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Original article

Agricultural biodiversity in peasant farms in Granma province

Biodiversidad agrícola en fincas campesinas de la provincia Granma

Alexander Alvarez Fonseca*, Licet Chávez Suárez

Instituto de Investigaciones Agropecuarias ¨Jorge Dimitrov¨, carretera de Bayamo a Manzanillo, Km. 17, Peralejo, Bayamo, Granma, Cuba. CP 85 100

ABSTRACT: Inventories of agricultural diversity in peasant farms in three municipalities in Granma province, were performed. Species number and area per crop were counted and classified taxonomically. The number of species was determinated by farms, the importance of the species given by the frequency of occurrence in agroecosystems studied. Results indicated that agrobiodiversity of the evaluated properties is represented by 27 species belonging to 17 botanical families. The largest number of managed species was achieved on farms "Bella Luisa" of Guisa municipality and "El Bosque" from Jiguaní with 11 and 10 species respectively. The wealth of species by crop group was dominated by vegetables and fruits. It concluded that diversity of crops of economic importance in the farms are low. The crops in the farm are closely related with basic nutrition, where predominated crops rich in carbohydrates, wilts that the source of vegetal protein is represented only by bean.

Key word: agrobiodiversity, richness.

RESUMEN: Con el objetivo de evaluar la diversidad agrícola, se realizaron inventarios en 12 fincas campesinas de tres municipios de la provincia Granma. La toma de datos se realizó mediante el conteo directo y el empleo de técnicas participativas como entrevistas a los productores. Las especies inventariadas se clasificaron taxonómicamente. Se determinó la riqueza específica y la importancia de las especies, dada por la frecuencia de aparición de estas en los agroecosistemas estudiados. Los resultados indicaron que la diversidad de cultivos de las fincas evaluadas estuvo representada por 27 especies, pertenecientes a 17 familias botánicas. El mayor número de especies se observó en la finca "Bella Luisa", del municipio Guisa, seguida de la finca "El Bosque", del municipio Jiguaní, con 11 y 10 especies, respectivamente. La riqueza de especies por grupos de cultivos estuvo dominada por las hortalizas y los frutales. Se concluye que la diversidad de cultivos de importancia económica en las fincas objeto de estudio es baja. Los cultivos manejados en cada finca están muy estrechamente relacionados con la alimentación básica, donde predominan los cultivos ricos en carbohidratos, mientras que la fuente de proteína de origen vegetal está representada solamente por el frijol.

Palabras clave: agrobiodiversidad, riqueza de especies.

INTRODUCTION

The diversity of genetic resources, as part of agrobiodiversity, is the basis of agriculture and food. Their conservation is essential for supplying humanity with products and providing food and nutritional security (1, 2). In recent years, much attention has been paid to the functions of biodiversity in agricultural systems as a basic attribute of sustainable agricultural production (3, 4). The loss of genetic heritage in recent years, which is expressed in agricultural diversity, is substantial and, in most cases, irreparable (5). This reduction of the genetic base on which natural selection acts leads to an alarming increase in the vulnerability of production systems to climate change or to the emergence of new pests and diseases (2, 6, 7).

In this context, making available to farmers the widest diversity of crop species and varieties is one of the basic purposes of the Local Agricultural Innovation Program (PIAL) in Cuba. This has been characterized by the permanent, real and active participation of the peasantry in strengthening agricultural innovation, with a concept of sustainable agricultural production, based on agroecological principles (8).

*Author for correspondence. alexanderf@dimitrov.cu

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On the other hand, several studies have been carried out in Cuba with the purpose of evaluating the state of biodiversity managed by farmers, in order to define new ecological strategies to improve it and propose indexes to evaluate the efficiency of agrobiodiversity in these systems (9-11). For this reason, the objective of this work was to evaluate the agricultural diversity in 12 peasant farms included in the PIAL, in three municipalities of Granma province.

MATERIALS AND METHODS

The research was carried out in 12 farms, called confidence samples, for the development of phase III of the PIAL, in Guisa, Bayamo and Jiguaní municipalities in Granma province. Table 1 shows their general characteristics.

