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Proposal of actions for the agro ecological reconversion of a farm in Las Tunas municipality

Propuesta de acciones para la reconversión agroecológica de una finca en el municipio Las Tunas

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ABSTRACT
The research was carried out in the period from January 2013 to December 2017, in the agricultural community "Calera II" the Farm "La Montaña" of Las Tunas municipality, with the aim of implementing a proposal of actions for the agro ecological reconversion of the farm, with the training to the producers. The actions carried out by researchers and producers are described. On the farm, the different productive subsystems were characterized. In order to collect the information, different techniques were used, including the analysis of farm production records, interviews and surveys with producers, participant observation, workshops, among others. The main problems that limit agricultural and livestock productions were identified, as well as the fundamental agro ecological practices that producers have introduced during the last years. As a result, a series of proposals were designed to carry out actions and raise the potential of the farm with regard to the biodiversity of both crops and animals, as well as the recycling

RESUMEN
La investigación se llevó a cabo en el período de enero 2013 a diciembre 2017, en la comunidad agropecuaria «Calera II» la Finca "La Montaña", del municipio Las Tunas, con el objetivo de implementar una propuesta de acciones para la reconversión agroecológica de la finca, con la capacitación a los productores. Se describen las acciones llevadas a cabo por investigadores de la Universidad de Las Tunas y productores. En la finca, se caracterizaron los diferentes subsistemas productivos. Para la captación de la información, se utilizaron diferentes técnicas, entre las que cabe destacar el análisis de los registros de producción de la finca, entrevistas y encuestas a productores, la observación participante, talleres, entre otras. Se identificaron los principales problemas que limitan las producciones agropecuarias, así como las prácticas agroecológicas fundamentales que los productores han introducido durante los últimos años. Como resultado, se elaboraron una serie de propuestas para llevar a cabo acciones y elevar las

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of nutrients and others that contribute to guarantee animal feed throughout the year in a way that allows them to raise production in a sustainable way and be able to achieve agroecological reconversion of the farm, with joint participation when defining the actions to be developed to implement the actions gradually.

Keywords: agroecology; agroecological reconversion; farm

potencialidades de la finca, respecto a la biodiversidad tanto de cultivos como de animales, así como el reciclaje de nutrientes y otras que contribuyan a garantizar la alimentación animal durante todo el año, de forma tal, que les permita elevar las producciones de manera sustentable y poder lograr la reconversión agroecológica de la finca, con la participación conjunta de investigadores productores a la hora de definir las acciones a desarrollar para implementar las mismas de forma paulatina.

Palabras clave: agroecología; reconversión agroecológica; finca

INTRODUCTION

The current model of agriculture, enriched and promoted by the Green Revolution, does not seem to be able to solve the world food crisis; the marked environmental deterioration as a consequence of modern agriculture is innumerable, together with the marked effects of climate change and all the consequences brought about by soil degradation and compaction, erosion and salinity, less rainfall and flooding in some regions of the world, increased average annual temperatures, etc. (Torres & Mogollón, 2015).

The problems of food production and consumption, just as in the world, are the subject of reflection in the case of Cuba. The low productivity of the agricultural sector in the Cuban economy, among others, are elements that suggest transformations in the country's agricultural production model and the development of public policies to promote healthy and nutritious food production and consumption, with guaranteed production and access throughout the year, on a sustainable basis (Casimiro Rodríguez, 2016).

In the case of Cuba, it is considered a problem of "national security" and motivates an intense debate that transcends borders, especially when approached from the perspective of Food Sovereignty and Agroecology (García Carrazana, 2012).

García (2012) adds that agroecology arises from traditional agriculture and is strengthened by different sciences under the postulate that a new form of production that is ecologically healthy, socially egalitarian, culturally acceptable and economically productive can be generated as a response to the crises that humanity is currently experiencing, related to food, the quality of natural resources and rural poverty.

Agroecology has reinforced traditional knowledge, combining elements of sciences such as Biology, Ecology, Agronomy, Engineering, etc. to achieve that agriculture improves its productivity, maintaining and improving the quality of natural resources.

