, as an essential part of technological packages, have drastically diminished in quantity and diversity. For instance, rice, with a production capacity of 8000 tons per year, at present 1000 tons are produced. It is worth saying that the former productions are essentially based on one at most two varieties. Such results make evident the dramatic limitations of the formal seed system of La Cuenca del Papaloapan. Therefore, it is difficult to satisfy farmers' demands regarding seed quantity and diversity, and the

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situation becomes harder, since prices surpass cooperativists' economic capacity.

Consequently, this paper is aimed at exploring the real situation of "Héctor Montes Parra" and "Juan Pacheco Alemán" cooperatives, with regard to management of interspecific diversity, external inputs applied and rice genetic resources, also to examine the relationships existing between rice genetic diversity management and the use of agrochemical inputs. It allows to determine local problems prior to the application of participatory plant breeding (PPB), the possible points of access to PPB and the inventory of genetic resources managed by local seed systems (3).

## MATERIALS AND METHODS

For a diagnostic study in rice crop, the regions selected were those with great possibilities of development and the ones with limited options for development, according to indicators evaluated, when giving priorities, with leaders of the General Worker-Farmer Union (UGOCP) of Mexico and other local actors.

This investigation was conducted in two cooperatives from Veracruz 10 years after being founded: "Héctor Montes Parra" located in Tres Valles town, consisting of 24 cooperativists, whereas "Juan Pacheco Alemán" from Joaquín town, consisting of 30 cooperativists.

With the purpose of defining a typology which enabled to evaluate agrobiodiversity management in the cooperative, both cooperatives were selected per cultivar: I) rainfed rice ("Héctor Montes Parra") and irrigated rice ("Juan Pacheco Alemán").

The information for this study was mainly obtained after applying a quiz containing 11 subjects previously prepared by a multidisciplinary group (agronomists, plant breeders, biologists, biochemists and economists).

Questions were mostly focused on characterizing the flow and management of genetic resources with respect to: crop diversity, devoted area to economically important crops, seed origin, frequency of seed introduction from the outside plots, seed selecting times, average varieties cultivated per cooperative over the last six years, cultural practices, labor costs, chemical inputs to apply to rice and animal diversity.

To estimate production cost/crop, average costs over the latest year was determined by those farmers. Benefits were estimated by considering relationship, average yield per area, harvest value in the last year and wastes of each component of the technological package applied; the amounts of inputs applied per cooperative were quantified.

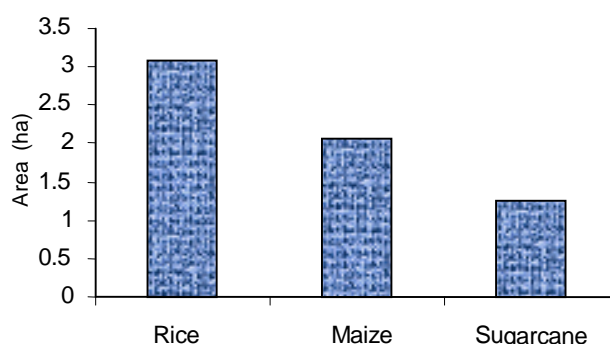
Surveys were applied in August, 2001, and 45 cooperatives were interviewed in both places.

## RESULTS AND DISCUSSION

### General characterization of the cooperatives selected

*"Héctor Montes Parra" cooperative.* The average age of surveyed cooperativists is 41 years old, 28.6 % of them are illiterate.

The average hectares of each cooperative member are 3.5 (Figure 1), which are mainly devoted to rice crop with an average of 3.09 ha, mostly rotated with maize (81 % cooperative men) on 2.05 ha surface area. Besides, only one cooperative woman rotates this crop with sorghum and other with bean. Another crop is sugarcane (28.6 % cooperative men), to which 1.25 ha area is dedicated. Apart from those crops, either in plots or yards, there are fruit trees as mango, orange, coconut and avocado.



**Figure 1. Relationship of areas per economically-important crop from "Héctor Montes Parra" cooperative**

In this cooperative, there was poultry, like hen, turkey, duck, pig, lamb and cattle. Table I shows that just 100 cooperativists raise hen and pig, two of them raise lamb and other two have cattle, whereas only one raises turkey and duck, who is the same person. It indicates that most of them do not use animal raising as an alternative for family self-consumption, so they have to depend on the market and increase their wastes to obtain products. It is also interesting to point out a few cooperative men employ the main crop (rice) or any byproduct for animal feeding.

