Scientific Paper

Family agriculture and food security in a farm of the Sancti Spíritus municipality

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Abstract

The objective of the research was to analyze the processes that participate in the development of family agriculture in the Ríos de Agua Viva farm located in the Sancti Spíritus municipality, Sancti Spíritus province, Cuba. The plant species were identified and the diversity index was calculated by Shannon's method. The family was interviewed and direct and participatory observations were made with the farm inhabitants for following up the activities. Food security was analyzed through the food availability, access and utilization and the stability in time of the three above-mentioned dimensions. Diverse productions, characteristic of a farm with family agriculture, were obtained, although Shannon index for crop diversity had a mean value (2,05). The animal husbandry system is diversified and composed by three horses, 30 cattle, 20 goats and 100 pigs, and the generated excreta is used in biogas production as energy resource by a 42-m^3 biodigester. In the farm positive effects have been promoted, on environment conservation as well as on generation of jobs and incomes. The socioeconomic perspectives and the enthusiasm of the farmer families that belong to the CCS in which they work and in others from different municipalities also improved. In addition, in the farm more than 15 foodstuffs are preserved and wines and vinegars are elaborated. Family agriculture is considered to be an alternative that contributes to food security, with particular production characteristics, which contributes to the improvement of the rural population's living conditions.

Keywords: biodiversity, environment, food production

Introduction

Family agriculture is a peculiar form of agricultural activity present in Latin America (Schneider, 2012). It is considered to represent around 75 % of the total productive units of that region and that, in some countries, the quantity can be more than 90 % (CEPAL-FAO-IICA, 2013).

In the context of the International Year of Family Agriculture a concept was elaborated: "Family agriculture (FA) is a way of organizing agriculture, animal husbandry, forestry, fishery, aquaculture and grazing, managed and operated by a family, and which especially depends primarily on family work. The family and farm are linked, co-evolve and combine economic, environmental, social and cultural functions" (FAO, 2013).

Family agriculture is the prevailing form in food production, and in Cuba it has been a strategy aimed at avoiding many obstacles, most of them related to the substitution of imports and the difficult access to essential resources and inputs for agricultural development (Sánchez, 2014).

During the first years after the triumph of the Revolution, the small-scale FA was devaluated against the "gigantism" of large agroindustrial enterprises, mainly of sugarcane, with the subsequent intensification of monocrop and ecosystem affectations. Nevertheless, during the crisis of the 90's, with the collapse of the socialist block in Eastern Europe, the fractioning of large agricultural extensions into smaller management units, the delivery of land to natural persons and cooperatives, the widening of market spaces, the promotion of agrooecological practices and the productive diversification of agricultural systems, started. In this context, from the official speech and public opinion, the role of agricultural farmers is acknowledged and enhanced (González and Rodríguez, 2015).

Within the context of food security, it is taken into consideration that FA has the property of generating healthy foodstuffs for national markets, which stimulates farmers to formalize their organizations (Shiavoni, 2001). In itself, FA is

characterized by the diversity of foodstuffs it can provide in a local territory (Manzanal *et al*., 2015).

According to the United Nations Food and Agriculture Organization (FAO), since the World Food Summit (WFS) of 1996, food security at scale of "individual, home, nation and world, is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food, to satisfy their food needs and preferences, in order to live an active and healthy life".

In the achievement of sovereign agroecosystems in feeding, the use of technology and energy implies the principles of agroecology, and has as final goal the development of resilient peasant family farms, with capacity to face any type of changes: climate, market or political changes (Altieri and Toledo, 2011), and to absorb transformation creatively without losing their identity as such (Escalera and Ruiz, 2011).

The objective of this work was to analyze the processes that participate in the development of family agriculture in the Ríos de Agua Viva farm.

Materials and Methods

Location of the study. The study was conducted in the Rios de Agua Viva farm, located in the Sancti Spíritus municipality, of the province of equal name. It is located on the road to Trinidad km 2 ½, La Sierrita community, Colón People's Council.

The Rios de Agua Viva farm belongs to a Cooperative of Credits and Services (CCS). Its size is three hectares, from which two are destined to food cultivation and pasture and forage production. The rest of the area is dedicated to the house and other infrastructures for agricultural production.

Information collection. Interviews to the family and direct and participatory observations with the farm inhabitants were made for following up the activities.

For the analysis of food security of the family which inhabits the farm the four primordial dimensions stated by FAO (2011) were taken into consideration:

- Physical availability of the foodstuffs.
- Economic and physical access to the foodstuffs.
- Utilization of the foodstuffs.
- Stability in time of the three above-mentioned dimensions.