The inventory was carried out during the period January-April 2014. Data collection was carried out through direct counting and the use of participatory techniques and semi-elaborated interviews with producers. The inventoried species were taxonomically classified. The specific richness was determined as the total number of species found in each farm and the frequency of occurrence, through the quotient of the number of farms where each species was found between the total numbers of them.

RESULTS AND DISCUSSION

Crop diversity in the 12 farms studied was represented by 27 species belonging to 18 botanical families (Table 2). The most represented families were Curcubitaceae, Poaceae and Solanaceae, with three species each. Together they represent 33 % (Figure 1).

Superior results were reported by other authors, who found the existence of 68 species of agricultural importance, belonging to 27 botanical families, in 15 peasant farms of Zaragoza community, in San José de las Lajas municipality, Mayabeque province (9). However, in the same province, but in Jaruco municipality, other authors found that human food agrobiodiversity per productive scenario evaluated, fluctuated between 15 and 26 species, a result similar to the one obtained in the present research (11).

In this sense, it is recognized the increase in the country of family gardens in rural and urban areas, based on highly planned agrobiodiversity, with more than one hundred cultivated species, which are used as a source of subsistence for the family and for commercialization (12). The management of these agroecosystems is constantly improved by the relationship between traditional and scientific knowledge, in a dynamic and adaptive way.

In general, the cultivation of cassava (*Manihot esculenta*), plantains (*Musa* spp.), beans (*Phaseolus* spp.) and maize (*Zea mays*), among others, manifest the attachment to a certain food culture (its origin goes back to some aboriginal cultures of Mesoamerica and South America), where roots, tubers and grains are fundamental in the family diet (13). In this sense, in a research conducted in milpa production systems in southeastern Mexico, it has been reported that of the 26 cultivated species, the main ones are: maize, beans, squash and cassava (14). In Colombia, in a study that included 20 home gardens in San Pablo municipality, the most diverse and frequent crops were bananas, mangos, guava and cassava (15).

The presence of other species, such as tobacco (*Nicotiana tabacum*) and coffee (*Coffea arabiga*), is directly related to income generation for producers and depends on the soil and climatic characteristics of each agroecosystem.

From a nutritional point of view, crops rich in carbohydrates, such as cassava and sweet potatoes, are indispensable for their energy supply to the body, while the source of vegetable protein is represented only by the common bean. Vegetables and fruits, on the other hand, are a nutritional source for human beings, due to their content of fiber, vitamins, mineral salts and other elements, all of which increasingly relate their consumption to the possibility of achieving a good quality of life (16).

The lowest number of species managed by farmers in these agroecosystems corresponds to the farm "El Tamarindo", in Bayamo municipality, with only five species; while the highest value corresponded to the farm "Bella Luisa", in Guisa municipality, with 11 species of agricultural crops (Figure 2A). A higher percentage of average species was observed in the farms corresponding to Guisa municipality (31 %), followed by Jiguaní (29 %) and finally Bayamo municipality (25 %) (Figure 2B).

Table 1. General characteristics of the farms under study

No.	Farm name	Production Center	Municipality	Total area (ha)	Relief	Type of soil
1.	La Esperanza	CCS “Clemente Ramos”	Bayamo	6,71	Plain	Vertisol
2.	Los Bernardo	CCS “Anselmo Aldana”	Bayamo	16,06	Plain	Vertisol
3.	La Luz	CCS “Pedro Pompa”	Bayamo	2,5	Plain	Fluvisol
4.	El Tamarindo	CCS “José Martí”	Bayamo	13,42	Plain	Fluvisol
5.	El Progreso	CCS “Braulio Coroneaux”	Guisa	7,7	Slightly undulated	Brown
6.	Antonio Maceo	CPA “Antonio Maceo”	Guisa	27,7	Slightly undulated	Brown
7.	El Descanso	CCS “José Ramón Vázquez”	Guisa	11,68	Slightly undulated	Brown
8.	Bella Luisa	CCS “Braulio Coroneaux”	Guisa	4,36	Slightly undulated	Brown
9.	El Bosque	CCS “Wilian Soler”	Jiguaní	13,42	Plain	Vertisol
10.	La Victoria	CCS “José Rosabal”	Jiguaní	3,21	Plain	Fersiallitic
11.	El Palmar	CCS “Efigenio Reyes”	Jiguaní	5,78	Plain	Brown
12.	La Baldomera	CCS “Abrahán Martínez”	Jiguaní	14,84	Plain	Brown