Agroecology provides food security with scientific and methodological foundations in the development of sustainable agroecosystems, independent of 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 policies of economic and technological support that encourage these processes, according to the authors Altieri and Toledo, (2011); Rosset et al .,(2011); this would support the development of agroecological family farms.

In Cuba, there are successful experiences of small and medium-scale family farms, development projects in various institutions, and a socio-political model that favors the development of agroecology as a production alternative, without having to renounce the agroindustrial model, which can exist in harmony with alternative models that support food production and consumption as a process that involves producers and consumers who interact dynamically and operate in sustainable systems (Casimiro Rodríguez, 2016).

The agroecological transition on family farms requires regenerating the functioning of ecological and sociocultural processes; hence Novoa and Funes (2016), state that, "this implies a prolonged and complex process of assembly of the components of the agroecosystem and of transformation of human interactions with the productive system; therefore it demands, depending on the scale, prolonged periods".

In the "La Montaña" farm, ecological imbalances due to anthropogenic action were identified, as well as the main problems that limit agricultural production and the fundamental practices that producers must introduce for their agroecological reconversion, under principles of social equity, economic rationality and ecological sustainability. On the basis of this situation, a proposal of actions is made to raise the potential of the farm with respect to biodiversity, both of crops and animals, as well as the recycling of nutrients and others that contribute to guarantee animal feed throughout the year, in such a way that allows them to raise production and income in a sustainable way.

MATERIALS AND METHODS

The research was carried out in the period from January 2013 to December 2017, in the agricultural community "Calera II" in the Farm "La Montaña", belonging to the Credit and Services Cooperative (CCS) Josué País García, in the municipality of Las Tunas. The area is located southeast of the capital city of Las Tunas; the soils are brown without carbonate, with slight undulations.

Among the methods and techniques used to diagnose the farm, the annual production records in the hands of the owners were reviewed.

In addition, interviews were carried out: one of the main techniques applied, basically to the owners of the farm.

Talks with specialists in animal health, feeding and management of different animal species.

Participatory observation as part of the application of the instruments for collecting information; several visits to the farm to collect the information and appreciate the management practices to the animals and crops in the middle of the daily farm work.

Several participatory workshops were held on the farm, with the inclusion of the main landowning actors where several proposals were made and participants' opinions were heard.

The main shortcomings and difficulties were identified with the participation of the producers; on that basis, a proposal for actions to achieve the agroecological reconversion of the farm was made.

RESULTS

In Cuba, with Decree-Laws 259/2008 and 300/2012, which allowed the delivery of more than 1.5 million hectares of idle land to producers in usufruct, and with the development of a biological input market underway, the decentralization of the market for other inputs and tools that are in the process of implementation, the granting of credit, The increase in prices of agricultural products collected by the State, together with the technical and technological base existing in universities and research centers, have created the basis for the development of agroecological family farming that will guarantee progress with firm steps towards food security and sovereignty in the country.

The above involves advancing the purposes of several of the guidelines of the Economic Policy of the Party and the Revolution, among which stand out, for the subject matter addressed, numbers 133, 177, 183, 187, 197,198, 247; since 2007 measures have been implemented that contribute to these guidelines, such as (García, Nova, & Cruz, Betsy, 2014):

- Increase in the price of milk, beef and some agricultural products
- Free hiring of the labor force
- Expansion of agricultural microcredit
- Decentralization of the marketing of agricultural products on the retail market
- Decentralization of functions, identifying the municipality as the key space for performance and decision making within the territorial agricultural activity
- Direct sale to establishments, hotels and gastronomic and tourism facilities
- Free sale of inputs and equipment (on an experimental basis from 2014 onwards on the Isle of Youth)
- Constitution of agricultural markets with cooperative non-agricultural management
- Handing over of land in usufruct by Decree-Laws Nos. 259, 282 and 300

Agroecological farms, supported by State projects and policies, will be able to restore biodiversity, manage it on a sustainable basis; occupy spaces that are not of interest to large agricultural enterprises, for example, in areas that are difficult to access, with slopes that make it impossible to work with machinery, or on degraded or idle soils (Casimiro, 2014); respond with new knowledge to the effects of climate change, resource scarcity, and natural resource degradation; and develop highly resilient agroecosystems.