In addition, the actors that participated in the capacity building of the family members were considered.

The plant species were identified and biodiversity was calculated through the Shannon Weaver taxonomic diversity index (Moreno, 2001), using the following formula:

Shannon Weaver index (H) = -∑ (number individuals per crop/ total number individuals).

Results and Discussion

Physical food availability. Table 1 shows the agricultural production that was obtained in the farm during 2018. Diverse productions were obtained characteristic of a farm with family agriculture; which coincides with the observations made by Manzanal *et al*. (2015), who stated that family agriculture is characterized by the food diversity that can be provided in a local territory.

The physical food availability approaches the aspect corresponding to the "offer" within the topic of food security, and depends on food production, existence and net trade (FAO, 2011).

Montagnini (2006), from different perspectives, has approached the study of family gardens, lots or backyards; in the studied farm there is a family garden where healthy feeding and nutrition are ensured. Planting at different strata is used, utilizing aerial trays that provide aromatic plants, herbs and medicinal plants, such as coriander (*Eryngium foetidum* L.), tomato (*Solanum lycopersicum* L.), pepper (*Capsicum* sp.), Swiss chard [*Beta vulgaris var. cicla* (L.) Schübl. & G. Martens], lettuce (*Lactuca sativa* L.), origanum (*Origanum vulgare* L.), leek [*Allium ampeloprasum var. porrum* (L.) J.Gay], largeleaf linden (*Tilia platyphyllos* Scop.), rue (*Ruta graveolens* L.), sage (*Salvia officinalis* L.), camomile [*Chamaemelum nobile* (L.) All.], aloe vera [*Aloe vera* (L.) Burm.f.] and holy basil (*Ocimum sanctum* L.). Around the area there are ornamental plants of bright and colorful flowers, such as African marigolds (*Tagetes erecta* L.), carnations (*Dianthus caryophyllus* L.) and sunflowers (*Helianthus annuus* L.), which serve as phytosanitary cordon.

In this regard, several authors emphasize the importance of family gardens as scenario of diversification and production processes in rural zones of the world; besides functioning as a permanent source of products of use and exchange value, which complement the diet and incomes of farmer families. It is probably the most widespread ecosystem at global level, because one is regularly found in each rural house-room; they are also found, although to a lesser extent and with different

Table 1. Agricultural production of the farm.

Species		Total production, kg	Destination	
Scientific name	Common name		Self-supply	Sale
Phaseolus vulgaris L.	Beans	90,0	90,0	0,0
Zea mays L.	Corn	1 000,0	682,0	318,0
Ipomoea batatas (L.) Lam.	Sweet potato	200,0	200,0	0,0
Cucumis sativus L.	Cucumber	41,0	41,0	0,0
Raphanus sativus L.	Radish	20,5	20,5	0,0
Mangifera indica L.	Mango	455,0	455,0	0,0
Musa paradisiaca L.	Banana	1 500,0	455,0	1 045,0
Psidium guajava L.	Guava	136,4	136,4	0,0
Prunus cerasus L.	Cherry	91,0	91,0	0,0
Annona squamosa L.	Sugar-apple	20,5	20,5	0,0
Tamarindus indica	Tamarind	68,2	68,2	0,0
Prunus domestica subsp. d*omestica*	Plum	1,3	1,3	0,0
Rubus glaucus Benth	Andean raspberry	68,2	68,2	0,0

characteristics, in urban and suburban homes (Mariaca, 2012).

Ospina (2006) states that home vegetable gardens satisfy a large part of caloric and nutritional requirements of the family diet. In addition, the surplus of general production, which is commercialized and exchanged, facilitates the economical access to foodstuffs which are not produced in the family yard. Their conservation as productive system has had direct incidence on the farm welfare and development. The garden agrobiodiversity has allowed the family to enjoy good nutrition and health.

The Shannon Weaver index for crop diversity in the farm was 2,05, which showed moderate diversity. Studies conducted in Cuba by Rodríguez (2013) indicate that at higher agrodiversity –regarding crops, livestock and tree species, as part of integrated and multifunctional agricultural systems– in agroecological systems with high degree of animal husbandry-agriculture integration and recycling, higher productivity and efficiency is reached.

Table 2 shows the livestock productions of the farm during the year under study. The animal husbandry system is diversified and composed by three horses, 30 cattle, 20 goats and 100 pigs; it also has poultry (150 hens, two Guinea fowls, five turkeys, two gooses and four ducks), five rabbits and 10 Guinea pigs.

