Scientific Paper

Agroproductive situation of farms in two municipalities of Matanzas province▲

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Abstract

In order to characterize the agroproductive situation of 10 farms, belonging to three agricultural entities of the Perico and Jovellanos municipalities, in Matanzas province, the diagnosis and evaluation of their animal and plant components were performed. A survey was applied and the farmers were interviewed. In addition, the floristic composition of the pastureland was determined and the incomes by the end of 2018 were recorded. From the statistical point of view, to describe the data principal component analysis was used. To group the farmers and select those farms with similar characteristics, cluster analysis was applied, from the results of the principal components. The statistical package SPSS®, version 15 was used. When performing the principal component analysis, the existence of high variability, accumulated in the first three components, was observed based on the variables included in the study. In component 1, the variance reached a value of 38,3 % and in component 2, 24,7 %; while in component 3 it was 10,6 %. The variables social object (0,705), total area (0,802), pasture area (0,774), floristic composition and stocking rate (0,693) were the ones with the highest influence on the variance extracted in component 1. In component 2, the variables quantity of agricultural practices, presence of agricultural crops and number of crops present in the farms appeared as the most influential. When making up the groups, three different ones were detected. It is concluded that the farmer in group III was the one who showed better performance for the evaluated indicators and had the highest values in the use of agroecological practices and farm incomes. The farmers in group I were dedicated mainly to animal husbandry. Not all the studied farms use agroecology in their system.

Keywords: diagnosis, botanical composition, statistical analysis

Introduction

Agroecological initiatives intend to transform production systems from the transition of food production systems, based on the use of fossil fuels and aimed at the production of agroexport crops and biofuels, to an alternative paradigm that promotes local agriculture and national food production by farmers and rural families (Altieri and Toledo, 2011).

Rojas-García *et al*. (2014) state that the base-line (BL) in an agricultural production system is the qualitative and quantitative reference framework to analyze the impact and changes occurred, as result of the intervention in such system.

The BL constitutes the initial value of the measured indicators. It is understood as the study of the actors' current situation (counterparts and beneficiary families) so that the evaluation system, whose first element is the BL, can show the expected changes of the transformation process of a project (Vallejos, 2012).

The Pastures and Forages Research Station Indio Hatuey (EEPFIH) has experience in the implementation of development projects funded by international collaboration. With them it has validated renewable energy sources, utilization of green manure, formulation, sowing, establishment and management of trees and utilization of efficient microorganisms, among other technologies. Their objective is to make transformations in the farms and territories, so that they may become more resilient to climate change.

In this sense, in 2018, the project *Strategy to develop diversified agroenergetic farms in the context of sustainable family agriculture in areas of the hydrographic basin Roque San Mateo, in Matanzas*, was approved. It is funded by the

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Small Donations Program of the United Nations Development Program.

With this project, the generation of a strategy to develop agroenergetic family farms is intended, through capacity building in the actors, so that they are allowed to understand the economic, social and environmental feasibility of using agroecological practices.

The baseline of the involved farms is needed to monitor their advance with the implementation of the practices promoted by the project. From this perspective, the objective of the work was to characterize the agroproductive situation of 10 farms, belonging to three agricultural entities of the Perico and Jovellanos municipalities, in Matanzas province.

Materials and Methods

Sample. The work was done with 10 farms, belonging to the Cooperatives of Credits and Services (CCS) "Julio A. Mella", "Mario Muñoz" and "Leonel Fraguela", in Matanzas (table 1). These farms participate in the project *Strategy to develop diversified agroenergetic farms in the context of sustainable family agriculture in areas of the hydrographic basin Roque San Mateo, in Matanzas*, funded by the UNDP Small Donations Program. The farmers were identified with numbers in order to respect anonymity.

Information collection. It was done through exchange with the farms' owners and their families. In these meetings participatory techniques of group work, participant observation and group and informational interviews, were applied.

Diagnosis and characterization of the productive system. For the information related to these aspects and the farm characterization, a survey was applied and 10 farmers were interviewed.

The floristic composition of the pastureland was estimated through the step method, described by EEPFIH (1980). This method consists in walking by the diagonals in each paddock. Every three steps, which coincide with the shoe tip, the observer will classify the pasture species. In addition, the incomes by the end of 2018 were recorded.

For their analysis, the qualitative indicators of the survey were transformed into numerical variables (table 2).

Statistical analysis. A principal component analysis (PCA) was used, which allowed to determine the variability, explained by all the variables that were considered and their relations. To identify the components that explained the higher variation, those that had proper value higher than one were selected. To identify the variables with the highest influence on the variability extracted by each component, it was taken into consideration that the sum or preponderance factors reached a value higher than 0,60. In order to group the farmers and select those farms which had more prominent similar characteristics, cluster analysis was applied from the results obtained in the PCA. As grouping criterion, the Euclidian distance and Ward's method were used, as form of ascending hierarchical aggregation (Torres *et al*., 2008). The cutting line for forming the groups was based on the researcher's criterion. As statistical package SPSS®, version 15, was used.

Table 1. Studied farms and their social object.

Municipalities	CCS	Farmer	Social object
Jovellanos	Leonel Fraguela	1	Staple crops
Jovellanos	Leonel Fraguela	2	Animal husbandry
Jovellanos	Leonel Fraguela	3	Staple crops
Jovellanos	Leonel Fraguela	4	Animal husbandry
Perico	Julio A. Mella	5	Animal husbandry
Perico	Julio A. Mella	6	Mixed
Perico	Julio A. Mella	7	Mixed
Perico	Julio A. Mella	8	Animal husbandry
Perico	Mario Muñoz	9	Mixed
Perico	Mario Muñoz	10	Animal husbandry

Table 2. Qualitative indicators and their transformation into quantitative.

