
 REVIEW PAPER

Need of an agroecological transition in Cuba, perspectives and challenges

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ABSTRACT: In Cuba, with a food system highly dependent on imports, transformations are needed in its farming development model; which are mainly based on a more endogenous production and the more efficient use of the locally available resources. Agroecology, as science and practice that promotes food sovereignty, can place those who produce, distribute and consume the farming production at the center of public policies which promote these processes close to the territory and in an ecologically sustainable way, which turns it into a sustainable alternative. This paper presents the current situation of agriculture in the country, its participation in national economy, the role of the cooperative sector and family agriculture in feeding the population; and it also analyzes soil deterioration and sociocultural, climate problems, among others, which suggest the need of alternative agricultural development models and favor the drive of guidelines and decisions around agroecology; reference is made too to the challenges that could support its progressive development. The need of an agroecological transition in Cuba is evident; for which the elements that could support the development of family agriculture in the country on agroecological bases are proposed.

Keywords: agroecology, family agriculture and food sovereignty

INTRODUCTION

The Cuban agricultural system shows three forms of property: cooperative, state and private (fig. 1). Since the triumph of the Revolution and until the nineties, the prevailing property form was the state one; in 1993, with the emergence of the basic units of cooperative production (UBPC, for their initials in Spanish), together with the already existing cooperatives of farming production (CPA) and the cooperatives of credits and services (CCS), cooperativism as a non-state form became the prevailing agricultural model (Nova, 2014; MINAGRI, 2015). These cooperatives have a high participation in the national food production; they produce 94 % of the corn, 73 % of the milk, 87 % of humid husk rice, 92 % of the roots and tubers, 94 % of the beans and 79 % of the vegetables (MINAGRI, 2015); the highest participation belongs to the families that integrate the CCSs and the private sector, because they produce more than 57 % of the total food and 63 % of the milk (Nova, 2014) with only 35,48 % of the agricultural surface (ONEI, 2015). All these property forms play essential roles in the farming and economic development of the country due to their contribution in food; their direct and indirect participation in the shaping of the gross domestic

product (GDP); and the direct employment of about one fifth of the economically active population (Nova, 2014); besides the impact they can cause on the conservation or deterioration of natural resources.

At present, the effects of climate change, the rise of prices in the food market, the increase of imports, the soil degradation, the low productivity of the farming sector in the Cuban economy, among others, are elements that suggest transformations in the farming production model of the country and the development of public stimulation policies which ensure a production and consumption of healthy and nutritive foodstuffs, with warrant of production and access throughout the year on sustainable bases.

In Cuba there are successful family farms at small and medium scale, development projects in several institutions, and a sociopolitical model which favors the development of agroecology as production alternative, without renouncing to the agroindustrial model; which can exist in harmony with alternative models that support food production and consumption as a process that involves the farmers and consumers who interact dynamically and operate sustainable systems.

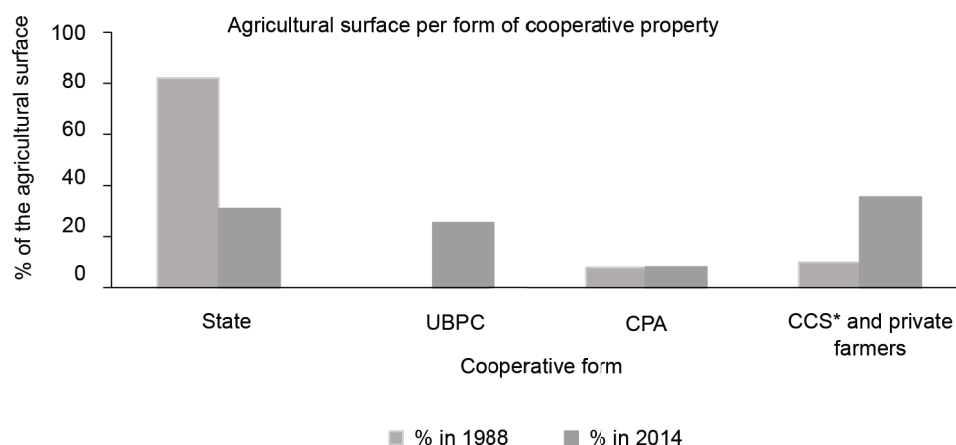


Figure 1. Agricultural surface percentage per form of property of the Cuban agricultural model. (The CCSs include the lands leased from Statutory Orders 259/2008 and 300/2012). Source: adapted from MINAGRI (2015) and ONEI (2015).

Due to the pertinence of these topics, in this review paper arguments are presented which support the need and importance of the agroecological approach, as well as the perspectives and challenges faced by Cuba in this regard.