**Table I. Relationship of animals from surveyed cooperativists in "Héctor Montes Parra"**

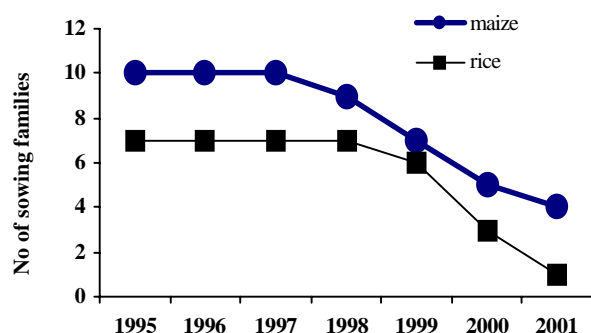
	Cattle	Pig	Hen	Lamb	Duck	Turkey
Number of cooperativists	2	10	10	2	1	1
% (n=21)	9.52	47.6	47.6	9.52	4.76	4.76
Average animals/cooperativist	0.09	0.80	4.95	1.09	0.57	0.19

*"Juan Pacheco Alemán" cooperative.* Lands are shared among 30 cooperativists, each of them with three hectares. Particularly, in this cooperative, the man manages his family plots, despite there has officially been any other cooperativist in the family; thus, we should talk about families instead of cooperativists. At the time of diagnosis, there were just 24 cooperativists grouped in 17 families in the zone.

There is a high average age (50 years old), that could affect cooperative agricultural continuity (50 % of them are illiterate).

Except one case, none of the surveyed cooperativists seed fruit plants or hort crops. Besides cultivating lands, nine surveyed cooperativists are dedicated to animal raising.

In spite that the cooperative is considered a rice-growing place with an infrastructure created for seeding irrigated rice, just 41 % of the families have seeded rice once. The other crops found in the zone were forage, maize and sugarcane with a drastic reduction of the area dedicated to rice and maize (Figure 2). In turn, there was not any family seeding common bean. All families sow fodder at present, 64 % of them have seeded maize once and just one family has planted sugarcane.



**Figure 2. Performance of seedings per crop in the latest years of "Juan Pacheco Alemán" cooperative**

Concerning cattle, 76 % of families recorded at least one bovine head. Table II shows a detailed description of all animals.

**Table II. Relationship of animals from surveyed cooperativists in "Juan Pacheco Alemán"**

	Cattle	Pig	Hen	Duck	Turkey	Donkey	Horse
Average of animals/cooperativists	9	2.8	13.8	1.3	3.1	0.1	0.2

In "Juan Pacheco Alemán" cooperative, farmers have improved animal raising in the latest years; cattle also increased on the basis of reducing basic grains (Figure 2). This phenomenon has provoked a greater external dependency of cooperativists' feeding and animal raising.

Even though the increment of animal raising, especially cattle, tends to be related with cooperativists welfare, this trend is based on reducing other lines. By reducing crop diversification and increasing cattle, agricultural systems could become more fragile to the complex changes of market and price relationships.

All the world over, there is a progressive awareness of conscience about the sustainable use of natural resources, which depends on the regenerating potential of genetic diversity, species and ecosystems (4). Therefore, it is necessary all resources must be adequately applied to cooperativists' welfare.

*Analysis of the relationship between profits and management of seeds from basic grains in cooperatives.* By means of survey results, the relationship of cost, profit and rice yield was determined in the cooperatives.

Table III presents data from yields, wastes and profits per ha of each cooperative studied.

**Table III. Analysis of the relationship among profits in cooperatives and seed flow from basic grains**

Crop	Cooperative	Yield (t.ha <sup>-1</sup> )	Waste (\$.ha <sup>-1</sup> )	Profit (\$.ha <sup>-1</sup> )
Rice	"Héctor Montes Parra"	4.7	3776.3	3627.2
	"Juan Pacheco Alemán"	8.6	10221.5	2661.5

In the case of rice crop, higher profits are recorded, despite yields from "Héctor Montes Parra" cooperative are lower than those from "Juan Pacheco Alemán". Such difference is mainly due to a lesser use of chemical inputs (especially fertilizers), which represents lower wastes. Also, there are more cooperativists with their own machineries, that means income savings in "Juan Pacheco Alemán" cooperative, whose labor has to be paid by machineries. This cooperative has more wastes by hand labor, since it is cultivated under irrigation and seeded by transplanting. Likewise, the farther the cooperative the more transport wastes are. Another difference is herbicide management in both cooperatives. Contradictorily, the one with irrigation applied more herbicides than the other. Seemingly, water has not been properly applied to weed control at the irrigated crop system.

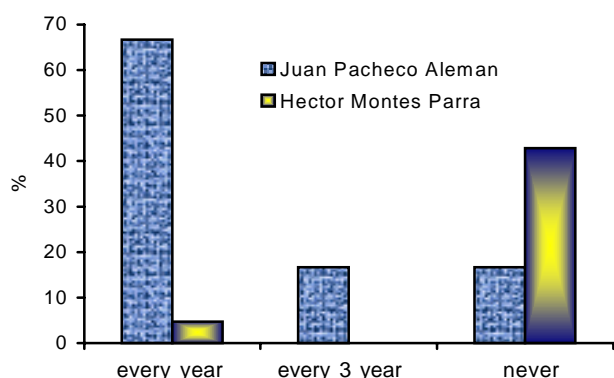
Differences recorded when using inputs between both cooperatives selected for rice crop mainly lie in fertilizer application. 50 % cooperativists surveyed preferred to use higher amounts of fertilizers, even though the present crop response is considered satisfactory. This apparent contradiction remarks the interest for investing in fertilizers, as an only choice for increasing yields. Probably the absence of an experimenting system and the lack of alternatives for management in lands determine these attitudes.