To this end, various technical criteria must be met, which according to Casimiro (2016) are:

- Exploitation of climatic conditions and selection of species highly adapted to each soil and climate condition
- Integration of an appropriate amount of agricultural, livestock and forestry components
- Conservation of the natural resource base involved in agricultural production, especially soil and water
- Conservation and promotion of biodiversity and agrodiversity
- Use of natural processes in the ecosystem, such as symbiotic relationships, mycorrhizal, allelopathy, biological control, etc., which provide advantages to production processes
- Establishment of multi-layered crops that generate micro-climate conditions and protect the soil; special emphasis on agroforestry crops for humid tropical conditions
- Application of fertilizing, management and conservation practices of soils, which give stability and improve their fertility
- Production planning for family self-consumption and market sales
- Vertical integration of production, generating added value to products that can be marketed
- Sustainable use of water; actions for conservation of natural sources, recycling and reuse of water in domestic and productive processes

Characterization of the farm "La Montaña"

Since the approval and application of Decrees Law 259 and 300, there has been a process of reverse migration from the city to the countryside. Until November 2014, in Las Tunas, more than 2,000 families had taken advantage of decree law 300, so about 18,300 hectares of land, which were idle, are now dedicated to the production of tobacco, rice, fruit trees, food, vegetables, sugar cane and livestock (Gómez Ramos, 2014).

The members of the "La Montaña" farm, in Las Tunas, are a clear evidence of this phenomenon that has occurred in Cuba and in Las Tunas specifically. The farmers obtained the farm that has a total area of 40.2 ha., which was totally covered with marabou (*Dichrostachys cinerea L.* Wight and Arn) and other natural grass species such as guinea grass (*Megathyrsus maximum L.)* and tree plants.

The farm dedicates 30.0 ha of the total area to cattle and sheep grazing, with 2.5 ha planted with sugarcane and 2.0 ha with fruit trees. In addition, it has 1.5 ha. where the facilities dedicated to the animals and the houses of the producers are located.

As it was planned, the entire farm was covered with marabou (*Dichrostachys cinerea* (L.) Wight and Arn), a situation that caused the first actions to be aimed at clearing that began with elementary means (machete, lime, axes, etc.) due to the lack of credits to facilitate the implementation of this work.

After obtaining bank loans, the transformation of the farm was more intense since, with these resources, the producers invested in the purchase of barbed wire for perimeter fencing and marking of the pasture areas and of new inputs, such as: machetes, lime, gloves, work clothes, shoes, and the purchase of animals, mainly cattle and sheep.

In this regard, Tejeda and Cué 2016, state that, "The Cuban State, in accordance with

the policy outlined to prioritize food production and ensure the proper functioning of internal finances, in November 2011, issued Decree Law No 289 on credit to individuals and other banking services, as a continuation of the economic and social policy applied by the country. This decree is considered an extension of the credit policy, since it incorporates new credit subjects and extends the prerogatives to natural persons, including farmers and usufructuaries".

Fruit and forest subsystem

The farm, in its process of transformation, already has two; it has diversified its fruit trees, among which species such as guava (*Psidium guajava*), medlar tree (*Manilkara huberi*), canistel (*Pouteria campechiana*), mango (Mangifera indica), red plum (*Spondias purpurea L*) and yellow plum (Spondias Lutea) stand out, cashew (Anacardium occidentale), soursop (Annona muricata), papaya (Carica papaya), sour and sweet orange (*Citrus sp*), banana fruit (*Musa sp*), pineapple (*Ananas comosus*), coconut (Cocus nucifera) and avocado (*Persea americana*). All of the above-mentioned fruit and melliferous plant species have been introduced to the farm.