Bases of the need of transition

Cuba is a country which has not being able to self-supply food (Casimiro, 2014), with an agricultural area of 6 619 500 ha, which represents more than 60 % of the total area of the country (ONEI, 2015); its farming culture was characterized from the beginning by an agricultural social structure in which the agricultural worker and not the farmer has prevailed as productive force (Cruz, 2007), monocropping, dependence on export markets, the overexploitation of natural resources (Funes Aguilar, 2013), and food import (table 1).

In the years of higher “development” in the Cuban agriculture, which coincided with the boom of the Green Revolution (seventies and eighties), there was state-of-the-art infrastructure in agricultural machinery and technology, availability and annual use of 17 thousand tons of herbicides and pesticides and 1,3 million tons of chemical fertilizers (82 % of the pesticides and 48 % of the fertilizers were imported), import of more than 600 thousand tons of feed concentrates for livestock production, etc.; yet, 57 % of the necessary foodstuffs to supply the population was imported (Machin *et al.*, 2010; García *et al.*, 2014).

Since 1990, with the loss of more than 85 % of the priority markets, the collapse of the USSR

and the recrudescence of the economic embargo imposed by the United States on Cuba, the development of agriculture in the country was hindered by the absence of an input market which until then was supplied from abroad (for example, more than 80 % of the availability of fertilizers and pesticides), which showed the fragility of an agricultural model based on the conventional methods of the Green Revolution; these were the beginnings of the financial and economic crisis the country faced, called Austerity Period, which motivated, among other programs and measures, a positive interaction between the rescue of farmer agriculture and the alternative technological advances from research centers (Machín *et al.*, 2010).

It must be emphasized that with the development of conventional agriculture in the country, the external foodstuff dependence increased; there was a negative impact on the soils, on biodiversity and forests; and the extensive deforestation and production costs increased (Funes Aguilar, 2013); this showed a low level of self-sufficiency, inefficiency in the use of energy, as well as the displacement and loss of the values and traditions linked to life in the countryside and food production (Funes Monzote, 2009).

At present, within the main five environmental problems in Cuba is the soil degradation, with 77 % of the productive lands affected by processes that lead to desertification and a low productive capacity; the anthropic factors considered as the causes of this process (CPP, 2014) are summarized, among others, in:

Table 1. Some characteristics of Cuban agriculture in different periods.

Period	Characteristics
1899	3,5 million ha of soil in farms; only 10 % cultivated, from them, around 50 % of sugarcane.
1946-1957	Only 22 % of the agricultural area was cultivated, 66 % of it was sugarcane. High food import.
1960-1988	57 % of the protein and more than 50 % of the calories consumed by the population were imported, as well as 97 % of the feedstuffs. 71 % of the agricultural land belonged to the state sector. More than 52 % of the cultivated surface was occupied by products aimed at exporting (sugarcane, coffee and tobacco), 48,7 % of it corresponded to sugarcane. An important part of the cultivated land was dedicated to pastures, which occupied 35 % of the total agricultural land. In 1975 the food imports represented 19,5 % of the total.
1989-1992	57 % of the arable land of the country was covered by sugarcane, more than 80 % of the agricultural surface belonged to the state sector.
1993-2002	The annual food imports represented 18,7 % of the total imports. Reform in the agricultural model about the tenancy and exploitation of the land linked to the destatization of the agricultural exploitation through the granting of land in free usufruct indefinitely and the creation of UBPCs.
2003-2012	The annual import of food represented 15 % of the total, around 2 thousand million dollars, more than 2 million hectares of agricultural lands declared idle. Increase of the lands granted in usufruct to natural and juridical persons with the implementation of the Statutory Orders 259/2008, later derogated by the Statutory Order 300/2012, which led to the higher percentage of agricultural land being under cooperative regime.
2013-2014	High level of food imports (50 % of the calories and 75 % of the total daily protein of the population), around 50 % of the lands were destined to sugarcane crops.

Source: elaborated from Instituto Cubano de Geodesia y Cartografía (1978); Nova (2013); Cruz (2007); Valdés (2009); Sánchez Egoscue and Triana (2010); Chan and Freyre (2010); Machin *et al.* (2010); CPP (2014); García *et al.* (2014); MINAGRI (2015).

