Evaluation of Ecuadorian Cattle Farms

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ABSTRACT

A group of 146 dairy farms from the northwest highlands region of Ambato Canton, Ecuador, was evaluated. The techniques used were survey, observation of the technological process, and selection of 20 production indicators as variables of conglomerate classification and analysis. An average of 1.9 and 1.5 ha were allocated to pasture production, with a stocking rate of 1.3 of adult bovine units/ha, 22 animals per farm (17 being milked). Dairy production is 6.1 l/cow/farm/day, and 10.1 l/farm/day. Two different groups of units were made for pasturelands, stocking rate, production per animal, farm/day, and farm/year; as well as for hygiene, husbandry, and reproduction. The first group was made up of 119 units, and had the lower results; the second group was made up of 27 animals. The group with the better results, located in areas with improved pasture, received better nutrition, and genetic breeding was performed. Actions are proposed to enhance production in the less efficient group. These results, combined with previous social and economic studies are the basis for further implementation by the provincial Government of Tungurahua, and other national bodies.

Key words: *highlands, milk production, transition region*

INTRODUCTION

Highlands are not only considered endemic of high mountains whose height determines elevated humidity values; they must be regarded, above all, as a fragile and bio diverse ecosystem. Highland characterization includes sources of fresh water from which more than five million inhabitants benefit in Ecuador, both directly and indirectly. Additionally, 248 000 people populate the highlands area in the country (Mena *et al.*, 2009).

Highlands are considered a high priority by the national authorities. Today, they are an important water regulating mechanism, and also a significantly important provider of living space to rural communities, because of their added unique biodiversity. These conditions have driven several sectors of the Ecuadoran civil society to play an active role into implementing new rules that can be seriously taken into account by the environmental authorities of the country. In that sense, an initiative presented by the Ministry of the Environment now promotes the design and national discussion of a guideline to standardize national provisions to guarantee proper highlands management and preservation. One the goals of the new guidelines is to foster a broad discussion process, which could be spread at all levels, and will be based on local knowledge, as part of a proper official framework (Albán and Burbano, 2001).

In the farmer productive systems, the crop subsystem has been shrinking agro biodiversity, which is caused, among other factors, by shortages in native crop seeds, especially caused by the decreasing number of farmers that use traditional Andean species. One of the reasons is that by using conventional production models, farmers become single-crop producers, particularly blackberries, potatoes and beans; another is reduced land availability. In terms of animal raising, the most critical problem is inadequate handling of reproduction and nutrition of milk producing bovines, caused by deficient follow up strategies of local productive projects. Impoverishing conditions and deterioration of the productive resources in the local communities have forced small cattle farmers to find productive alternatives in the highlands, with ensuing expansion of the local agricultural border (FMPLPT, 2012).

MATERIALS AND METHODS

The area of study is located northwest of Tungurahua province, in the Kisapincha parish, with altitudes between 3 000 and 3 600 m above sea level. Average annual rainfall is 2 500 mm, and there are two not very distinct seasons: dry, from January to March; and rainy, from May to November; April and December are transition months. Mean annual temperature is 10º C, with a maximum of 20º C and a minimum of 0º C (INAMHI, 2012). The location has 8 563 ha total, and a crop area of 1 468.7 ha (CESA, 2009).

In Tungurahua, the transition area to the north-western highlands (Kisapincha), is inhabited by 1 578 families (about 90 % is aboriginal) living in rural areas. For primary information collection and sample size, the researchers visited 800 farmers in the Highlands Management Plan (Plan de Manejo de Páramos), who are directly involved in production projects offered by the HGPT. That criterion was considered for selection of 146 farmers for non-probability sampling types by shares, also called direct sampling, according to Hernández *et al*. (2004).

A survey especially designed for this study was applied, based on recommendations given by Hernández *et al*. (2004), made by structured or closed questions, with choices; and open or mixed questions, which stood for quantitative and qualitative variables, grouped according to general, technological, productive and sanitary data. All comments regarding the survey were recorded.

