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Characterization of Cattle Farms for Rural Extension Work in Ecuador. II. Classification

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ABSTRACT

The aims of this paper were to classify cattle farms by multivariate statistics, and to characterize the groups of cattle farms of two parishes in Chunchi canton, Chimborazo province, Ecuador, for rural extension work. The factors achieved in the reduction of dimensions (8) were used to make hierarchical clustering analysis based on the Ward´s method, with an Euclidean distance cut of 15. Four groups were made and named after the appearance frequency. The groups were characterized using the central tendency and frequency distribution. Group 4 was superior in terms of area, though all the farms studied may be regarded as small, according to the classification of the National Institute of Statistics and Census (INEC). The number of trees was lower in group 2, suggesting interest in intensification based on space. Group 4 had more cows, thus recurring to concentrated feeds more often. Group 1 reported the need for more training. It was concluded that groups 1 and 3 required greater support from the rural extension system; whereas group 4 showed traits of numerical superiority of the variables. Accordingly, an efficiency study of the groups identified is suggested.

Key words: *cattle farm characterization, rural extension*

INTRODUCTION

Gurdian (2011) defined rural extension as a process in which the extension worker and farmers, and their families interact with knowledge to achieve integrated development of people and their active, autonomous, and solidarious participation in organizing process that lead to the transformation and development of society. He also described the advantages of group work, since the method provides greater opinion and knowledge exchanges, as well as coverage for knowledge dissemination than individual methods.

Cabrera *et al*. (2004) explained that when the farms are pooled according to their main differences and relations, it is important to maximize each group´s homogeneity. Accordingly, research methodologies associated to production systems are based on the knowledge of specific factors (endogenous and exogenous). The aims of this research are,

- To classify cattle farms in two parishes of Chunchi Canton, province of Chimborazo, Ecuador, using multivariate statistics.
- To characterize pools of cattle farms for rural extension work.

MATERIALS AND METHODS

The study took place in the parishes of Matriz and Capzol, in Chunchi, Chimborazo, Ecuador. The local climate conditions of the Ecuadoran cities in the Andes are characterized by high plateau areas that favor frequent precipitations, with decreasing temperatures as altitude is higher. Besides, slopes cover 40% of the area.

The grazing area is mainly covered by graminaceae: perennial ryegrass (*Lolium perenne*); annual ryegrass (*Lolium multiflorum*); Kikuyo (*Pennisetum clandestinum*); orchard grass (*Dactylis glomerata*); Yorkshire Fog (*Holcus lanatus*) and legumes: White clove (*Trifolium repens*); red clove (*Trifolium pratense*) and lucerne (*Medicago sativa*), according to the Technical Memoirs of the Canton (MTCCh, 2013).

The study comprised 82 farms chosen at random, a number proportional to the total number of farms in each parish. The information compiled for the research was from 2014. The surveys (individual and group) were applied by the Ministry

of Agriculture, Livestock, Aquaculture and Fishing MAGAP specialists in Chunchi.

The factorial scores derived from dimensional reduction were used in hierarchical cluster analysis (Ward procedure). To characterize the new groups measures of key trends were used. Frequency distribution was also applied as this study also included interpretation of qualitative information.

RESULTS AND DISCUSSION

Typification and characterization

Fig. 1 shows the distribution percents of the sample, according to the classification achieved in the hierarchical cluster analysis. The groups were arranged by size, with the greatest pool observed in group 1 (G1), followed by G2. The other groups, G3 and G4, that might have bound at a Euclidean distance of 20, now take small portions of the population studied, though they showed important differentiation data.

The main differences between groups are presented in Table 1. The youngest population observed in G2 stood out, considering the years of cattle raising activity. The total farm area ranked G2 on top, whereas G4 stood on the bottom. This variable was concomitant with the grazing area. The superior values from all the data collected proved they were small areas (<20 ha), according to the classification of the National Institute for Statistics and Census (INEC, 2010).