- Use of inappropriate machinery and cultivation practices, which cause soil compaction and erosion, degradation of the surface layers, reduction of infiltration, increase of runoff and soil loss due to the impact of rainfall, etc.
- Inadequate management of fertilizers, causing soil acidification and low yield of crops.
- Inadequate use of irrigation, which depletes aquifers and increases soil salinity.
- Little use of such agricultural practices as polycropping, crop rotation, livestock production-agriculture integration, among others.
- Fire and burning (89 % is estimated to be of anthropic character). Besides all the negative impact on the soils, it is estimated that due to this cause 199 681 t of carbon dioxide (CO₂) are annually released into the atmosphere, in Cuba.
- Inadequate selection of crops with regards to the productive potential for each context.
- Deficient management of the livestock and wrong genetic policy.

These factors are aggravated as a consequence of the action of natural factors and the effect of climate change. The gradual increase of temperature,

which in the last fifty years rose in 0,5 °C (CPP, 2014) and whose rise is estimated between 1,6 and 2,5 °C for 2100, is associated with a reduction of 10 to 20 % of the total annual rainfall, a decrease in the rainy season and an increase in the dry season (CPP, 2014). The drought that affects the country has doubled its frequency in the last decades. The incidence of hurricanes in the Caribbean has increased and the National Office of Statistics and Information acknowledges 109 which have directly impacted the island since 1800 until 2014 (ONEI, 2015); in 2008, because of this there were losses of 10 thousand million dollars due to affectation in the agricultural plantations (Chan and Freyre, 2010); a progressive reduction of the hydric potential of the basins, the decrease of the dammed water and its availability for crop irrigation are also foreseen (CPP, 2014).

According to CPP (2014), 14 % of the country is affected by desertification; one million hectares by salinization; 2,9 million hectares by the strong erosion; 2,7 million hectares by deficient drainage; 1,6 million hectares by high levels of compaction; 2,7 million hectares by high levels of acidity and

4,7 million hectares by low volumes of organic matter. In thousands of these hectares more than one of these affectations coincide.

These soil degradation processes, in some cases, jeopardize the natural resilience of the systems and their recovery capacity (CPP, 2014), giving way to hysteresis phenomena. The deterioration of the ecosystem functions reduces the potential to adapt to the processes of climate change (Álvarez, 2004). Rural zones also, with the deterioration of soils and livelihoods of their population, show problems and unsustainable demographic trends, characterized by rural depopulation and emigration (CPP, 2014).

The economic development of the country largely depends on a higher local food production; food imports annually ascend to more than 2 000 million dollars, a large part is aimed at the rationed assignation the State distributes to the population and social consumption in schools, hospitals, kindergartens and nursing homes (García *et al.*, 2014).

Each year a larger expense is incurred for the same amount of food, due to the rise of prices in the international market and the freight cost, both directly related to the price rise of fossil fuels (Chan and Freyre, 2010); this systematic growth of imports exerts negative results on the payment balance because of the deficiencies in the domestic offer.

Since the late eighties, until the present, the farming sector is the one with the lowest productivity (it contributes less than 10 % of the GDP and uses more than 20 % of the economically active

population), which affects the Cuban economy as a whole (García *et al.*, 2014) and the Cuban family in particular, which, for food acquisition, allocates between 70 and 75 % of its average expense (Sánchez Egozcue and Triana, 2010).

However, in the worst years of the above-mentioned crisis there was a process of change in agriculture, as a consequence of the country's need for food self-supply, and important movements, programs and measures emerged around the agroecological development in farmers' families, such as: the Farmer to Farmer Agroecological Movement, of the National Association of Small Farmers; the Urban and Suburban Agriculture Program; and the international collaboration projects related to desertification and drought, soil conservation and recovery of their productive capacity, local food production, diversity and seeds, mini-industry of vegetables and fruits, among other not less important ones.

With the development of farmer family agriculture on agroecological bases the country could sustain the first strike of the crisis, because these farmers decisively contributed to the recovery of the sector and to feed the population, although they had at the time the lowest percentage of the agricultural land of the country (Rosset *et al.*, 2011). Afterwards, with the boom of the cooperative sector, their participation in food production at national level increased (fig. 2); within this sector the farmer families belonging to CCSs stand out with higher participation in the production of the main food items (table 2).