There are also varieties of forest and melliferous plants in which cattle and sheep are handled, such as *guásima (Guazumaulmifolia*), *piñón florido* or *júpito* (*Gliricidium sepium*) and Cuban carob. In addition to *júpito*, producers introduced linden (*Moringa oleifera*) and *piñón botija* (*Jatropha curca*) to live fences.

The forest plant species mentioned were found on the farm, in the middle of the areas covered with marabou; the producers, in their intense work, as they freed the areas that were invaded with this legume, left the timber trees; many of them serve as food for the animals, mainly the cattle and sheep in grazing.

Agricultural Subsystem

Before the intervention, agricultural production on the farm was practically nil, as there were only areas dedicated to animal grazing. However, there are now varied productions of melon (Cucumis sativus), beans (Phasuolus vulgaris), corn (Zea mays), yucca (Manihot esculenta), pumpkin (Cucurbita moschata), sweet potato (Ipomoea batatas), tomato (Solanum lycopersicum), and banana fruit (Musa spp.), with which they have become self-sufficient and are complying with the delivery plan to the cooperative. Family members and nearby farmers benefit from this production. From the dividends, resources are obtained to supply other basic needs such as the purchase of clothes, personal hygiene, small items, household appliances, etc.

The remains of the production of some fruit trees, mainly guava (*Psidium guajava*), are used by farm animals, chickens and pigs.

These actions and others described in the work have brought stability and economic sustainability to the farm, through diversified production that contributes to substituting imports and increasing food sovereignty. In terms of production, increases are achieved in all areas and positive costs per peso.

Water supply

The main source of supply for the property are two wells that were built by the owners. From them the drinking water is obtained for the supply of people, animals and for the irrigation of some crops of the farm. These sources of supply are

sufficient to meet the water needs throughout the year.

However, to have this precious liquid it is necessary to introduce irrigation techniques and technologies on the farm for the crops that require it, since the turbine it has is of little power and lacks the necessary hoses to carry the water to areas far from the supply source.

The producers have been selected in the cooperative for their production results; they have been benefited by a project to boost grain production, which has made it possible to assign an irrigation system with which they will be able to favor the production of grains and other crops.

Use of crop residues

In spite of making use of some of the crop residues on the farm, not all of them are usable: such as yucca stalks and leaves, sweet potato vines, corn plants, bean stubble; only a part of them is used because some of the crop residues are burned, a not recommended cultivation practice, and others are taken out of the field to the edges of the fences, without being consumed by the animals or incorporated into the soil.

In interviews with producers, they reported that they do not have time to carry out such practices of using crop residues for animal feed or to be incorporated into the soil; they see this as an obstacle when preparing the soil.

Handling of animals

At present, approximately 30 ha are dedicated to cattle and sheep grazing under the semi-extensive farming system.

In the low rainfall period, they are supplied with ground sugar cane and other protein plant fodder for animal feed as a supplement to avoid overgrazing in the pasture areas. In addition, 20 % of the area of the pastures, in its perimeter fences, are provided with various species of plants as living fences that have served as food for cattle and sheep in this critical period. The species of live poles they have are *piñón florido* and *moringa*, which corresponds to previous research developed in the municipality of Las Tunas by Salmon and authors' collective (2012).

There have been several sales of animals, mainly cattle, with which they have fulfilled the delivery plans and the money obtained has been invested in the farm, in the purchase of more animals, especially cattle and sheep, as well as the purchase of grain, vegetable and other fruit seeds to continue expanding the productive areas.

The farm has also introduced other species of domestic animals such as hens for fattening, Guinea fowls and turkeys.

Some of the agroecological practices used

On the farm, organic waste is used to fertilize crops, from the collection of cow dung in their own facilities, used to fertilize pastures and crops, as an example of the recycling of nutrients.

Funes and the authors' collective, 2002, state that, "there are two tendencies to answer the question of where to get organic matter: one is, by importing it from another system, as is generally done in obtaining organic products for the market, and the other is, by producing it on the farm itself. The authors state that we do nothing if, in order to maintain an organic production in one system, we extract the organic matter from another to impoverish it. Furthermore, they teach us that to solve this problem we must

produce the fertilizer on the farm itself, managing to recycle the nutrients and, at the same time, maintain the fertility of the soil with good soil management".