Technical procedures of pasture management, milking management, breeding, calf raising and nutrition, and others, were observed *in situ*. The methodology used corresponded to a descriptive study aimed at specifying key properties in the group of farmers studied. The research design used was non-experimental (Hernández *et al.*, 2004).

Information was collected by activists and technicians of bodies in charge of the Highlands Management Plan in Kisapincha, in coordination with the undergraduate student, professionals working for the Honorable Government of Tungurahua Province (HGPT), and management OSGs.

Normality of all dependent variables was analyzed, and descriptive statistics analyses were made for quantitative variables.

A hierarchic conglomerate analysis was made for farm characterization, using the Ward´s method; the metrics used for distance was Euclidean Quadratics (Sepúlveda Carrillo, Meneses Báez and Goldenberg, 2014), including 20 variables chosen due to direct relationship with milk production, including also physical aspects of farms, stocking rates, milk production and breeding indicators, all according to a methodology proposed by Cabrera *et al*. (2004).

SPSS 21 was used for statistics analysis.

RESULTS AND DISCUSSION

The productive activities of small-scale dairy farms (SSDF) located in the transition area to the northwest highlands in the Ambato canton, are shown below, with info highlighting the main characteristics of farmers to handle their animals (cattle), before the need to survive the climatic, social and cultural conditions, for the sector. The behavior of each type is shown by variable description, with differences in some indicators.

The first type, with 119 SSDF accounts for 81.5% of all farms studied; the second type, with 27 SSDF, accounts for 18.5%, which have different variability for specific indicators.

The land possession average for the first type is 1.72 ha per tenant, whereas type 2 has 2.70 ha, with a marked influence on grasslands (also higher in type 2 than in type 1, with 2.18 ha and 1.40 ha, respectively. It matches the results from UMICIT studies (2013), which refer to grassland degradation and pressure to expand the agricultural frontier in the highlands due to low land possession indexes, and poor agricultural outcome. Ruiz (2011) stresses that properties of less than 1 ha, contribute with 6.37 % of the national milk production, usually with two or three cows per SSDF.

The extension of farms in the northwest transition highlands area in the Ambato canton does not exceed 5 ha; land possession is very low (0.5-5 ha per farm), mainly caused by smallholdings spreading in the area. Animal handling becomes difficult in such areas, and it causes deterioration of production. This phenomenon will continue to exist due to land inheritance; therefore, public institutions will have to design supporting projects (FMPLPT, 2012).

The first type has more native (53.8 %) than improved pastures (46.2 %); the second type has less native pastures (48.2 %), and more improved pastures (51.8 %). Native pastures are kikuyo grass (*Pennisetum clandestinum*) and small amounts of locally found weeds; improved pastures include *rye-grass (Lolium perenne)*, cock's-foot (*Dactylis glomerata*) and white clove (*Trifolium repens*), as the main pastures used for feedstuff. They are available for work in the location of the study, because they can adapt to extreme edaphoclimatic conditions. One of the most highly impacted needs suffered by the rural families is the implementation of grassland lots with improved seeds, especially in highlands of Ambato communities. Considerable extensions have been planted without the expected results, and bovine nutrition is still poor (COCAP, 2012).

Pastures are the most cost effective source of nutrition; a rural producer has to maintain the animals. However, it depends on proper handling so the pasture acquires all its potential and leads to animal growth, development, production, and reproduction (Fundación Pastaza, 2013).

It is also critical that farmers know grassland behavior, both in the rainy season and in the summer, because that is what the best use of its main resource depends on (ECONOBA, 2011).