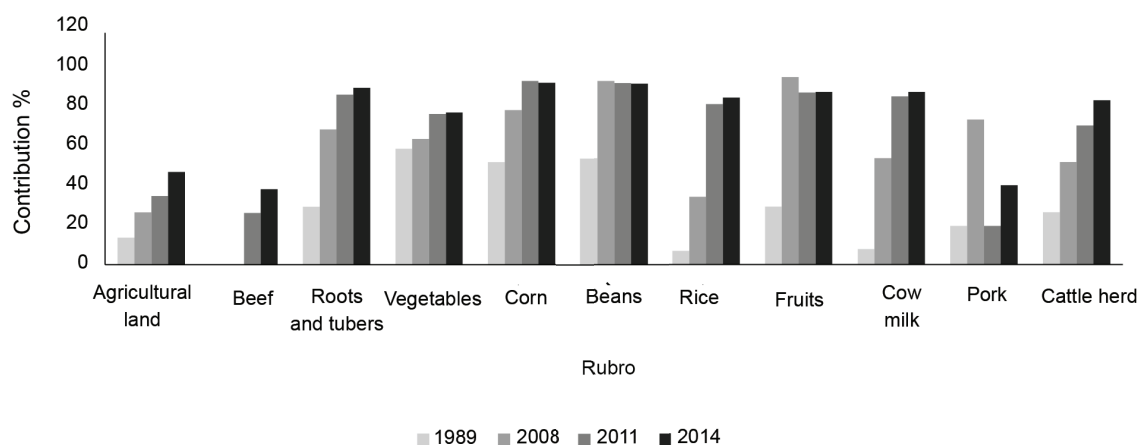


Figure 2. Contribution of farmer agriculture to total national production in diverse items. (The agricultural land and production of 1989 and 2008 refer only to CCSs and CPAs, years 2011 and 2014 to the total of cooperative forms).

Source: adapted from Machín *et al.* (2010), MINAG (2013), MINAG (2015) and ONEI (2015).

Table 2. Distribution of the farming production volumes (%), according to the type of entity. Year 2011.

Production	Total state sector	UBPC	CPA	CCS	Total cooperative sector
Rice	17	15	3	65	83
Roots and tubers	12	13	9	66	88
Vegetables	22	5	4	69	78
Corn	5	7	5	83	95
Beans	6	8	7	79	94
Tobacco	2	3	14	81	98
Citrus fruits	67	12	2	19	33
Other fruits	11	7	5	77	89
Milk	13	17	5	65	87
Beef	79	8	2	11	21
Pork	80	1	1	18	20
Mutton	29	9	5	58	72
Goat meat	19	7	4	71	82
Eggs	98	0	0	2	2

Source: Hernández and Arteaga (2013)

Agroecological family agriculture, unlike industrial agriculture which depends highly on external inputs as well as the fluctuations and controls of the agroexporting market, shows diversified production systems which subsidize their own fertility and productivity, with soil conservation and amelioration practices, polycropping and silvopastoral systems, lower dependence on oil and its derivatives, for which it is more resilient and plays an important role in the mitigation and adaptation to the climate change (Rosset and Martínez, 2013).

However, although at present many farmer families practice agroecology, several authors acknowledge that it is rather done due to economic problems, scarcity and high prices of agricultural inputs, than because of conviction or in order to preserve natural resources; this does not ensure that in the case of having new favorable conditions and subsidies of conventional technological packages there will not be a return to the methods used before the economic crisis that gave origin to these practices (Cruz, 2007; Funes-Monzote, 2009; CPP, 2014).

Other farmer families, convinced of the advantages of agroecology, do not practice it, due to the limited financial immediate return that is obtained, which is incongruous with the characteristics of their economies; this is in addition to the scarcity of labor, because of the exodus of the new generations

from rural zones to the cities, which considerably raises the cost of labor (CPP, 2014).

On the other hand, agroecological farms do not have sufficient support of policies by the public administration, which allow them to develop at a higher scale; also considerable volumes of their production are wasted, due to inefficiencies in the processing, packaging, transportation, conservation and storage mechanisms (Funes Monzote, 2009).

Nevertheless, farmer families in the country maintain traditional practices, have agricultural culture are the most productive and efficient farming production model (Machín *et al.*, 2010); in 2011 they produced more than 65 % of the food with only 25 % of the land and with sufficient yields per hectare to feed between 15 and 20 persons per year and an energy efficiency not lower than 15:1 (Funes Monzote, 2009; Rosset *et al.*, 2011).

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

Perspectives and challenges

Agroecology is very important for food sovereignty (FS), which sustains that a people's feeding is an issue of national security and sovereignty, and should make

sense for farmers as well as consumers, because all of them face rural crises and the lack of affordable, healthy, nutritional and locally produced food. With emphasis of agroecological farmer family production and the local markets and economies, the FS differs from the concept of food security, which refers to the security that each citizen has sufficient food each day, but without comprising its provenance or how it is produced (Rosset, 2003; 2007). Agroecology provides FS with scientific and methodological bases in the development of sustainable agroecosystems, independent from the market of chemical inputs and less dependent on fossil fuels, based on the development of family agriculture, fair markets and the adoption, by governments, of public economic and technological support policies that promote these processes (Altieri and Toledo, 2011; Rosset *et al.*, 2011); this would support the development of agroecological family farms.