In this agricultural system, production is diversified with mixtures of varieties and polycultures, varieties of crops tolerant to soil and climate conditions are selected, drainage is done in areas that require it to avoid waterlogging, live and dead barriers (stone and wood) to prevent erosion, cover crops with the timely use of green manure, is used for this purpose the *canavalia*. All of these actions serve to increase biodiversity, conserve natural resources, stabilize yields without agrochemicals, provide ecological services, and provide remarkable lessons in resilience in the face of continuous environmental and economic change.

DISCUSSION

The work contributes, from the practical point of view, the rescue and the impulse of the sustainable economic development in the farm "La Montaña", knowledge and development of abilities are generated in the handling of the species of cattle and ovine fundamentally.

An action plan is proposed to achieve the agroecological reconversion of the farm, with emphasis on the training and education of producers and the promotion of their quality of life.

Since the intervention of researchers on the farm and the training carried out on various topics, the producers have been selected as the best producers of the cooperative. Obtaining several recognitions in emulation checks, the selection of agroecological farm has made possible the participation in different forums, at a base and provincial level, with outstanding results.

The implementation of the proposals for actions will help producers to carry out actions for the gradual establishment of the chosen species, with the help of researchers.

The results of the farm are still far from the aspirations referred to agroecological transformation; therefore, based on the deficiencies identified, as well as the potentialities present on the farm, a proposal of actions is recommended to accelerate the agroecological reconversion for a better use of the resources of the agroecosystem and to achieve sustainable productions.

Proposal to accelerate the process of agroecological reconversion of the "La Montaña" farm

1. Make a sketch of the areas of the farm for better planning and execution of production processes and decision-making.
2. Encourage the association of legumes and grasses to achieve greater diversification on the farm and to promote animal feeding through the promotion of Silvopastoral Systems; Leucaena (*Leucaena leucocephala*) and guinea grass (*Megathyrsus maximus*) are proposed.
3. To use sheep manure for fertilizing crops and pastures because of its good properties.
4. Implement the use of dead and live barriers to reduce water erosion of soils.
5. Introduce other fodder species to encourage animal feeding. These include mulberry (Morus alba), titonia (Titonia diversifolia), etc.

and increase the area of species on the farm.
6. Promote an area dedicated to the production of seedlings of fodder, forest and ornamental species.
7. Use harvest waste, such as sweet potato vine, leaves and stems of cassava for feeding cattle and sheep or incorporate it into the soil.
8. Make better use of fruit trees that cannot be marketed in the production of preserves.
9. Continue with the training of producers in agroecological issues.
10. Use methods that help to conserve and improve soil fertility such as cover crops, biofertilization with mycorrhizae and bacteria and use of green manure.
11. To promote an area dedicated to the production of worm humus and thus make better use of the farm's waste.
12. To increase the diversity of pasture and forage plants, the association of crops and intercropping.
13. As far as possible, continue with the fencing of the paddocks until a correct subdivision is achieved and, in this way, establish an adequate rotational grazing system to make better use of the pastures and, at the same time, achieve a better recycling of nutrients.
14. Increase the use of biopreparations for pest management. For example, tobacco, the Nim tree, etc. as well as others produced in the province's CREE.
15. Carry out an economic assessment to see the feasibility of implementing a Biogas in areas of the farm.
16. Expand the forage areas with other species that can be CT-169 and OM-22 (*Cenchrus purpureus)*.
17. Most of the proposed actions are relatively easy to carry out and will undoubtedly contribute to the sustainability of the farm and its agroecological reconversion.

On the farm, an agroecological transition process has begun with the substitution of external inputs and the application of agroecological technologies and practices. However, this is still insufficient; the agroecosystem needs to be redesigned in such a way as to further promote integration and interactions between the different components. Hence, the importance of implementing the action plan proposed to accelerate the ecological reconversion of the "La Montaña" farm in Las Tunas Province, Cuba.

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