The overwhelming preference for tether grazing may be related to Apollin and Eberhart´s (1999) statement that when the land is the most deficient production factor in a region or country, the general interest is to favor more intensive systems. Contrary to that theory is the criterion that prolonged occupation of grasslands caused by the low number of fields, would force the needy animals to eat low-quality pastures, with deficient nutritional values (Vargas *et al*., 2011).

Today, the number of trees in the grazing areas has become a real problem for cattle systems when attempts were made to provide the best possible use to land surface. For instance, some research concluded that the intensive systems had lower tree densities on the fields, but such trees were bigger than less intensive systems. The explanation is that in more intensive systems the trees were cut down to avoid the negative effect of shadows on grass growth (Pérez, 2006). Apollin and Eberhart (1999) noted that it had a negative effect on the environment, because high slopes facilitate erosion. A productive view was presented by Villa-Méndez *et al*. (2008), who highlighted that natural trees and plants in general improved the alternatives of ruminant system development in regions that endured more than four months of drought.

The variables that considered the time calves spent by their mothers, and the time it took to fatten cattle for commercial sales, might be combined for analysis. The rationale is that progenies often take part in milking along with lactation, and they are sold at early ages because fattening is not a common practice in the area. In the rural areas of Los Ríos and Cotopaxi, Vargas *et al*. (2011) demonstrated that the weaning age of calves coincided with the end of lactation in cows.

Cattle raising based on business practices demands investments. Important aspects to consider were grasslands and animal health; some farmers were far from investing, and others gave top priority to income as a key element to increase production. Obando (2005) indicated that highland livestock raising comprised increased needs to intensify the system, and investment in concentrated feeds, with ensuing price rises.

One influential point was the supply of quality feeds to meet the nutritional requirements, as it was directly linked to present-day milk production. In that sense, G4 (Fig. 2) was predominantly positive concerning balanced feeds administered to cattle. However, 53.7% of the population did not use technology, which might have been attributed to the size of the farm and the number of producing cows. Accordingly, Estrada and Paladines (2000) noted that the large increase in production per animal observed in Sierra Ecuatoriana was achieved in the 90s, thanks to a higher use of concentrated feeds per cow, heifer and calf.

The production traits studied showed a relationship to the data explained. The total amount of cattle heads included in this research is highly linked to the number of cows, and subsequently, to lactating cows. Thus, all the groups had a better national average percentage; only group 1 was higher than the provincial values (71%). The data submitted by the Survey of Surface and Continuous Agricultural Production (ESPAC, 2012) showed that nationally, the category cows accounted for 38% of the herd, and 53% was lactat-

ing. Provincially, 36% were cows, 69% of them were lactating.

Daily milk production a month after the cut on each farm had an aspect ratio per number of cows. Some farms with only one cow were unable to accomplish continuous production during the year, thus corroborating the results in Table 2 that show no production values for some farms. This situation was also observed in the last month. Since most cattle-related income derived from milk production, homes were affected during that time.

MTCCh (2013) suggested three groups of farmers, depending on size (large, medium and small). The large group succeeded in making associations within the group. Also remarkable was an inclination to self-consumption and production of dairy products manually by small farmers. It also described collectors in two groups (informal groups and MAGAP-encouraged groups), with collecting centers.

MAGAP´s efforts to stimulate farmers through milk collecting centers will help stabilize prices, based on the market. Therefore, disloyal competition will be prevented. Figure 3 shows the prices at the time of verification of information and results from the field. There was an increasing tendency, with USD $0.44 per liter of milk on the farm. Although MAGAP encourages payment based on milk quality and hygiene practices, the traditional selling conditions make this practice difficult in the area.

Considering the data shown in figure 4, Aguirre (2012) suggested a classification method for the rural extension system, to identify more suitable farmers for public or private services, because in the particular case of Latin America, the groups that should have paid for that service were privileged due to wrong economic practices, based on the lack of information about the results and impact of rural extension. In case rural extension occurs, principles like inclusion and equality must be taken into account, as the Ecuadoran Government does today. Moreover, there must be a private structure that can become an alternative to development.

