Scientific Paper

Economic-financial balance and food production performance in a diversified farm

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ABSTRACT: An evaluation of the performance and economic-financial balance of food production in the diversified farm Guamá, located at the Pastures and Forages Research Station Indio Hatuey, was carried out during three years, in order to determine to what extent the diversification of the agricultural production could contribute to the increase of productivity. For such purpose four commercialization modalities were introduced: self-supply, wholesale, retail and sale to the tourism industry. The economic efficiency in the third year of evaluation reached a favorable cost per peso ($ 0,83) and a profitability of $ 0,17 for each peso spent. Likewise, the mean salary-productivity correlation allowed to pay the salaries and obtain a positive financial result in the analyzed periods. It is concluded that the enhancement of agricultural management, from an effective spatial and temporary design of diversified agroecological strategies, could offer opportunities for a better land utilization. Likewise, the increase of the farm's incomes due to the wholesale and retail sale of agricultural products could be a convenient strategy to achieve profitability. These results can serve as referent to consider diversified farms as a path towards sustainable development.

Keywords: agricultural exploitations, diversification, profitability

INTRODUCTION

Sustainable agriculture has become a way to guarantee healthy and stable food, without affecting the environment (De Shutter, 2010). In this regard, in studies conducted by Altieri (1997) and Roselló-Oltra *et al*. (2012) it was proven that with the use of sustainable agricultural techniques healthier and fresher foodstuffs are produced, with a higher concentration of minerals; the harvests are equal or higher than the ones achieved with conventional methods, with low production and environmental costs; likewise, they cause lower soil erosion as well as higher long-term profitability.

Agroecology-based agricultural systems have become an unquestionable need, due to the current situation of Cuban agriculture, for which the farmers' experiences neglected by conventional agriculture are taken up; which, along with the scientific-technical results, are decisive for the sustainable development of agriculture (Guzmán and Morales, 2012).

In Cuba, since the nineties of the past century, a transition has occurred towards sustainable agriculture, characterized by the substitution of chemical (imported) inputs with biological (locally available) ones, with strong emphasis on environmental protection and agrodiversity. The small- and medium-size farms, highly diversified, heterogeneous and complex, have proven that they can reach higher levels of productive efficiency and have more resources than the higher-scale specialized agriculture and farming systems (Funes-Monzote *et al*., 2011).

In this regard, Funes-Monzote (2009) considers that if a higher biodiversity is achieved in the farms, they are closer to obtain an agroecological production based on the conservation of nature and the respect to the environment.

Based on the existing experience, in Cuba efforts are aimed at the search for viable solutions that contribute to the conversion of productive systems into agroecological ones. A fundamental strategy to achieve agroecological diversification is the implementation of the system approach, and, thus, considering the farm as a whole, in order to increase its productions and reduce costs, as well as to make a more efficient use of the available resources and a conscious management of the interaction among its components, through the practice of agriculture with agroecological approach and sustainability principles.

Taking the above-mentioned facts into consideration, the objective of this study was to evaluate

integrallythe performance and the economic-financial efficiency of food production in the diversified farm Guamá, and thus determine to what extent the diversification of agricultural production contributes to the increase of productivity.

METHODOLOGY

The study was conducted in a period of three years, in the farm Guamá, which is located at the Pastures and Forages Research Station Indio Hatuey –Perico municipality, Matanzas province, Cuba–, on a Ferralitic Red soil. The average annual rainfall is 1 200 mm, from which approximately 70 % falls between May and October. The average temperature is 26,9 ºC; while the relative humidity varies between 82 and 85 %, and reaches the highest values during the rainy season. The farm has an area of 8,2 ha and its distribution is shown in figure 1.

Previous to this evaluation, high external inputs (fertilizers, insecticides and herbicides) were used in the farm Guamá for two years and low productivity levels were reached (2,2 t/ha year[1])[1]. In order to turn this farm into an agrocological one, during the second year of evaluation the crop association (polycropping) was enhanced, with emphasis on the areas where the fruit trees and physic nut (*Jatropha curcas*, an appropriate tree for biodiesel production) were planted, for the total area of the farm to become productive.

In addition, other low-cost agroecological practices were developed to improve productivity, such as diversification (production of four new crops in the third year: pineapple, rice, avocado and potato), crop rotation, nutrient recycling, and utilization of bioproducts (IHplus®, Biobras-16®, EcoMic®, *Rhizobium*) and organic fertilizers (earthworm humus and decomposed filter cake).

