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Agroecological Practices on Private Farms in the Province of Camagüey, Cuba

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ABSTRACT

The aim of this research was to gather together the dairy farms of the José Antonio Echeverría Strengthened Cooperative of Credits and Services (CCSF) in the province of Camaguey, Cuba, according to the frequency of application or no application of agroecological practices, and their relationship to some bioproductive variables of economic interest. Information compiled for three years was used. Three groups were made, based on hierarchical clustering analysis. The grouping system used was the link between groups. The measure criteria used was the squared Euclidean distance from agroecological practices by the farmers. SPSS 21.0 was used for statistical analysis. The groups made were considered the factor to perform variance analysis (ANOVA) to with eight dependent variables. The Tukey´s multiple comparison test was made to the variables that showed differences for $P < 0.05$. A total of seven out of ten agroecological practices applied with effects on the behavior of bioproductive indicators were identified. Group three included the farms with the best results, and the highest number of agroecological practices.

Key words: *clustering analysis, cattle, agroecological practices, milk production*

INTRODUCTION

In view of the new changes in Cuban agriculture, it is important to create agricultural systems based on low-foreign inputs, low costs, high local diversified resource use, and energy efficient, which can produce sustained yields, based on economically balanced technologies. In other words, these systems will demand sustainable management of agroecological practices. These changes, however, must be gradual and in concert with measures to re-establish soil fertility and biological balance, while reducing chemical fertilizer dependence. Today´s rural transformations point to a re-setting of traditional models, relying on input substitution, and greater protagonism of agroproductive sectors to increase crop yields and cost effectiveness (Altieri, Funes-Monzote, Petersen, Tomic, and Medina, 2011).

The aim of this research was to pool dairy farms of the José Antonio Echeverría Strengthened Cooperative of Credits and Services (CCSF), in Camaguey, Cuba, according to the frequency of agroecological practices implementation, and their relation with some bioproductive variables of economic interest.

MATERIALS AND METHODS

Location, climate and soil

This study lasted three years, and was developed at the José Antonio Echeverría Cooperative of Credits and Services (CCSF), from The National Association of Small Farmers (ANAP), in the municipality of Camaguey, province of Camaguey.

The predominant soils were fersialitic brown, red brown, and gray brown, dark plastic nonglaysed soils, without carbonates, category II.

Methodology

Twelve dairy farms (10% of total cattle farms) were chosen. The farmers were interviewed collectively, to gather information about the application of agroecological practices. Ten indicators were chosen, based on the previous information (hedges, field trees, replacement animal production, crop-livestock raising integration, sugar cane plantation, kingrass plantation, protein banks, organic fertilizer use, animal, draft animals, and residue treatment), in order to make hierarchical conglomerate analysis. The pooling method used was the relation within the group, and the measurement was the squared Euclidean distance.

Single factor ANOVA was performed to each group, with the following dependent variables: ar-

ea of planted sugar cane (area-sugar cane), stocking rate (stocking rate), cow total (cows), birth total (births), gestating cow total (gestating), total cow production (total-prod), milking cows (milk-cow), milk production per hectare, per year (milk/ha/year). The Tukey´s multiple comparison test was applied to the variables with differences for $P < 0.05$. SPSS, version 21.0 (2012) was used for statistics analysis.

RESULTS AND DISCUSSION

Figure 1 offers information about the agroecological practices performed on every farm. Only 5 of fams implemented 30 - 50% of such practices; whereas the rest (7), are above that percent, particularly, La Nena Farm (100%).

Moreover, other agroecological practices were identified, like hedges, field trees, and replacement animal production, which were accomplished by all the farmers.

Fig. 2 shows the results of hierarchical cluster analysis based on agroecological practices used by farmers. Three groups stood out from the rest, defining the number of cases (farms) per cluster.

Few related papers have been published on this topic, though Perera (2002) and Campo (2011), and Bello (2007) used the same analysis based on the criteria to put similar farms in the same group. Multivariate clustering was used to implement pooling and assess sustainability indicators.

In turn, Blanco, Monzote, Ruiz and García-Soldevilla (2006) used statistical multivariate techniques to assess factors that limit sustainability of cattle farms in the municipality of Cotorro, Havana, based on quantitative variables that evaluate indicators in four areas or dimensions, such as, area distribution, environment, production and social-economic dimension.

The variance analysis performed to the eight variables evaluated showed that only four of them had significant differences among the groups (see table), which confirms their heterogeneous behavior.

The farms studied had a somewhat discouraging rate of sugar cane inclusion frequency. As a nutritional alternative, it offers great benefits to livestock, especially during the dry season.

The inclusion of sugar cane (*Saccharum officinarum*) in the animal diet has taken an important place in Cuba. During the dry season, over a million tons of whole sugar cane plants are supplied to cattle. Ugarte (1988), cited by Fernández (2011), noted that it accounts for 10% of all the feed supplied in that season; however, several this alternative is not commonly implemented by-farmers.

The values for stocking rate were similar to the ones achieved for production in Cuban livestock companies, according to Blanco *et al*. (2009), who reported 1.48 LU/ha. These values may be regarded as acceptable in the first two groups, particularly. However, in general terms, weed infestation of grazing areas is limiting optimal use, thus forcing farmers to increase the stocking rate per hectare.