Although the need for training claimed by farmers constitutes a basis for extension activities (Vargas *et al.* (2011), suggested that the application of participatory methodologies for rural innovation that included most actors of the production, marketing, planning, implementation, control, and the innovation assessment chain, contributed to follow up and useful life of technologies and processes that benefit farmers. Today, if an extension program is not sustainable it will lack support at different levels.

CONCLUSIONS

The classification used for cattle farms in Chunchi included four groups. Minority concentration in group 4 provided a greater range of differences and the intervention axes for rural extension.

A greater need of support for optimum resource use was corroborated for rural extension in G3 and G4. Furthermore, G4 superiority was influenced by the larger size of the fields and number of cows, without showing continuous efficiency regarding the other groups.

RECOMMENDATIONS

The results of this study should be available to local farmers, as part of the documents needed to design rural extension planning, in order to achieve integrated development of all the groups found in the dairy sector in Chunchi.

Each group found in the research should be further studied, especially the productive efficiency indicators that help manage rural development policies to optimize and standardize production conditions.

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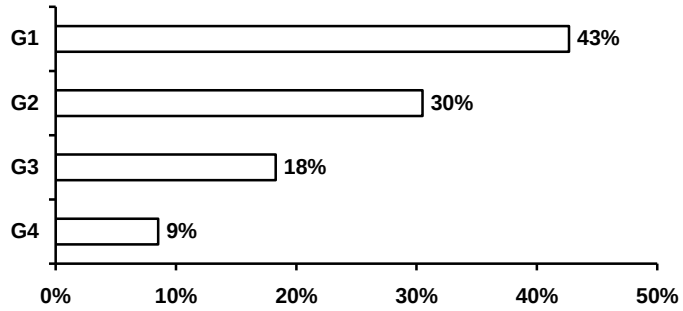

Fig. 1. Cluster frequencies

Table 1. General features of farmer groups

Ward	MTC	Experience in years	Total area	Grazing area	Number of trees	Calf-mother raising time	Cattle fattening time (months)	Investment in pastures	Investment in animal health (yearly)
G1	N	35	35	35	35	35	35	35	35
	Mean	47.20	3.66	3.14	25.97	239.29	31.89	80.40	71.00
	Median	50.00	3.00	2.50	15.00	240.00	30.00	6.00	60.00
	Minimum	10	1	1	0	90	0	0	0
	Maximum	75	9	8	200	365	60	600	200
G2	N	25	25	25	25	25	25	25	25
	Mean	25.72	2.40	1.86	9.56	189.20	21.84	462.24	286.80
	Median	20.00	2.00	2.00	5.00	180.00	24.00	200.00	200.00
	Minimum	2	1	0	0	120	0	0	0
	Maximum	65	5	3	30	300	60	3 000	3 000
G3	N	15	15	15	15	15	15	15	15
	Mean	42.20	2.80	2.36	18.60	221.00	20.00	200.27	134.67
	Median	40.00	2.00	1.00	11.00	210.00	24.00	6.00	80.00
	Minimum	20	1	1	0	120	0	0	0
	Máximo	68	7	7	50	365	36	1050	500
G4	N	7	7	7	7	7	7	7	7
	Media	36.00	9.86	8.47	10.86	218.57	13.43	246.57	242.86
	Median	40.00	10.00	9.00	10.00	210.00	12.00	270.00	200.00
	Minimum	3	5	3	4	150	0	0	50
	Maximum	50	15	15	20	300	30	500	400