The system concept was applied, which is the union of physical components related among themselves so that they act as a whole, with a certain objective, and react as such against external stimuli (Funes-Monzote *et al*., 2009; Gliessman and Rosemeyer, 2010); the conceptual model of the system to be evaluated[2] was designed, with the description of the inputs, the outputs, and their components (fig. 2).

The entrances to the system were represented by the inputs, among them the new results of science and technology, the seeds of the improved varieties and bioproducts; while in the outputs the agricultural productions (such as fruits, grains and roots and tubers), the raw materials for the production of biodiesel and

Figure 1.Distribution of the total area of the farm Guamá.

[1]In Cuban agroecological farms, between 7 and 10 t/ha/year is considered a favorable productivity (Vera, 2011).

[2]In the model and its application the concept of agroenergetic farm is used, conceived as "the productive exploitation where technologies and innovations are developed, improved and evaluated to produce, in an integrated way, food and energy, the latter being used as input to produce more food in the farm, in order to improve the quality of rural life and protect the environment" (Suárez *et al*., 2011).

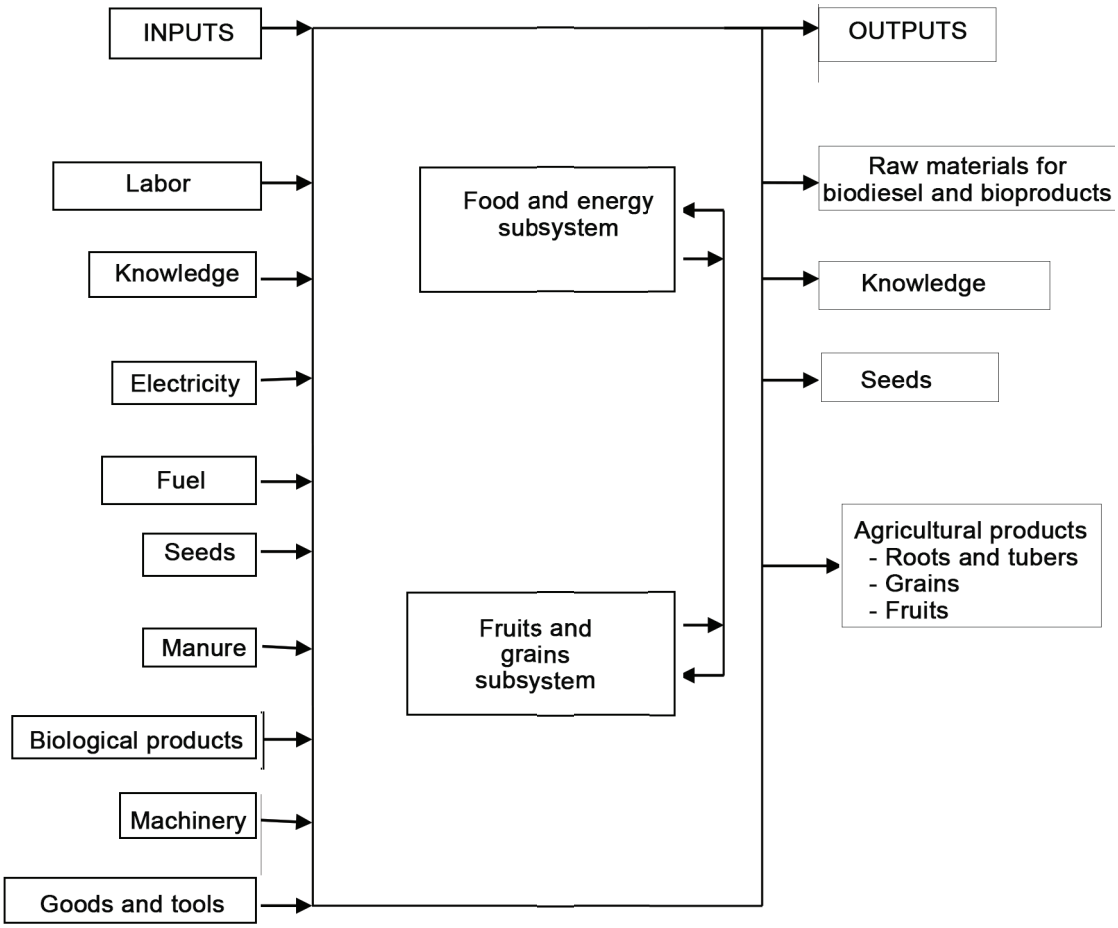

Figure 2.System design in the farm Guamá.

biofertilizers and the environmental services, were taken into consideration, in correspondence with the consulted literature (Alonso and Guzmán, 2010; Di Falco *et al*., 2010), to guarantee in a practical way the ecological sustainability of the farm.

