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Characterization of Cattle Farms for Rural Extension Work in Ecuador I. Determination of the main heterogeneities

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ABSTRACT

Eighty-two cattle farmers were surveyed to determine the main variables involved in cattle farm heterogeneity for rural extension work in Chunchi canton, Chimborazo province, Ecuador. The dimension reduction method suggested by Cabrera *et al*. (2004) was applied. Eight factors derived from the study: PCA (4) was made to variables investment in pastures and monthly milk income (F1); cattle fattening time (F2); total area (F3), and related farm members (F4). Whereas MCA (4) included variables missing indispensable service and applicability of state of the art technology on the farm (D1); personnel in emergency situations (D2); breed or crossbreds (D3), and farm technology (D4).

Key words: *cattle farms, rural extension work*

INTRODUCTION

Cattle extension practices in Latin America faces big challenges in unfit areas which need implementation of proper cattle raising technology, particularly for milk production. In that sense, the study or diagnosis of milk production systems whose basic nutrition relies on pastures and forages, provides identification of strengths and weaknesses for sustainable management that allow for a more efficient use of resources that guarantee sustainability and food safety (Curbelo *et al.*, 2009).

Apollin and Eberhart (1999) said that when the land is the most critical factor in a country´s agriculture, the general interest (of people and the economy) is to favor more intensive production systems; that is, those that generate the largest values per area unit available. In addition to it, Mora (2011) conceived the intensive system on the basis of large initial investments in machinery, equipment and facilities that favor the use of confinement and supplementary feeding technologies for cattle.

Individuals in a population may gather together in several ways, usually based on apparent features. In statistical terms, it is given by the relation among shared features of rural extension. The identification of the context in which the relation occurs prevails in determining the pooling possibilities of cattle raising systems. The aim of this study is to determine the main variables that effect on the heterogeneity of cattle farms, to implement rural extension in Chunchi canton, Chimborazo province, Ecuador.

MATERIALS AND METHODS

This research took place in the Matriz and Capzo parishes, Chunchi Canton, 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, there are 40% of slopes.

Eighty-two farms were chosen at random for the study; that figure was proportional to the number of parishes. The database included 100 variables, all validated by the Group of Experts at the Center for Animal Production Development (CEDEPA), at the University of Camaguey, Cuba, together with experts of the Ministry of Agriculture, Livestock and Fishing (MAGAP), in Chunchi, Chimborazo, Ecuador. The information compiled for the research was from 2014.

The surveys (individual and by groups) were applied by MAGAP specialists (Chunchi). The information was corroborated by personalized interviews to farm leaders, technicians (members of the rural extension group), and MAGAP members. The research advisors helped verify the data

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from farms and milk collecting centers, at random.

The diagram in figure 1 shows the differences of two important phases, like variable dimensional reduction, in which every subsequent procedure is intended to achieve a lower number of variables, that could provide statistical differences among the individuals studied. It will be the basis for a new classification model.

The minimum acceptable variation coefficient (VC) for variable selection was 50% (Cabrera *et al*., 2004). These variables were also considered important for the study with inferior values (García and Ramírez, 2011). The variable association degree was measured with a correlation matrix. The minimum correlation value was 0.5.

Variable typification: factorial analysis was performed through Principal Component Analysis (PCA) for variable dimensional reduction, with varimax rotation for quantitative data. Multiple Correspondence Analysis (MCA) was made for qualitative data. The factors were chosen according to the total explained variance percent, with a minimum of 70%.

RESULTS AND DISCUSSION

Dimension reduction

Twenty-three variables with discriminating power were achieved and divided in two groups: quantitative (8) and qualitative (15); three variables were removed due to the poor contribution to the factors achieved. The principal component values were collected after the PCA, and the first four components in the list higher than 1 were selected; they had accumulated variance of 82.04%.

The first component (F1) was observed to significantly describe pasture investment and monthly milk income. The effect of the latter on the former could be deducted, as farmers reported about grassland leasing to cover the needs of cattle. In that context, Escobar and Berdegué (1990) noted that farmers are more interested in maximizing profits and/or production when the market conditions are fair and stable. Ostensibly, when the conditions were precarious and haphazard, the main interest was based on minimizing risks by increasing the use of abundant resources with low or inexistent opportunity costs.

The second component (F2) clearly showed a representative value for the variables: the time needed to fatten cattle for sale (months) and the number of trees on the farm, indicating an interest in intensification practices, prioritizing space optimization in detriment of tress. It occurred because tress were removed in more intensive systems to prevent the negative effect of shadow on grass growth (Pérez, 2006). The marketed cattle would correspond to areas with more space for animal production.

In that sense, the third component (F3) described the variables of the total farm area and the sale prices of cattle. In production, Benítez *et al*. (2006) and Vargas *et al*. (2011) noted that size of the herd and farm extension defined the system´s capacity to feed animals. According to these authors, the sterile animals in smaller areas were sold quickly to use the space. In larger areas, the animals stayed longer, until they were ready for the market, at a better price.

In the fourth component (F4), an important contribution was corroborated in the explanation of related members on the farm or area, the social side of the research. However, there was no significant value in terms of total area with a low correlation (0.28) between the two variables. A detailed analysis of the variable showed that households of 1-4 members accounted for 73% of the samples, and the higher values (up to 11 members on the farm) accounted for 27%. Addition to it, the Technical Memoirs of Chunchi (MTCCh, 2013) showed a population distribution with technical precision values in the Canton for children (28.28%), teenagers (15.22%), young adults (17.15%), adults (27.83%), and elders (11.52%); with an average age of 29.