In the achievement of sovereign agroecosystems in feeding, use of technology and energy, their management is implicit from the principles of agroecology, and its final objective is the development of resilient farmer family farms, capable of facing changes of any nature: climate, market and political ones (Altieri and Toledo, 2011), and creatively absorbing the transformation without losing their identity as such (Escalera and Ruiz, 2011).

Agroecological principles can take up different technological or practical forms, according to the historical context of a farm, and have a different effect on its productivity or resilience, depending on the local and environmental surroundings and the availability of resources (Altieri, 2010).

These principles are mainly supported on ecological processes; however, the social complement that is associated to them is extremely important, as real warrant of the development of agroecological family farms and the continuity of a culture that can be acquired, maintained and enriched in them. Table 3 shows an analysis of such principles and of others referred to economic viability and social justice in the strengthening of farmer families.

The different practices have preventive and multipurpose character, give way to diverse mechanisms that reinforce the immunity of the agroecosystem and respond to several principles at the same time (Altieri, 2002), in order to achieve minimum dependence on agrochemicals, fossil fuels and energy subsidies, emphasizing complex agricultural systems which subsidize their own fertility and productivity (Martínez and Rosset,

2014). For such purpose agroecology is profiled as the most viable choice for farming production in view of the current energy, climate and financial limitations (Altieri and Nicholls, 2010), based on the capacities and knowledge of farmer families.

In Cuba, with the Statutory Orders 259/2008 and 300/2012, which allowed the leasing of more than 1,5 million hectares of idle lands to farmers; and with the development of an ongoing market of biological products, the decentralization of the market of other inputs and tools which is under process of implementation, the granting of credits, the increase of prices of farming products which are collected by the State, along with the existing technical and technological basis in the university and research centers, the bases have been created for the development of agroecological farmer family agriculture which will guarantee the advance towards food security and sovereignty in the country.

The above-explained facts involve advancing in the purposes of several of the Guidelines of the Economic Policy of the Cuban Communist Party and the Revolution, among which numbers 133, 177, 183, 187, 197, 198, 247 stand out, due to the topic approached; since 2007 measures have been implemented which contribute to these guidelines (García *et al.*, 2014), such as:

- Increase of the price of milk, beef and some agricultural products.
- Free hiring of labor
- Enlargement of the agricultural microcredit.
- Decentralization of the commercialization of agricultural products in the retail market.
- Decentralization of functions, identifying the municipality as the key space for the performance and decision-making within the territorial agricultural activity.
- Direct sale to establishments, hotels and gastronomic and tourism facilities.
- De-controlled sales of inputs and equipment (experimentally since 2014 in the Isle of Youth).
- Constitution of farming markets with non-farming cooperative management.
- Land leasing through Statutory Orders Nos. 259, 282, 300 and 310

The support of institutions and research centers through such projects as BIOMAS-Cuba, PIAL, Co-Innovation, Agrocadenas and BASAL, among others reinforce capacity building in the family farms, to solve local problems and develop agroecosystems capable of facing and mitigating the effects of climate change; thus, inter-institutional

Table 3. Agroecological principles and associated socioecological technologies or processes for the development of agroecological family farms.

Agroecological principles	Socioecological technologies or processes associated to the development of family farms
Nutrient and organic matter recycling.	No waste generation, cycle closing, utilization of opportunities, promotion of biodiversity beneath the soil, use of efficient microorganisms, treatment of residues. Process of training, sensitization, participatory action and knowledge management by farmer families and actors implied in the development of family agroecology (for all the principles).
Plant and animal diversification at species or genetics level in time and space.	Polycropping, rotations, livestock production-agriculture integration, maximum possible biodiversity, promotion of functional diversity.
Optimization of nutrient and water flow.	Production of organic fertilizers from harvest residues or animal excreta; infiltration ditches, containment barriers, water harvests, minimum tillage, contour rows, crop integration and animal raising, etc.
Provision of optimum edaphic conditions for crop growth.	Addition of organic fertilizers, covers, green manures; incorporation of mulch, optimum irrigation, use of biological inputs.
Minimization of losses.	Covers, containment barriers, terraces, windbreaks, stimulation of the beneficial fauna, cycle closing, added value to productions, development of local mini-industries.
Integration of synergies.	Polycropping and rotations, incorporation of fruit or forestry trees, incorporation of animals, use of renewable energy sources. (Each element performs several functions and each function is supported by several elements).
Economic viability.	Use of renewable energy sources and the adequate technologies to achieve the maximum possible efficiency; independence from the market of external inputs; innovation, farmer experimentation and knowledge dialogue; optimum utilization of the available resources. Prices of family productions adjusted to production costs. Development of rustic breeds and crops adapted to the environment and the local possibilities, conservation of autochthonous or adapted seeds, adjustment to the family's preferences and to the market of local consumers. Maximum added value to productions. Articulation of short commercialization channels of the agroecological family productions. Market policies which favor the agroecological family productions.
Social justice	Public policies of promotion and support, institutionalization of family agriculture, fair markets, solidary economy, consumers aware of the importance of healthy food consumption and development of family agriculture, valorization of the quality of agroecological products, "denomination of family origin", popular certification, social recognition of the ethics of agroecology.