The generated excreta is used in biogas production as energy resource through a 42-m^3 biodigester. This energy is used in food cooking for the family, elaboration of some feedstuffs for the animals, seed conservation, fruit dehydration and lighting. The remaining liquid and solid wastes are used as organic fertilizer in composting processes.

Funes-Monzote *et al*. (2009) stated that the objective of biointensive agricultural systems, which try to maximize the use of renewable energy sources to achieve an increase of productivity, should achieve high productivity equivalent to high efficiency in the use of energy and that the degree of integration of the system is an important factor to achieve this objective.

Table 2. Production of animal origin in the farm.

Product	Measure unit	Total production	Self-supply	Sale
Pork	kg/year	4 591	500	4 091
Milk	L/year	6 000	1 800	4 200
Eggs	u/year	2 200	200	2 000

In the farm several sources of renewable energy are used. The construction and use of the biodigester were explained above, which guarantees the elimination of the methane produced with the feces and constitutes an aid to protecting the ozone layer and the environment. They have a windmill which, unlike the combustion or electrical pumping equipment, is little complex, its maintenance is not difficult and saves an important amount of fuel, electricity and resources, justifying the investment, and has an exploitation time higher than thirty years (ACPA, 2010).

The energy and protein for animal feeding are ensured by sowing pastures and forages such as king grass (*Cenchrus purpureus* Schumach.) CT-115 and OM-22, star grass (*Cynodon nlemfuensis* Vanderyst), Chinese wisteria [*Wisteria sinensis (Sims*) DC.], leucaena [*Leucaena leucocephala* (Lam.) de Wit], *Urochloa brizantha* cv. mulato and bahiagrass (*Paspalum notatum* Flüggé).

Economic and physical access to the foodstuffs. An adequate food offer at national or international scale in itself does not guarantee food security in the homes. The concern about an insufficiency in the access to food has led to the design of policies with higher approach regarding incomes and expenses, to reach the objectives of food security (FAO, 2011).

Almost all the foodstuffs that are consumed are produced in this space. In Cuba, there are still around one million hectares of agricultural lands declared idle (ONEI, 2015); if they became family farms, it would mean that in that amount of potential lands for food production more than half the Cuban population could be fed in energy and almost the entire population in protein (Funes-Monzote *et al.,* 2011).

The cooperative sector in Cuba manages 71 % of the agricultural lands (MINAG, 2015), and family farms are the ones that contribute more than 65 % of food in the country (MINAG, 2015; ONEI, 2015).

Most of the work is based on physical force, supported by animal draught for soil management. During the harvest peaks hired labor is used to collaborate in specific tasks in the different productions, but active participation of the family is always kept. They are not fixed employees, but they are paid for particular works, per worked hours or days.

These aspects about the dynamics of labor are commented because they are transcendental for this type of agriculture, for they constitute one of the pillars on which the productive system is established, and contribute to guaranteeing the continuity of exploitation in time. In this case, the reallocation of tasks proves the flexibility of the farm to adapt to changing contexts or situations; according to Van Der Ploeg (2013), it is the capacity to "dance in time".

The farm is a system with little use of external inputs, with few exceptions for cattle feeding and health and product packaging; the inputs for soil fertility support are produced in the system. This coincides with the criteria expressed by Paz and Bruno (2013), who refer that producing the highest possible quantity of inputs within the farm (to maintain low production costs), shows the strong degree of endogeneity and control over its resources, as alternative to the externalization and vulnerability a production based on the purchase of external inputs in the market would generate.

In the farm positive effects were promoted, in environmental conservation as well as in the generation of jobs and incomes. The socioeconomic perspectives and enthusiasm of the farmer families that belong to the CCS in which they work and in others from different municipalities were also improved.

The attitude change could be observed in the family; from a condition of resignation to economic stagnation, these actors began to observe new economic alternatives and new sources of employment and development opportunities. These activities contribute in general sufficient incomes to cover the family needs and only occasionally other non-agricultural activities are necessary.

Food utilization. Food utilization is normally understood as the way in which the body utilizes the diverse nutrients present in them. The ingestion of sufficient energy and nutrients is the result of good health and feeding practices, correct food preparation, diet diversity and good food distribution within homes. If these factors are combined with the good biological use of the consumed foodstuffs, the individuals' nutritional condition will be obtained (FAO, 2011).

At the beginning the family started from a traditional rural economy, like most farms of the country; afterwards, they assumed agroecology and organic agriculture as the basis for their development strategy, and at present it is considered an agroecological farm. Thus, they perform practices within which crop rotation and association, organic fertilization (solid and liquid effluent from the biodigester, earthworm humus,

and compost), harvest waste recycling, rearing of small animals and efficient microorganisms (EM), stand out. They also sow living fences, experience that allows to limit the access of animals and people, preserve the soil, serve as living barrier, contribute feed, food and firewood.