Differences between both cooperatives concerning yield and profits, make suppose the first indicator does not necessarily determine the second. "Juan Pacheco Alemán" cooperative with favorable lands for rice seeding and irrigation system, showed the least profits and surpassed yields from "Héctor Montes Parra" cooperative with rainfed rice.

Farmers' systems could be characterized by three elements: seed production, use of varieties and ways for seed exchange (5). When analyzing diversity of seed varieties employed in both cooperatives, it was extremely low, since most cooperativists use Milagro Filipino cv (99 %) and just a few (1 %) use two varieties, Milagro Filipino and Morelos, the latter is recently introduced from a region with a completely different climate to La Cuenca zone, which makes evident its poor adaptation to the agroecosystem. However, in Cuba, growers from the

western region perform a whole management of genetic diversity in maize and bean crops, which allows to produce, exchange, select and preserve seeds, to maintain and widen genetic diversity in their lands (6) and in case of rice, a high percentage of these farmers manage more than three varieties in relatively small areas. The fact that they prefer to seed more than one variety makes possible a valuable variant, which could be considered at the strategies for preserving agrobiodiversity (7).

Seed production is usually integrated to crop production, whereas the greatest production is used for domestic and marketing consumption; one portion is separated to be used as seed for the next seeding (8). When analyzing seed flow in “Juan Pacheco Alemán” cooperative, farmers change seed once a year (Figure 3). This frequency of change, according to surveyed criteria, does not have to do with the search for better varieties but to limitations when preserving them. It is notable that the main supplier of rice seeds does not perform his sowings in the studied cooperative.

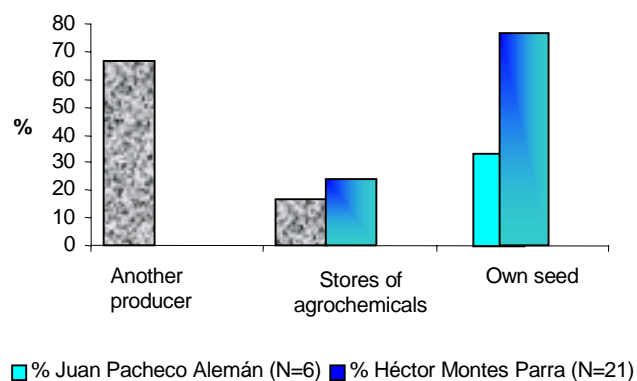


**Figure 3. Change frequencies of of rice seeds in “Juan Pacheco Alemán” and “Héctor Montes Parra” cooperatives**

Farmers have an optimal range of seed sources; sometimes, they prefer seeds obtained in their own farms, for the known quality which is economic and can be reached in time (8). When analyzing the sources for obtaining seeds from both cooperatives, the highest percentage of seed from out of the plot is attained in “Juan Pacheco Alemán” (Figure 4), so coinciding with the same practices of smallholders from Zaire and Bangladesh (9), whereas in “Héctor Montes Parra” cooperative, farmers select seeds in their own cooperative. In this way, it is probable that some patterns of specific adaptation can be conferred, coinciding with management of rich farmers from the above regions. The most important seed supply is reached by preserving a position of the farmer’s own harvest (10).

There are differences of herbicide management in both cooperatives: “Juan Pacheco Alemán” with irrigation systems applies more herbicides than “Héctor Montes Parra”. Seemingly, water has not been appropriately employed on weed control in “Juan Pacheco Alemán”.

Differences between both cooperatives concerning yield and profits make suppose that the first indicator does not necessarily determine the second. “Juan Pacheco Alemán” cooperative, with favorable lands for rice seedings and irrigation systems presented the best profits and higher yields than “Héctor Montes Parra”, which seeds rainfed rice.



**Figure 4. Sources for obtaining rice seeds in “Juan Pacheco Alemán” and “Héctor Montes Parra”**

## CONCLUSIONS

- \* Low schooling level in both cooperatives, the highest value being recorded in “Juan Pacheco Alemán” with 50 % illiterates, so there is the need of developing extensionist approaches and/or transference of technological innovation considering this limitation.
- \* Poor crop diversity, since in most cases, growers use one single variety.
- \* In “Juan Pacheco Alemán” cooperative, the highest percentages of growers obtain their seeds out of their farms, meanwhile in the other one, cooperativists select their own seed.
- \* The technically cultivated rice, characterized by obtaining high yields on the basis of using great agrochemical inputs, is not associated to the rising of growers’ profits.

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