Source: the agroecological principles were elaborated from Altieri and Nicholls (2013).

alliances must be created which allow higher advance, enhanced from the union of factors and legal bodies that support the agroecological development and the achievement of food sovereignty in Cuba.

A more integrating approach of agroecology is needed to connect the diverse research and extension lines, as well as to generate a methodology that links the different knowledge levels at the level of the whole agroecosystem (Altieri, 2010), including the ecological, sociocultural and political surroundings. With participatory agroecological methodologies,

traditions lost in the Cuban countryside could be enhanced and recovered, and in turn a new culture pertinent to the current context would be created, which by being developed from the fundamental cell of society –family itself– would allow to promote in these farms inter-generational learning spaces, consolidated with the advances of farmer innovation and experimentation and the relations with the different research centers, constantly interacting with the surroundings and as part of networks of commercialization circuits that could be extended to towns and cities.

These families in the agroecological farms, supported by projects and State policies, will be capable of restoring biodiversity, management on sustainable bases; of occupying spaces which are not of interest for the large agricultural enterprise, for example, in zones of difficult access, with slopes that render impossible the work with machinery, or on degraded or idle soils (Casimiro, 2014); of responding with new knowledge to the effects of the climate change, the scarcity of resources, the degradation of natural resources; as well as developing highly resilient agroecosystems and becoming linked through fair markets to a local and national customer, with increasing knowledge of the importance of healthy feeding.

According to García *et al.* (2014), the farming sector in Cuba contributes approximately 50 % of the energy and 35 % of the total daily protein consumed by the Cuban population, the remainder is imported. In general, in almost all the countries the increase in imports affects the local production, especially small farmer and inhabitants; which does not occur in Cuba, because they do not compete with the local market to which the Government pays attention, but the opportunity to import food causes that somehow priority and incentives are reduced for local productions (Chan and Freyre, 2010).

In Cuba, there are still around one million hectares of agricultural lands declared idle (ONEI, 2015); if these lands became family farms more than half the Cuban population could be fed in energy and almost all the population, in protein. This is based

on the studies conducted by Funes Monzote *et al.* (2011), who evaluated 25 agroecosystems throughout the country, in different stages of agroecological conversion, and reported that, as average, they are capable of feeding per year 6,64 people per hectare in energy and 10,8 persons in protein.

The efficacious application of measures is needed to support these processes; among other elements which would back up the pertinent transformation of the farming sector and the development of agroecological family farms the following can be mentioned:

- Consolidation of a market of organic products and production goods, at the proper time and at adequate prices, which are in correspondence with the prices received for the production (Casimiro, 2007; García *et al.*, 2014).
- Price policy that is adjusted to the costs of agroecological farmer production (Casimiro, 2007; Nova, 2013) and stimulates with better prices the products that substitute imports (fig. 3) and which are paid at high prices (Nova, 2013).
- By favoring short circuits of commercialization which lower the costs of transport and storage, and in turn contribute in quality and freshness to the products offered in the local market.
- Sensitization, inclusion and participation of the consumer in the decisions around the market of agroecological products.
- Warrant of the adequate framework for the granting of soft credits to the families that decide to have agroecological development in