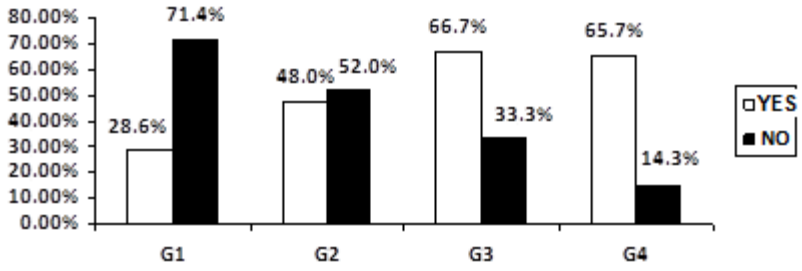

Fig. 2. Supplementation with balanced feeds on the farm

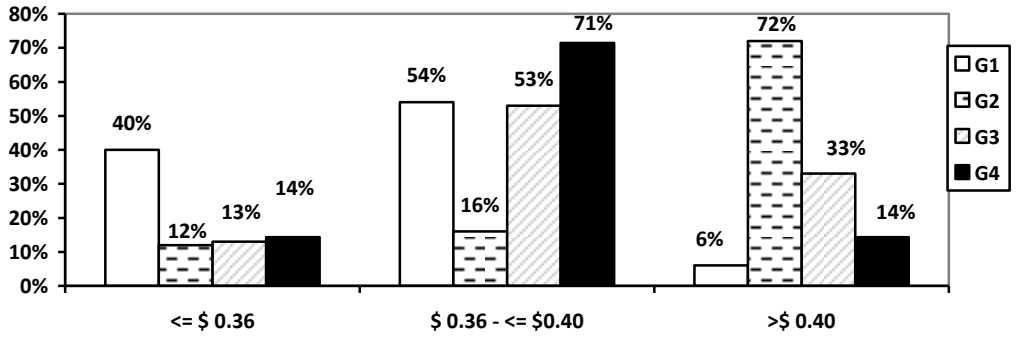

Fig. 3. Price of milk liter on the farm

Table 2. Characteristics of dairy activity in the groups

Ward Method MTC		Total animals	Total cows	Lactating cows	Current milk production l/d	Liters of milk sold a month after cut	Milk monthly income
G1	N	35	35	35	35	35	35
	Mean	8.71	3.31	2.34	19.00	483.14	205.57
	Median	7.00	3.00	2.00	16.00	450.00	190.00
	Minimum	2	1	0	0	0	0
	Maximum	24	10	6	75	1 500	800
G2	N	25	25	25	25	25	25
	Mean	10.04	4.68	3.16	21.36	520.40	201.57
	Median	7.00	3.00	2.00	14.00	450.00	189.00
	Minimum	1	1	1	3	100	40
	Maximum	30	16	9	97	2 500	1 050
G3	N	15	15	15	15	15	15
	Mean	7.33	3.20	1.93	12.60	379.33	147.80
	Median	7.00	3.00	2.00	10.00	350.00	126.00
	Mínimum	2	1	0	0	0	0
	Maximum	15	6	4	30	950	350
G4	N	7	7	7	7	7	7
	Mean	20.71	7.57	4.43	31.14	862.86	338.57
	Median	19.00	7.00	5.00	45.00	1 200.00	490.00
	Minimum	12	4	1	5	140	55
	Maximum	32	13	8	50	1 400	525

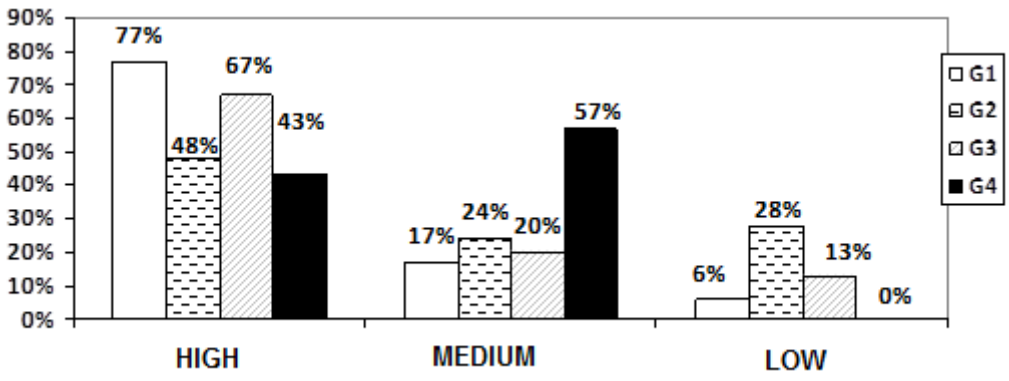

Fig. 4. Training level estimated by the farmer