Indicators	Form of measuring	
	Scale	Meaning
Social object	1	Staple crops
	2	Animal husbandry
	3	Mixed
Quantity of agroecological practices	1	Agroecological practices are not used
	2	One agroecological practice is used
	3	Between two and three agroecological practices are used
	4	More than four agroecological practices are used
Use of renewable energy sources	1	No
	2	Yes
Presence of crops	1	Yes
	2	No
Floristic composition of the pastureland	1	There is no pastureland area
	2	Predominance of natural pastures
	3	Natural pastures and cultivated grasses

Results and Discussion

When performing the PCA (table 3), the existence of high accumulated variability was observed in the first three components, based on the variables included in the study. Regarding variance in the principal components (PC), PC1 reached value of 38,3 %, and PC2, of 24,7. The variables with the highest influence on the extracted variance in PC1 were social object (0,705), total area (0,802), pasture area (0,774), floristic composition and stocking rate (0,693). In PC2 the quantity of agricultural practices,

Table 3. Results of the PCA and relation among the variables.

Variables	Principal components (PC)		
	PC1	PC2	PC3
Social object	0,705	0,363	-0,431
Total area	0,802	-0,112	-0,128
Pasture area	0,774	-0,313	0,056
Quantity of agroecological practices	0,356	0,737	0,489
Renewable energy source	0,583	0,190	0,297
Presence of agricultural crops	0,424	-0,688	0,059
Number of crops	-0,482	0,782	0,330
Floristic composition of the pastureland	0,723	-0,066	0,126
Number of animal species	0,592	-0,310	0,609
Stocking rate	0,693	0,320	-0,261
Income	0,488	0,780	-0,248
Proper value	4,209	2,717	1,162
Variance, %	38,270	24,704	10,563
Accumulated	38,265	62,968	73,531

Underlined values indicate higher contribution.

the presence of agricultural crops and the number of crops present in the farm influenced more. In PC3, the highest values were for the quantity of animal species (0,609) and the variance was 10,6 %.

The above-described results allow to consider that there was higher differentiation among the farms, depending on the variables present in PC1-PC2, and it was much lower for the variables of PC3.

The analysis allowed the characterization of the farms which are differentiated regarding the social object and quantity of total area, as well as the pasture surface and stocking rate. In most of them, the *Dichanthium caricosum* (L.) A. Camus-*Dichanthium annulatum* (Forssk.) Stapf complex prevailed. The natural grasses represented 80 % of the floristic composition of the pastureland, and the legumes, 5 % approximately.

Through the cluster analysis based on the PCA results, three different groups were identified. Table 4 shows the categorization of the farmers by groups and their identification. In group I the highest quantity of farmers was found (seven); while in II and III, only two and one, respectively.

Table 4. Group formation.

Group	Quantity of farmers	Farmer
I	7	1, 2, 3, 4, 8, 9 y 10
II	2	5, 6,
III	1	7

Most of the farmers in group I did not have agricultural crops. The social object that prevailed was animal husbandry. Nevertheless, what they had in common is that they did not use agroecological practices (silvopastoral systems (SPSs), microorganisms with native strains, renewable energy sources, compost production, among others). These farmers were the ones who reached the lowest incomes (table 4).

SPSs can contribute feedstuffs of high nutritional value for livestock and thus achieve system sustainability, propitiating nutrient recirculation, environment protection and maintenance, as well as the improvement of farm incomes (Congo-Yépez *et al.,* 2018). In turn, the ecosystem biodiversity is higher and propitiates the habitat of many bird species. Tree sowing offers environmental advantages that allow to establish productive, sustainable and environment-friendly agroecosystems (Olivares-Pérez *et al.,* 2018).

In group II two farmers were grouped (5 and 6), who had farms of 47,0 and 33,6 ha of total area and pasture area, respectively. They do not use agroecological practices, but have average incomes of 677 339,70, higher than group I.

Group III is formed by only one farmer, who has a diversified farm. He uses renewable energy sources (windmill), utilizes a fixed-dome biodigester for processing pig excreta and has incomes higher than one million pesos (table 5).

It is concluded that the farmer from group III was the one who showed the best performance for the evaluated indicators. This farmer had the highest

Table 5. Categorization of the farmers by groups.

Variable	Group I		Group II		Group III
	X	SD	X	SD	X
Social object	1,9	0,690	2,5	0,71	3
Total area	23,4	18,0	47,0	9,50	40,2
Pasture area	19,7	19,237	33,5	28,45	31,6
Quantity of agroecological practices	1,3	0,488	1	-	4
Renewable energy source	1,4	0,535	1	-	2
Presence of agricultural crops	1,4	0,535	1,5	0,707	1
Number of crops	1,7	2,360	1	1,4	5
Floristic composition of the pastureland	1,9	0,378	2	-	2
Number of animals	2,1	1,345	1,5	0,707	2
Stocking rate	0,6	1,627	1,0	-	1,9
Income	79 929,1	61 797,382	677 339,7	147 968,613	1 464 766,2

values in the variables use of agroecological practices and farm incomes. Those in group I were dedicated mainly to animal husbandry. Not all the farms use agroecology in their system.

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