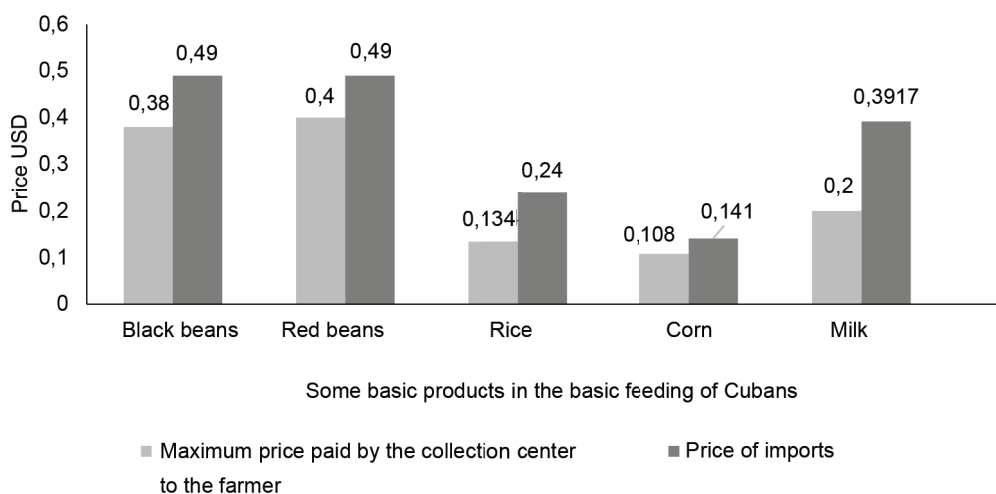


Fig. 3. Comparison of maximum prices paid to farmers with regards to the prices of import. The analyses made by Nova (2014a), the Resolution 239/2015 of the BCC (2015), are taken as reference.

their farms, use of adequate technologies and renewable energy sources.

- Promotion of agroecology from the stimulation to farmer families through honorific, economic and judicial means.
- Promotion of life styles in the rural as well as urban population, which allow to solve its current and future needs with the available resources.
- Creation and development of a national program which promotes agroecology as a basis of local development, that contributes to food security and sovereignty and the development of a new culture of life in the countryside in private farms and rural communities, in which it could be appreciated that living in the countryside and from it is a pleasure that improves the human welfare and makes an important contribution to the construction of a prosperous socialist society.

CONCLUSIONS

In Cuba, the highest percentage of agricultural lands shows degradation problems; the imports of foodstuffs and agricultural inputs increase each year, just like their prices in the international market; the effects of climate change are materialized through the gradual increase of temperatures, the reduction of rainfall, extensive droughts, higher incidence of hurricanes, etc., which cause considerable damage on the agricultural productions; other social factors, such as the loss of traditions linked to family life in the countryside, along with the exodus of rural populations to the city, the discouragement of young people to be dedicated to agriculture, allow to visualize the need of the development of alternative farming models in the country.

Agroecology, as science and practice that promotes food sovereignty based on social inclusion, equity, use of local resources and farmer wisdom, provides the scientific-practical bases for the development of self-sustainable family systems. In the country there is experience, as well as significant impacts from the agroecological family agriculture, on sustainable food production; there are also measures and guidelines that can favor agroecological transition in family systems more efficaciously and at higher scale.

According to the results of this study, the importance of the promotion of agroecological family systems in Cuba was proven, with public policies and concrete actions that encourage those production forms which combine elements of economic viability, ecological sustainability, welfare and so-

cial acceptance; which will allow to favor the application of successful experiences existing in Cuban farms, sovereign in food, production and energy use, which could influence the gradual increase of a large variety of healthy and nutritional foodstuffs, the supply of spaces in still unsatisfied markets and the achievement of an also food-sovereign Cuba.

BIBLIOGRAPHIC REFERENCES

- Altieri, M. A. Agroecología: principios y estrategias para diseñar sistemas agrarios sustentables. En: S. J. Sarandón, ed. *Agroecología: el camino hacia una agricultura sustentable*. La Plata, Argentina: Ediciones Científicas Americanas. p. 27-34, 2002.
- Altieri, M. A. El estado del arte de la agroecología: Revisando avances y desafíos. En: T. E. León Sicard y M. A. Altieri, eds. *Vertientes del pensamiento agroecológico: Fundamentos y aplicaciones*. Medellín, Colombia: Universidad Nacional de Colombia, Instituto de Investigaciones Ambientales-IDEA, SOCLA. p. 69-94, 2010.
- Altieri, M. A. & Nicholls, Clara I. Agroecología y resiliencia al cambio climático: principios y consideraciones metodológicas. En: M. A. Altieri, Clara I. Nicholls y L. R. Ríos, eds. *Agroecología y cambio climático: Metodologías para evaluar la resiliencia socio-ecológica en comunidades rurales*. Medellín, Colombia: SOCLA. p. 7-20, 2013.
- Altieri, M. A. & Nicholls, Clara I. Agroecología: potenciando la agricultura campesina para revertir el hambre y la inseguridad alimentaria en el mundo. *Revista de Economía Crítica*. 10:62-74, 2010.
- Altieri, M. A. & Toledo, V. M. The agroecological revolution of Latin America: rescuing nature, securing food sovereignty and empowering peasants. *J. Peasant Stud.* 38 (3):587-612, 2011.
- Álvarez, A. *Panorámica de la actividad forestal cubana en relación con el cambio climático*. La Habana: MINAGRI, 2004.
- BCC. Información económica. *Banco Central de Cuba*. 10 (19):1-2, 2015.
- Casimiro, J. A. *Con la familia en la finca agroecológica*. La Habana: Cubasolar, 2007.
- Casimiro, J. A. *Pensando con la familia en la finca agroecológica*. Medellín, Colombia: Cubasolar, 2014.
- CPP. *Programa de Asociación del País "Apoyo a la implementación del programa de acción nacional de lucha contra la desertificación y la sequía en Cuba"*. La Habana: Iré Production, 2014.
- Cruz, M. ¿Agricultura sostenible? En: Ada Guzmán Camporredondo, ed. *Desarrollo local en Cuba:*