The methodology used was based on the system analysis (Checkland and Holwell, 1998), and the economic efficiency of the farm was quantified. Data of three years were evaluated, as well as the yield and evolution of the system. In addition, four commercialization modalities were introduced: self-supply, wholesale, retail and sale to the tourism industry, as alternative to identify the economic efficiency.

To make the economic balance a template was elaborated (three-year period) where the necessary elements to make the calculations were recorded. Likewise, the data related to the farm were reviewed, which were filed in the economics, statistics and human resources areas, such as: area, type and quantity of food used, products obtained, productions entered in the process, and costs.

In the performance of the financial balance the accounting system developed by AGROMIN (2005) was used, and the results of each year were compared. The items used were the following:

1. Agricultural incomes.
2. Forestry incomes.
3. Other incomes.
4. Agricultural expenses.
5. Forestry expenses.
6. Other expenses.

Result ($) (1 + 2 + 3) – (4 + 5 + 6)

Cost/benefit ratio = total expenses / total incomes

RESULTS AND DISCUSSION

The changes in the productive design of the farm allowed a higher diversification and a better utilization of the agroecological practices. The results of

diversification (fig. 3) are in correspondence with the most demanded agricultural products, favored with the production of four new crops, which allowed to widen the offer of food in the locality with productions that are considered satisfactory.

The benefits provided by the farm can be ascribed to the integrated management, which propitiated the adequate utilization of space, and to the application of simple and low-cost technologies, that allowed to make the agricultural labors more efficient (Alonso *et al*., 2009) and prove that there are alternatives which contribute to higher efficiency and efficacy of the production systems.

When analyzing the volumes reached in the three years of evaluation, a trend to growth was observed after the implantation of the system (fig. 4), with the highest production (27 960 kg) in the third year. Similar results were obtained in two farms of the San Antonio de los Baños town –in Artemisa, Cuba– (Funes-Monzote, 2009), where the sustainability indicators were evaluated between 2000 and 2004. In the farm under study, this higher yield could be associated to the increase of crop diversity, nutrient recycling (with the improvement of soil fertility) and utilization of ecological techniques. The diversified systems that combine crops, fruit trees and associated plants offer considerable opportunities for the sustainability of the ecosystems and the efficiency in the use of internal and external resources.

In correspondence with the increase of agricultural biodiversity the food self-sufficiency increased, which was shown in a higher production in the farm. These

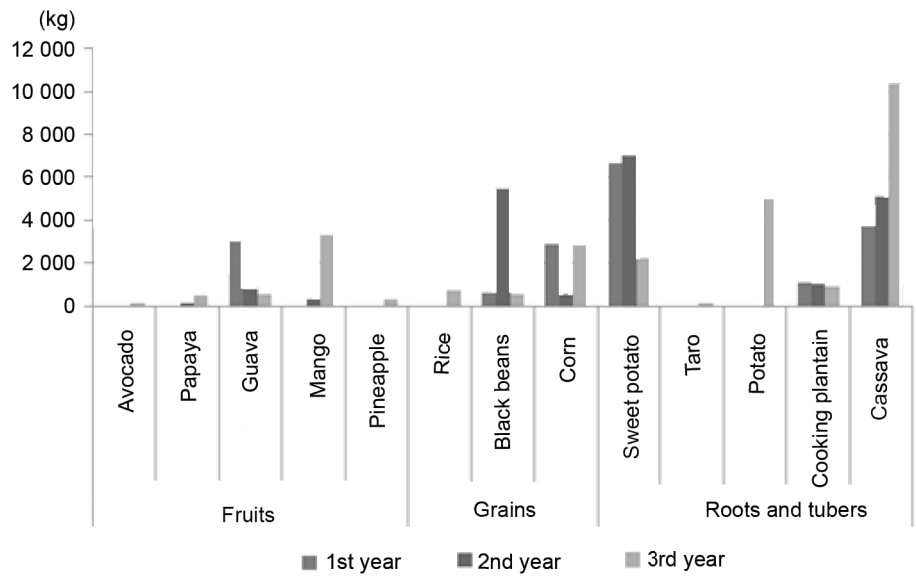

Figure 3.Production of the different crops in the period.