Studies conducted in Cuba, by Funes-Monzote *et al*. (2011), in 25 agroecosystems in different stages of agroecological conversion, showed that these systems are capable of feeding 6,64 people per hectare per year in energy and 10,8 people in protein.

The family has invested resources in the training and infrastructure for compost production from residual biomass or biomass cultivated in the farm, using as basis pig manure and grass and harvest wastes, as well as legumes and plants that provide diverse nutrients. In addition, they utilize green manure at small scale through jack bean [*Canavalia ensiformis* (L.) DC.], which guarantees the contribution of nitrogen to the soil.

These production systems, supported with methodologies for agroecological transition and public policies of promotion, can increase their biodiversity, resilience and energy efficiency, which are the bases of the food sovereignty strategy and of agroecology (Altieri and Toledo, 2011).

The challenge of food production with the use of sustainable practices has caused the development of integral and diversified productive systems, which make a more efficient use of inputs and energy, based on the principles of agroecological science (Sarandón and Flores, 2014).

Stability in time of the three above-mentioned dimensions. An outstanding aspect in the farm was food conservation. They started to insert conservation practices with the participation of the family members and based on the rescue of food sovereignty applying methods such as solar drying of staple crops and herbs, conservation with vinegar, by fermentation and with sugar or salt. The capacity building on this topic allowed to provide the family with the procedures to preserve foodstuffs, spices and medicinal plants through simple and natural techniques. The methodology of "learning by doing" was the guide for the activities that were carried out.

At present in the farm more than 15 foodstuffs are preserved and wines and vinegars are elaborated. Among them the ones made from cassava (*Manihot esculenta* Crantz) meal stand out. These practices allow the family to have foodstuffs throughout the year, independently from the production season, decrease the losses in the harvest peaks and increase the added value of the raw material of their productions. In addition, they constitute a way of diversifying culinary preparations and improving family nutrition with the consumption of nutritional foodstuffs without artificial additives by means of simple and natural procedures with no refrigeration.

They have commercialized more than 10 products through direct sale to consumers in innovation fairs that are organized in the province, as well as in habitual fairs that take place on Sundays in the urban zone of the capital of Sancti Spíritus.

This process showed the capacity of family agriculture to be strengthened progressively, trying to obtain, not a return on the investment, but an increasingly higher valorization of the family labor by adding value in the production (Van der Ploeg, 2010).

Capacity building. Diverse associations, organizations and projects have complemented the development initiative of the farm since more than a decade ago. The capacities have been enhanced for solving problems generated in the farm, in order to be able to face and mitigate the adverse climate effects. Thus, the following stand out:

- Agroecological Movement "from Farmer to Farmer" from the National Association of Small Farmers (ANAP for its initials in Spanish)
- BIOMAS-Cuba Project – Biomass as renewable energy source for rural areas funded by the Swiss Development and Cooperation Agency (SDC).
- Local Agricultural Innovation Project (PIAL), funded by SDC.
- Cuban Association of Agricultural and Forestry Technicians (ACTAF).

Training from other farmers and participation in many courses taught by institutions or projects, related to the farming sector, as well as their own management to study and innovate solutions against specific problems and challenges, have been important for the success of the family as animal husbandry farmers.

From the point of view of the intangible patrimony, family agriculture has developed a "socio-cultural dimension" of its own, characterized by the formation of inter-generational links and the transfer of knowledge and traditions and customs from generation to generation. The participation in community life and organization forms such as

cooperatives, also represent a distinctive quality that speaks of its good social management, establishing a network of relations and strategies reinforced by the values of solidarity and long-term commitment (Van der Ploeg, 2014).

The production experience in this farm is of reference for farmers and technicians, at national as well as international level.

Each year the family organizes workshops and field tours to share from the technical perspective crop management, production of organic fertilizer, production of bioinputs and the productive processes that are carried out. In addition, they have received more than 15 awards for their work.

The family members consider that the fundamental elements of success in family agriculture are: labor force and family union, information and knowledge for production, fertile soil and clean water to be able to expand the operations in the farm.

Final considerations

Family agriculture is considered as an alternative that contributes to food security, with particular production characteristics, which aids the improvement of the living conditions of the rural population.

The family members generate active responses that allow to solve economic and social problems.

The development of family labor, production diversification, low external dependence and control of resources, are shown.

Maintaining social networks, rooting to rural areas and conservation of plant and animal species, provide this farm with capacities for adaptation and resilience.

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