- retos y perspectivas. La Habana: Editorial Academia. p. 193-220, 2007.
- Chan, Mayling & Freyre, E. F. *Atando cabos. La agricultura cubana: contratiempos, reajustes y desafíos*. La Habana: OXFAM International, 2010.
- Escalera, J. & Ruiz, E. Resiliencia socioecológica: aportaciones y retos desde la Antropología. *Revista de Antropología Social*. 20:109-135, 2011.
- Funes Aguilar, F. El enfoque agroecológico en el presente de la agricultura cubana. *Taller Nacional BTJ "Prácticas agroecológicas para un desarrollo sostenible"*. La Habana, 2013.
- Funes Monzote, F. R. *Agricultura con futuro: la alternativa agroecológica para Cuba*. Matanzas, Cuba: EEPF Indio Hatuey, 2009.
- Funes Monzote, F. R.; Martín, G. J.; Suárez, J.; Blanco, D.; Reyes, F.; Cepero, L. *et al.* Evaluación inicial de sistemas integrados para la producción de alimentos y energía en Cuba. *Pastos y Forrajes*. 34 (4):445-462, 2011.
- García, Anicia; Nova, A. & Cruz, Betsy A. Despegue del sector agropecuario: condición necesaria para el desarrollo de la economía cubana. En: *Economía cubana: transformaciones y desafíos*. La Habana: Editorial de Ciencias Sociales. p. 197-260, 2014.
- Hernández, Aymara I & Arteaga, C. M. *Gestión integral cooperativa. Guía para formadores y facilitadores*. La Habana: Ministerio de la Agricultura, 2013.
- Instituto Cubano de Geodesia y Cartografía. *Atlas de Cuba*. La Habana: Editorial Félix Varela, 1978.
- Machín, B.; Roque, Adilén D.; Ávila, Dana R. & Rosset, P. *Revolución agroecológica: el Movimiento de Campesino a Campesino de la ANAP en Cuba. Cuando el campesino ve, hace fe*. La Habana: ANAP, Vía Campesina, 2010.
- Martínez, María E. & Rosset, P. Diálogo de saberes in La Vía Campesina: food sovereignty and agroecology. *J. Peasant Stud.* 41 (6):979-997, 2014.
- MINAGRI. *Taller de perfeccionamiento de la formación de grados científicos en el área agropecuaria*. La Habana: Ministerio de la Agricultura, 2015.
- Nova, A. Un nuevo escenario, un nuevo modelo agrícola y de gestión económica cubano. *Seminario Anual sobre Economía Cubana y Gerencia Empresarial*. La Habana: Centro de Estudios de la Economía Cubana. p. 24, 2013.
- Nova, A. Un nuevo modelo cubano de gestión agrícola. *Temas*. 77:84-91, 2014.
- ONEI. Agricultura, ganadería, silvicultura y pesca. *Anuario Estadístico de Cuba 2014*. La Habana: Oficina Nacional de Información y Estadísticas, 2015.
- Rosset, P. *Food sovereignty: global rallying cry of farmer movements*. Oakland, USA: Institute for Food and Development Policy. <http://nyeleni.org/IMG/pdf/FoodSovRosset.pdf>, 2003.
- Rosset, P. Mirando hacia el futuro: la reforma agraria y la soberanía alimentaria. *AREAS. Revista Internacional de Ciencias Sociales*. 26:167-182, 2007.
- Rosset, P.; Machín, B.; Roque, Adilén M. & Ávila, Dana R. The Campesino-to-Campesino agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty. *J. Peasant Stud.* 38 (1):161-191, 2011.
- Sánchez Egozcue, J. M. & Triana, J. Un panorama actual de la Economía Cubana, las transformaciones en curso y sus retos perspectivas. En: O. E. Pérez Villanueva, comp. *Cincuenta años de la Economía Cubana*. La Habana: Editorial Ciencias Sociales. p. 83-152, 2010.
- Valdés, J. *Los procesos de organización agraria en Cuba 1959-2006*. La Habana: Editorial Félix Varela, 2009.

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