Table 2. Taxonomic identification of agricultural biodiversity in 12 rural farms in Granma province

Family	Scientific name	Common name	Crop group
Anacardiaceae	*Mangifera indica* L.	Mango	Frui tree
Annonaceae	*Annona muricata* L.	Soursop	Frui tree
Arecaceae	*Cocos nucifera* L.	Coconut	Frui tree
Asteraceae	*Heliantum annus* L.	Sunflower	Oleaginous
Bromeliaceae	*Ananas comosus* (L.) Merr.	Pineapple	Frui tree
Convolvulaceae	*Ipomea batatas* (L.) Lam	Sweet potato	Tuber
Curcubitaceae	*Curcubita pepo* L.	Pumpkin	Vegetable
	Cucumis melo L.	Melon	Frui tree
	Cucumis sativus L.	Cucumber	Vegetable
Euphorbiaceae	*Manihot esculenta* Crantz	Cassava	Tuber
Fabaceae	*Arachis hypogaea* L.	Peanut	Oleaginous
	Phaseolus vulgaris L.	Common bean	Grains
Lauraceae	*Persea americana* Mill	Avocado	Frui tree
Liliaceae	*Allium* cepa	Onion	Vegetable
Moringaceae	*Moringa olifeira* Lam	Moringa	Oleaginous
Musaceae	*Mussa sp*	Plantain	Viands
	Mussa	Donkey plantain	Viands
Pedaliaceae	*Sesamum indicum* L.	Sesame	Oleaginous
Poaceae	*Cenchrus purpureum*	Kingras	Others
	Sacharum oficinarum L.	Sugar cane	Others
	Zea maíz L.	Corn	Grains
Rubiaceae	*Coffea arabiga* L.	Coffee	Others
Solanaceae	*Capsicum annuum* L.	Chili bell pepper	Vegetable
	Nicotiana tabacum L.	Tobacco	Others
	Solanum lycopersicum L.	Tomato	Vegetable
Umbeliferae	*Coriandrum sativum* L.	Coriander	Condiment
	Daucus carota L.	Carrot	Vegetable

The importance of the species is given by their frequency of occurrence in the systems studied (Figure 3). In the 12 farms studied, the most represented crop is cassava, which is grown in 75 % of the farms, followed by sweet potato, plantain and beans, which are grown in 50 % of the farms.

Genetic and specific diversity has a strategic value in the peasant economy, hence its selectivity, importance and frequency of occurrence. The order of importance of the species, given their frequency of appearance, is not only conditioned by their quantitative market value and nutritional contribution of the species, but is also influenced by socioeconomic and ecological aspects, such as: family traditions, availability of resources, marketing channels, availability of land and consumption habits (9).

The appearance of the different crop groups is dominated by vegetables and fruit trees (Table 3), which represent 44 % of the species registered, but only occupy 19% of the cultivated area, which could suggest that these groups do not represent the economic support of the farmers, but the remaining crop groups, mainly viands and grains, which occupy the largest percentage of the cultivated area, 38.0 and 22.5 %, respectively.

In the referred study carried out in 20 home gardens in Colombia, it was found that 48% of the species were fruits, 16 % roots and tubers, 11 % vegetables and 9 % condiments (15).

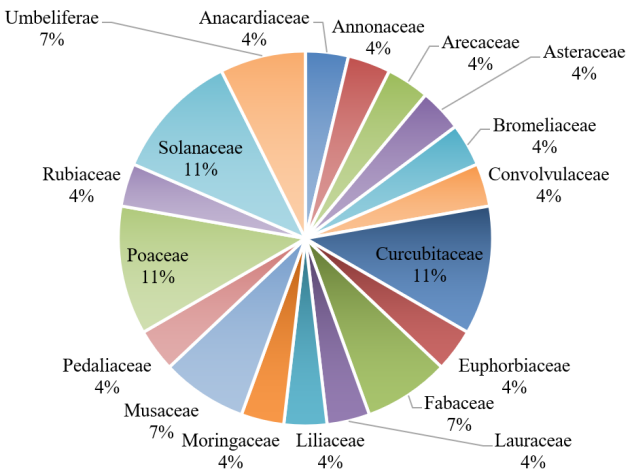

Figure 1. Species distribution by botanical families

The number of fruit species present in agroecosystems is due, among other reasons, to their importance in the production of food for human and animal consumption and industry (17). They also beautify the countryside due to the extraordinary color of their leaves, flowers and fruits, their use as living fences, windbreaks, protective strips, among others; in addition, they contribute to increase biodiversity.