The alternative for prairie management must have a direct effect on productivity and environment of the farm, but the data available do not allow to completely knowing the dynamic behavior of these systems. As observed, the farm has insufficient type 1 pasture grown or improved, and the absence of renovation, or sowing of improved pastures, are some of the factors causing weed spreading on pasturelands, including the propagation of undesirable species, which has direct effects on the productive and reproductive indicators of the farm, as they fail to meet the nutritional requisites (García, 2003).

The stocking rate capacity for type 1 is 1.25 AU per hectare, lower than reports for type 2, with 1.77 AU per hectare. This indicator must be taken into account to measure the efficiency of the milking herd (AGSO, 2009), directly influenced by pasture quality and farm area. Another factor is the absence of technical support in the location due to lack of information on soil type, pasture species that can easily adapt to the area. Additionally, rational use of resources may help incorporate important resources and halt the negative impact of cattle raising activity in the location. The previous provides cattle farmers with 1.69 animal units, and 1.26 milking cows, in type 1; whereas type 2 shows 4.47 animal units, and 3.63 milking cows, approximately. In the two types, the highest values account for milking cows, but no information is given on replacements, or fattening, because the grassland area does not allow for it, and the climatic conditions of the location makes development slow (HGPT, 2011).

Poor herd distribution in other categories occurs because farmers say that animals that do not produce milk are not cost-effective. That explains why the lactation days are more than a calendar year; as a result, farmers tend to sell unproductive animals and purchase animals in production (HGPT, 2012). That indicator is part of analysis and decisions required for great deal of the overall economic efficiency at the UPL (García López, 2003).

Daily milk production per type 1 cow is 5.89 l, and type 2 has 7.04. These values make possible to calculate annual productions such as, farm production, grassland production per hectare and workforce production. It occurs thanks to the presence of crossbred animals in the location that have effected on milk production, contrary to purebred animals. Despite the fact that reproductive handling is made by natural mating, small cattle farmers have introduced *Holstein Fresian* and *Brown Swiss* breed studs; also the purchase of cows for immediate milk production at the Ambato canton fairs, tend to produce type 2 milk.

UMICT (2013) points that implementing artificial insemination programs to increase milk production in the location and the ensuing quality of farmers´ lives, is necessary, without putting aside adaptability and rusticity of purebred animals. Vargas (2010) stated the importance of increasing production per cow, as there is fixed costs per animal. But as they prorate more, the costs of a liter of milk could decrease, and, consequently, higher total profits in milk producing locations are possible.

Different from type 2, type 1 has better values: age at weaning (157), open days (147), and lactation days (425), which is caused mainly by the influence of lactation days, one of the most important indicators. The main income source for the local families is daily milk production, though the reproductive side is not taken into account. Once the cow has stopped producing milk, the owners replace the unproductive animal for another who can produce milk, in the local markets, without considering the economic losses caused to the production systems at the SSDF. Meantime, the age of the first service (25 months), and age of first calving (34 months) are better for type 2, due to enhanced pasture availability and better mineral supply. The reproductive indicators represent fertility in a cattle herd (De Jarnette, 2002).

Cabezas (2010) points that each cow´s dairy production greatly depends on the capacity to be fertilized or remain gestating, because the lactation cycle is re-started or renewed by gestation; thus, the more frequent a cow bears calf, the more milk the animal will produce during life.

Arévalo (2008) indicates that reproductive assessment must be considered an important tool, and its main objective is to increase dairy production of cow per milking line, and cow per gestation, increasing the productive life of the animal and cutting on costs.

Then, the difference between the two types can be determined: type 1 has SSDF with less area, and smaller grassland areas; it is the more deficient type in terms of milk production, pasture grassland quality (improved and native), and low stocking rate capacity, despite better results in some other productive and reproductive indicators, like age of first service, age of first calving and lactation days. However, type 2 farms have better results for the previous indicators, except for calf day of weaning (better for type 1).

Small local cattle farmers said that sowing in the open field has high costs of production, but studies have revealed that based on the costs of raw materials in Ecuador, it is costlier to manage cattle nutrition with supplements (high costs of raw materials like wheat and corn, and other nutritional supplements). Studies proved that nutrition of dairy cattle based on pasture was not as costly, and therefore concluded it was better to invest in the open fields (León 2002).