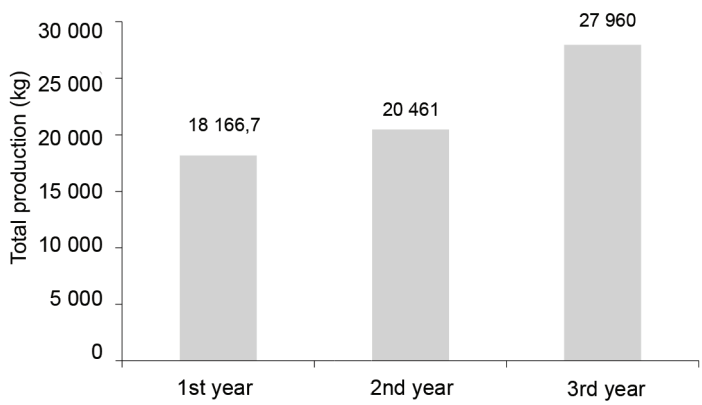

Figure 4.Total production in the farm Guamá.

results confirm the potential of diversified farms to face the productive limitations of tropical regions (Funes-Monzote *et al*., 2011) and the environmental, economic and social limitations of the sustainable agricultural development, because they increase agrodiversity and provide important environmental services, with an increase of the system productivity (Tilman *et al*., 2001). Besides these benefits, it is necessary to have an economic-financial analysis to have incidence on a higher economic efficiency.

Economic-financial analysis of the farm Guamá

Diversified farms constituted a structure that can be viable under the current conditions as practice of a small-scale agriculture, whose production can be important without demanding high costs (Pimentel *et al*., 2005).

When analyzing the financial indicators (fig. 5) a very deteriorated mean salary-productivity correlation could be appreciated in two of the four variables (self-supply and tourism sales), because no sales were made or they were minimal in the former, and there were no sales to the tourism sector in the second year. In the two others there was a balance between productivity and mean salary, because in the second year a value of $ 0,40 was achieved in such correlation, which allowed to pay the salary and obtain a positive financial results in the analyzed periods.

Likewise, an excessive increase of the salary fund was observed in the second year, which decreased in the third year. This was due to the fact that part of the productions was used for saving costs (self-supply), because otherwise the entity to which the farm belongs should have disbursed 176 400 Cuban pesos.

Cost constitutes one of the most important indicators of the farm; the lower it is to fulfill the production plan in quantity and quality, the higher the effectiveness. In the costs the level of economic management and the degree of utilization of resources and land are shown (Páez, 2008).

Figure 6 shows that the wholesale and retail modalities contributed higher results, and better indicators of economic efficiency as an average in the three years

It was proven that the wholesale (to Selected Fruits Enterprise and Collection Center) was the best variant to contribute to the farm profitability, because in it the commercial process of attention to the client or the tax on sales does not intervene; the farm's function, which is food production, is not unfulfilled either.

The cost per peso was $ 0,83 in the analyzed period, which satisfied the initial expectations of