MCA produced four dimensions, with a total variance explained of 74%.

The first dimension (D1) showed some influence of the basic service regarded as priority, which is currently absent due to frequent grassland management. Also, the feasibility to apply state of the art technology accounted for 60%. This confluence might have been explained by the poverty levels observed in the systems studied; the traditional requirement is that innovation depends on the capital available. Therefore, it was important to encourage optimum use of resources, through rural extension processes (Gaitán and Lacki, 2014). All the previous must be considered when dealing with the social use given to goods and services, that favor life in communities, not just in isolation (MTCCh, 2013).

In the second dimension (D2), several preference variables of assistance in emerging productive conditions coincided with the one associated to area deforestation. That relation may have derived from the effect of roads to the farms, as well as the effects of long distances from the Canton´s capital. In that sense, permanent planned collective participation of public and private organizations is important (Vargas *et al*., 2011).

Dimension three (D3) detailed the variables of roads and the cattle breed or crossbreds in the area. This relation may have been caused by the effect of historic inclusion of artificial insemination programs which are sometimes favored in locations where access by road is easy, and offer improvements in terms of cattle breeds and biotypes. In detail, in 60% of cases, the herd was made up of crossbred animals (Holstein Friesian); 21% of Swiss Brown; and 19% of crossbreds between the two and Jersey. All this coincided with MTCCh (2013), that reported the presence of Criollo and Crossbred cattle for milk production.

Dimension four (D4) included three points of view that may have been linked from a sociocultural perspective. It concerned high priority and nonexistent services, according to the kind of cattle breed and the origin of the technology applied for production; the ones with traditional technologies were less engaged in cattle breeding. Concerning service shortages, it was deducted that those with less access to services available, including technical training to enhance production and implement breeding, had been traditionally excluded by development policies throughout history. Another study determined that herd formation and the technological alternative applied had repercussions on the system´s productivity and the environmental situation of the farms (Vargas et al., 2011).

CONCLUSIONS

The analysis of quantitative variables tackled differences in terms of intensification based on space; however, the qualitative differences were more related to social and cultural issues observed in the population studied.

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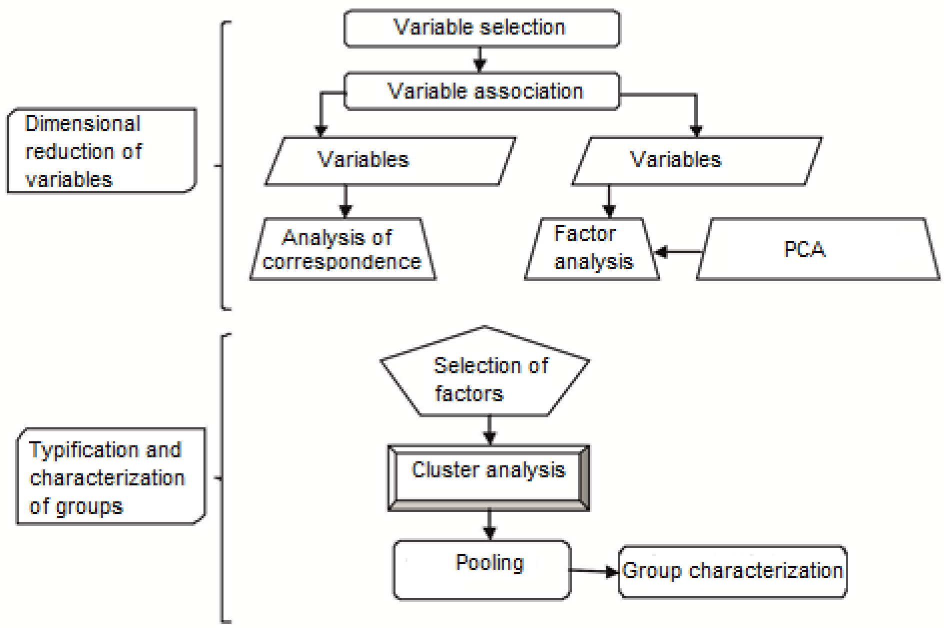

Source: Cabrera *et al*. (2004), author´s adaptation

Fig. 1. Flowchart of information processing

Table 1. Matrix of principal components rotated

Variables	Components			
	1	2	3	4
Investments in pastures	.904	.039	-.086	.013
Monthly milk income	.751	.116	.502	-.006
Cattle fattening time (months)	.104	.888	.032	-.083
Number of trees	.041	.693	-.052	.484
Total area	.153	-.087	.899	.231
Price of sold cattle	-.348	.474	.588	-.390
Family memebers on the farm	-.014	.041	.139	.897

Table 2. Contribution of qualitative variables to dimensions

Variables	Dimension				Mean
	1	2	3	4	
Inexisting priority service	.453	.150	.171	.310	.271
Where to turn to during emergencies	.047	.510	.192	.069	.204
Farm road conditions	.273	.056	.313	.073	.179
Tree species	.383	.285	.165	.178	.253
Water suplly for agriculture	.241	.121	.084	.041	.122
Destination of organic matter	.262	.001	.288	.023	.143
Deforestation issues	.287	.395	.020	.166	.217
Grassland management	.451	.110	.054	.224	.210
Grazing	.316	.179	.124	.041	.165
Breed or crossbred	.061	.297	.386	.320	.266
Destination of milk	.181	.179	.015	.081	.114
Farm technology	.028	.106	.169	.318	.155
Applicability of state of the art technology on the farm	.405	.000	.001	.019	.106
Total active	3.386	2.388	1.981	1.862	2.404
Variance %	26.043	18.368	15.235	14.321	18.492