It is important to determine the influence of cattle management on the herd, because productivity depends on it a great deal. The reproductive level in a herd can be measured in terms of cow reproductive features, which derives from the existence of different methods to appreciate the reproductive status of cattle (Urdaneta *et al.*, 2004).

In terms of sustainability, cattle systems must guarantee sustainable social and economic conditions for the family type, which favor production of high quality animal products, and guarantee environmentally friendly operations, in order to maintain or improve the existing natural resources in the system (Murillo *et al.*, 2004; Meul *et al.*, 2009).

Table 6 shows the behavior of qualitative variables at the SSDF; emphasis is made on the five days pasture endurance (81.9 % for type 1, in contrast to 71.4 % for type 2). Likewise, both types have favorable values in terms of grassland recovery (46-60 days). These values take place because tethered cow grazing is performed in all SSDFs of each type, which makes possible better pasture management.

Type 2 maintains the best results concerning breed kind, with 84.5 % crossbred (Native and improved *Holstein Fresian* or *Brown Swiss*), in contrast to type 1, with mostly native animals. Although the reproduction method is by natural mating, some concerns have been raised after breeders introduced the latter kinds for genetic breeding. To choose the most suitable breed, farmers must set the agro-climatic conditions of the location, and the kind of exploitation made (Rojas, 2006).

The implementation of breeding programs using artificial insemination to improve the production capacity of the herd is required.

Type 1 displays farmer negligence both in terms of animal nutrition and health; type 2, however, shows more concern on these issues, because they know how important their animals are for the economy of the family. Supplements administration must be cost effective, based on the existing local resources (ECOBONA, 2011).

Animal health care must be more preventive than therapeutic. Cows have to be healthy and well-fed; colonization by foreign parasites should be prevented. Farmers may also use natural or biological products to prevent diseases that affect milk quality, like mastitis (Vázquez, 2010).

In the parish, the main cause of animal sale or rejection is disease (70.8 %) for type 1, and farmer s´ cash shortages (78.6 %), in type 2, especially due to various economic issues that affect vulnerable farmers in buffer zones of the sector.

CONCLUSIONS

In general terms, management in all the farms has basic deficiencies that limit better production.

The two types of units studied differ in aspects like grassland area, stocking rate, production per animal, production per farm/day and per farm/year; others were reproduction issues, supplements and medication use. Overall, type 2 had the best results, accounting for 18.5% of the SSDF studied.

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Table 1. Behavior of structural and productive indicators for farms of both types

Variables	Type 1 119 81.5 %	Type 2 27 18.5 %
	Average	Average
Farm area (ha)	1.72	2.70
Pasture land area (ha)	1.40	2.18
Native pasture (%)	53.80	46.20
Improved pasture (%)	48.20	51.80
Animal units (AU/farm)	1.69	4.47
Animal stocking rate (AU/ha)	1.25	1.77
Nº of milking cows	1.26	3.63
Production/cow (l/cow/day)	5.89	7.04
Milk production (l/day/farm)	7.20	22.96
Age at weaning (days)	157	164
Open days (days)	147	153
Lactation days (days)	425	429

Table 2. Behavior of some herd qualitative indicators for both types (%)

Qualitative variables	Type 1 (%)	Type 2 (%)
Time of grassland occupation (days)		
3-5 days	18.1	21.4
+5 days	81.9	71.4
Grassland resting time (days)		
46-60 days	51.4	82.1
+60 days	48.6	17.9
Breed: Crossbred with Holstein and Brown Swiss	30.0	84.5
Mineral salt use	3.6	62.5
Antiparasite treatment and vitamine administration	35.7	70.8
Reason for rejection		
Disease	70.8	21.4
Need	29.2	78.6