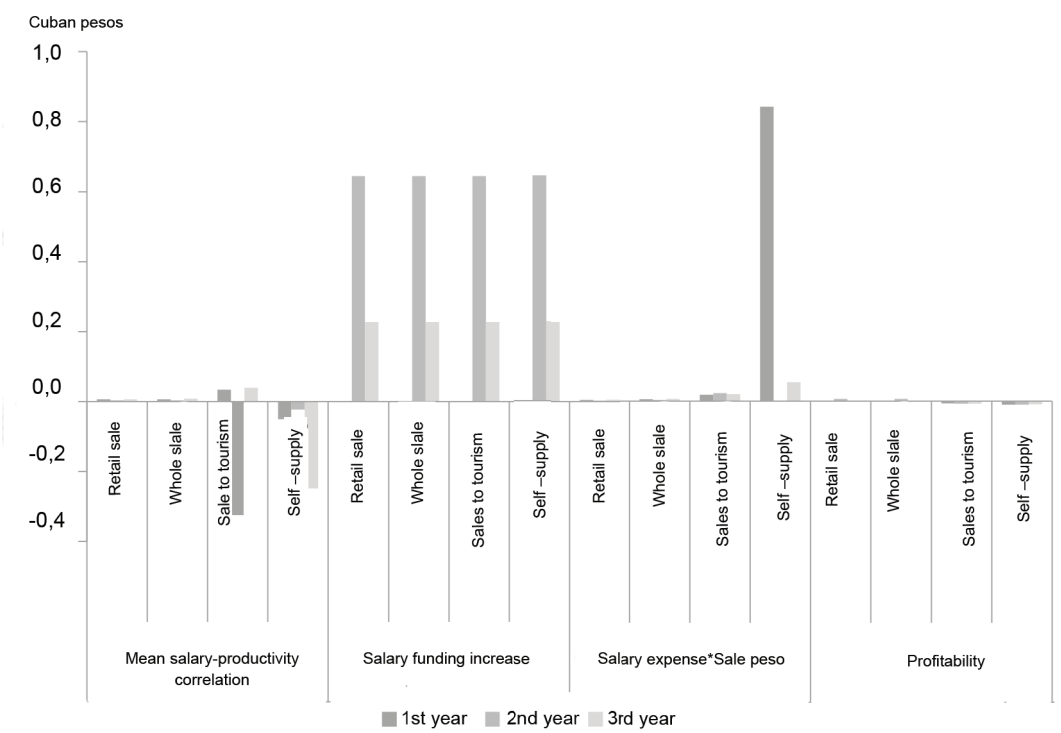

Figure 5.Financial indicators.

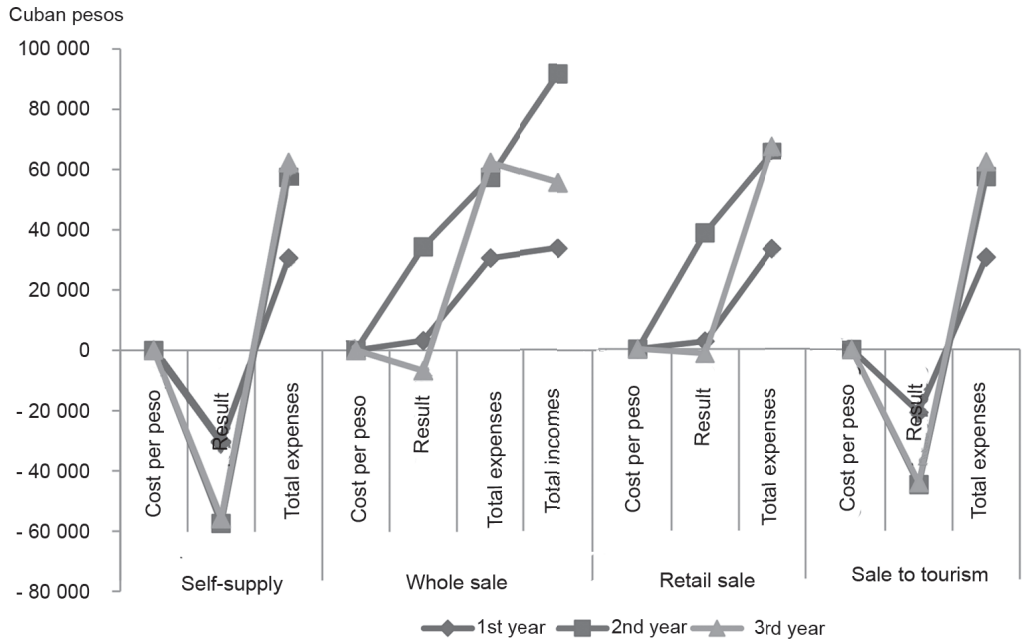

Figure 6.Economic-financial indicators according to the commercialization modality.

the farm, because it allowed to obtain a profitability of $ 0,17 for each invested peso; especially if it is considered that in the first three years, although the productions increased, the costs due to the investments increased too.

Any strategy for the farm to be sustainable should allow to produce food with the minimum environmental damage and at low cost in external inputs (Gorfinkiel, 2006), for which the importance of the financial impact should not be dismissed when adopting diversified systems to promote changes in land use. This increases the relevance of these results, which become referents that point at the integrated food and energy production farms as a path towards sustainable development.

CONCLUSIONS

The enhancement of agricultural management from an effective spatial and temporary design of agroecological diversified strategies offers opportunities to reach higher land productivity.

Likewise, the increase of the farm's incomes with the wholesale and retail sales of agricultural products could be a convenient strategy to achieve profitability and positive mean salary-productivity correlation, as well as allow to pay the salaries and obtain a positive financial result.

It is recommended to include, within the social object of the Food and Energy Area of the EEPF Indio Hatuey, that the farms have the possibility of making sales to the wholesale entities or in frontier markets, to contribute to the implementation of the Guidelines approved at the 6th Congress of the Cuban Communist Party.

ACKNOWLEDGEMENTS

The authors thank *M.Sc*. Elvira Ortiz and *M.Sc*. Vivian Sánchez for their collaboration in processing the economic information.

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Received: April 29, 2015

Accepted: October 13, 2015