On the other hand, it is argued that fruit trees are very important in the supply of vitamins and minerals, replacing

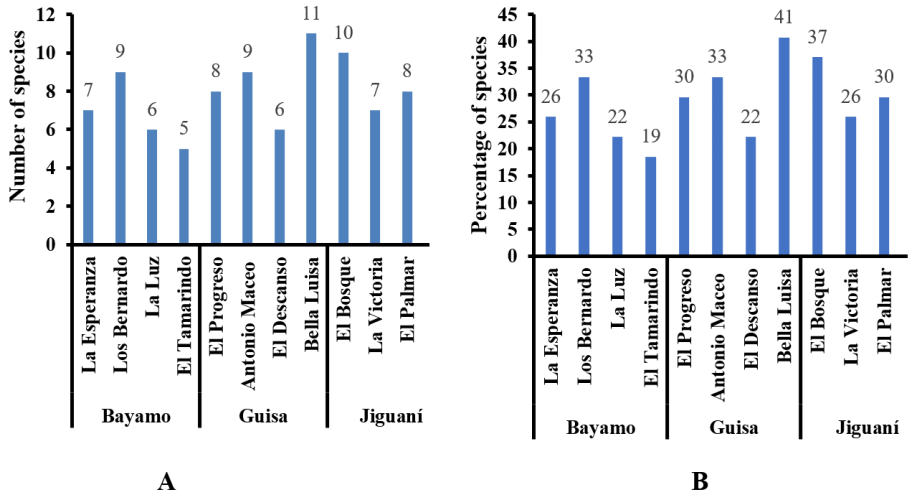

Figure 2. Number and percentage of agricultural species in 12 farms in Granma province

vegetables, since the latter require a high consumption of water (13); in rural areas this resource is scarce during the period of their cultivation, which coincides with the low rainfall period.

Other authors have pointed out the importance of agrobiodiversity in production systems, since it allows the optimization of the nutrient and organic matter cycle, the promotion of soil biological activity and biotic regulation, through the promotion of biological interactions and positive synergies among the components of agroecosystems (18). In addition, it allows the efficient use of energy and the increase of total biomass production.

CONCLUSIONS

- Crops managed on each farm are very closely related to the staple diet, with a predominance of carbohydrate-rich crops, while the vegetable source of protein is represented only by beans.
- The best represented crop groups were vegetables and fruit trees, with 44 % of the species recorded; however, viands and grains occupy the largest percentage of the cultivated area (35.0 and 22.5 %, respectively).

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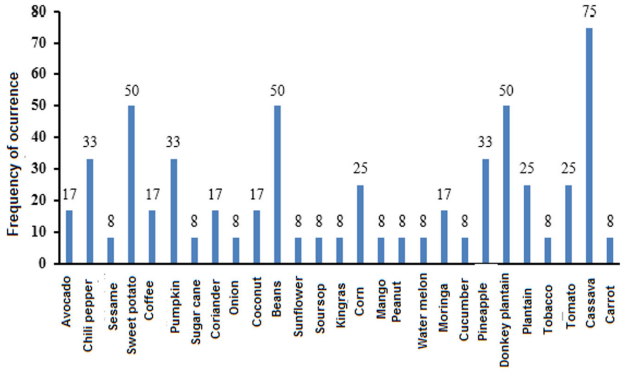

Figure 3. Occurrence frequency of agricultural species in 12 farms in Granma province

Table 3. Number of species by crop group in twelve farms in Granma province

Groups	Quantity of species	Percentage	Cultivated area (%)
Fruit trees	6	22.22	10.7
Vegetables	6	22.22	8.3
Grains	2	7.40	22.5
Groceries	4	14.81	38.0
Condiments	1	3.70	2.9
Oleaginous	4	14.81	2.6
Others	4	14.81	14.8

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