Due to the economic relevance of milk production, and in relation to the significance found in the groups, it can be noted that there were significant differences. It is also important to stress that the farms in group 3 (with the best application of agroecological practices), are the ones with the highest production values.

In turn, Carrizales, Paredes, and Capriles (2000) studied the technological behavior of 12 dual prupose farms with undefined modality to dairy production, located in the municipality of Colón, state of Zulia, Bolivarian Republic of Venezuela. The results included three levels of technological performance: advanced, intermediate, and lag, demonstrating the technological variability of the farms. The average values were 2 099 ± 249; 981.4 ± 239, for the advanced and lag groups, in terms of liter/ha/year, respectively. It proved that the farms perform the same modality, structurally; but functionally, they are different.

Blanco *et al.* (2006), when studying some sustainability indicators on cattle farms in the province of Havana, reported milk yields of 943 kg/ha/year, similar to the results achieved in this study.

CONCLUSIONS

Seven of the ten agroecological practices that had an effect on the bioproductive indicators of the dairy farms at the José Antonio Echeverría CCSF were identified.

Three groups were made on the farms studied, based on clustring analysis, having the amount of agroecological practices as reference. Group 3 pooled the farms with the most outstanding production results, coincidentally, the ones with the largest number of agroecological practices implemented.

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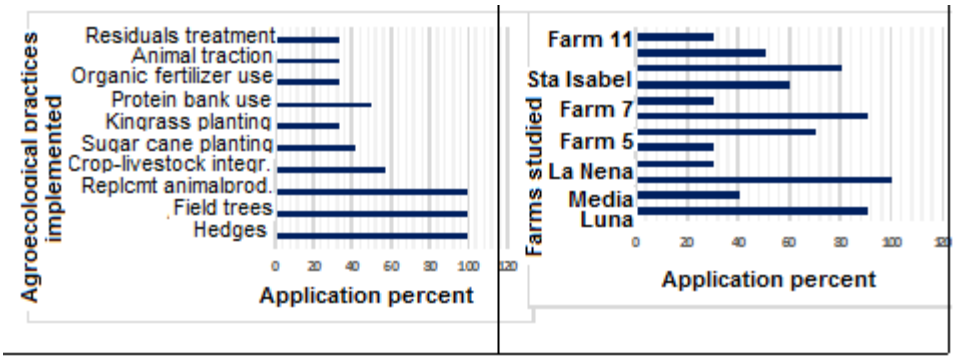

Fig. 1. Agroecological practices evaluated, and application percent on the farms studied

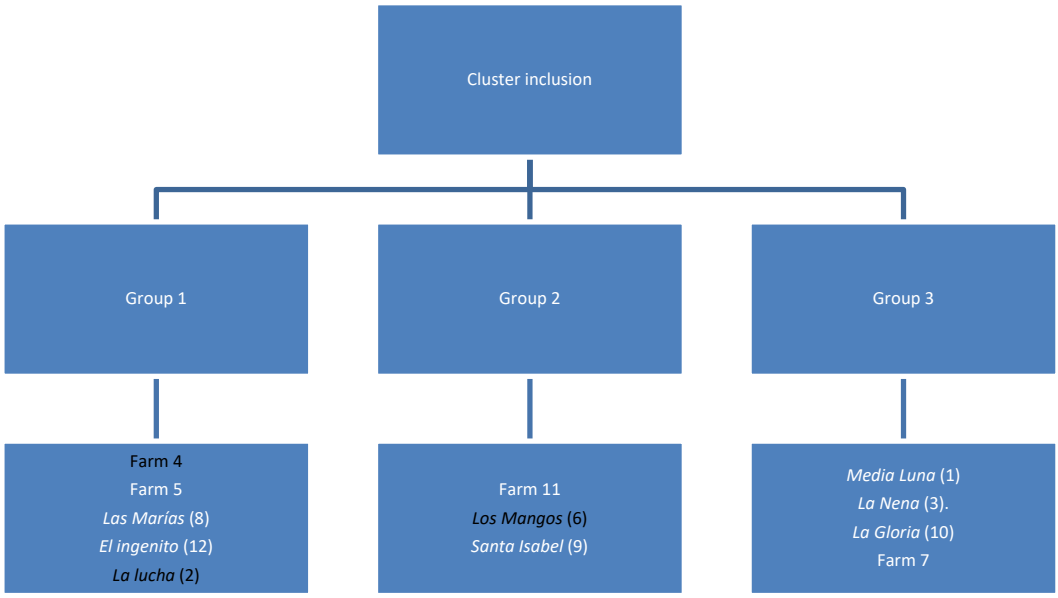

Fig. 2. Pooling of farms according to cluster inclusion

Table. ANOVA results among the groups made and the bio-oproductive variables

Variables	Groups	N	Mean	Sig.
Sugar cane area (ha)	1	5	.000	.008
	2	4	.500	
	3	3	1.000	
Stocking rate (LU)	1	5	1.472	.001
	2	4	1.396	
	3	3	2.843	
Total milk production (kg)	1	5	4079.20	.046
	2	4	12318.75	
	3	3	28241.00	
Milk/ha/year (kg)	1	5	147.78	.029
	2	4	374.87	
	3	3	859.18	

Significant values between ranges differ for $P < 0.05$