

Milk market of small scale artisan cheese factories in selected livestock watersheds of Honduras and Nicaragua

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Abstract

Surveys were made of rural artisan cheese factories located in the region of Olancho, Catacamas, and Juticalpa in Honduras (n=10) and in Esquipulas and Muy-Muy in Nicaragua (n=13). The objective was to analyze the milk market of small rural artisan cheese factories in livestock watersheds of Honduras and Nicaragua to determine if:

- **there is a market for higher milk production**
- **how much additional milk can the market absorb in each season of the year**
- **there is a market for milk of higher hygienic quality.**

The main buyer of the milk from small and medium scale farmers in Honduras and Nicaragua is the rural artisan cheese industry, which absorbs almost 80% of the milk produced in both countries. Total milk production during the rainy season is about twice that during the dry season, causing an over-supply and scarcity of milk, respectively. The shortage of fluid milk during the dry season leads to an unsatisfied market. The artisan cheese factories in Honduras and Nicaragua would be willing to buy 76% and 55% more milk during the dry season, but this supply is not available due low milk productivity. This fact suggests that an aggressive program for the promotion of shrub legumes with sugarcane to supplement the herd during the dry season would have more impact than the promotion of grasses or legumes for the rainy season when there is little market for additional milk produced. In addition, rural artisan cheese factories in Honduras and Nicaragua, that consider the milk they collect is of bad quality, would be willing to pay a higher price if the option to collect milk of better hygienic quality exists. In Honduras this price would be about 9% higher during the dry season and 11% higher during the rainy season. In Nicaragua the cheese factories would be willing to pay a milk price which is 17% higher, but only during the rainy season. As a result, large incentives exist in both countries to increase milk production during the dry season and to improve the hygienic quality of milk in the studied areas.

Keywords: Milk market, milk quality, small scale cheese factories, Honduras, Nicaragua

Introduction

Milk production

The production of fresh milk in Central America is about 2 billion liters per year. Of this amount, Honduras produces about 26% and Nicaragua 12% (Umaña 1998). These figures indicate an annual per capita consumption of about 110 kg of milk in Honduras

(16% imported) and 42 kg in Nicaragua (11% imported).

The dominant production system in Central America is the dual-purpose, where cows are milked by hand once a day and both male and female calves are raised and sold shortly after weaning. The genetic base in this production system is *Bos indicus* (mainly Brahman) and crossbreeds with *Bos taurus* breeds (usually Holstein). The most abundant feed resources are native forages and crop residues, but their quality and quantity is low. Thus, milk productivity is also low (800 to 900 kg milk/lactation). In addition, another constraint is that forage supply is related to availability of rains.

During the 6-month dry season (from December to May), the quantity of forage on offer is minimum, especially grasses, and thus milk production drops sharply compared to the rainy season when there is abundance of green pastures. Milk production during the dry season is about 40% lower compared to the rainy season in both countries (Argel 1999a; 1999b).

The Tropileche Consortium operates in both Honduras and Nicaragua. The objective is to test and promote legume-based forages to increase the productivity of both milk and beef in small-scale, dual-purpose farms. Tropileche is led by CIAT (International Center for Tropical Agriculture) and operates under the System-wide Livestock Program convened by ILRI (International Livestock Research Institute).

Milk marketing

The fresh milk that reaches the consumer in Honduras and Nicaragua comes from two broad sources: (1) the industrial circuit, and (2) the artisan circuit. The industrial circuit collects and markets about 25% and 20% of the milk produced in Honduras and Nicaragua, respectively (Umaña 1998). There are 5 industrial milk plants in Honduras and 4 in Nicaragua.

This circuit is also known as the “formal sector” because milk is pasteurized and dairy products are usually sold in packed form under reasonably good quality standards. In addition, industrial plants have accounting records and pay taxes.

Industrial plants usually buy milk from farmers who produce good quality milk. The milk price paid to these farmers by industrial plants is highest (about \$0.30/kg in both countries) and it is constant throughout the year. However, this price is obtained by less than 5% of dairy farms because plants require (a) milk to be cooled in order to obtain a product of higher hygienic quality and (b) farms to be located along roads with easy access throughout the year (Argel 1999a; 1999b).

The remaining 75% to 80% of the milk produced in both countries is marketed by the artisan circuit, mainly constituted by small-scale rural cheese factories which do not pasteurize milk and are located within the various milk watersheds. This circuit is also known as the “informal sector” because these small family-type of enterprises do not pay taxes.

Generally, these rural artisan cheese factories require a health permit to operate, which is given by the Ministry of Health in each country. However, the operating conditions of most artisan cheese factories are deficient and no formal accounting records are kept. Most have dirt floors and use instruments to make cheese that are made out of wood or cement instead of stainless steel.

The use of chlorine solutions to clean and disinfect the equipment is nil (De Franco et al 1995; Garcia 1996). Quality control is non-existent.

These artisan cheese factories transform milk into fresh, popular cheeses with a shelf life shorter than 10 days (De Franco et al 1995). It is estimated that in Honduras there are about 600 artisan cheese factories (Argel 1999a). As a result, the artisan cheese industry in both countries is the principal buyer of milk produced by small and medium scale producers, which does not fulfill the requirements of industrial milk plants.

The milk price paid to farmers in the informal sector is generally about 20% lower than the price paid by the formal sector because it is collected raw (ie, not cooled) and thus, its quality is lower (ie, shorter shelf life).

The Problem

The price paid to producers by artisan cheese factories depends on the supply and demand for milk, which is seasonal with abundance during the rainy season and scarcity in the dry season. This fluctuation in the milk supply is directly related to the rainfall pattern which, in turn, influences the availability and quality of forage on offer, the main feed source of livestock farms in tropical Latin America.

This situation leads to serious difficulties in allocating the surplus milk produced during the rainy season because both countries lack an efficient industrialization and marketing system to absorb it (eg: a milk powder plant). Thus, the only alternative for the artisan circuit to market the excess supply of milk during the rainy season is by reducing the milk price to both producers and consumers. Thus, the fluctuations in milk price between seasons is large, with differences of up to 50% between the price during the dry season and that of the rainy season (De Franco et al 1995; Cajina 1994).

This problem is of less importance in dairy farms supplying milk to the industrial circuit because the amount of milk produced during the dry season is not significantly different from that produced during the rainy season. This is because these farms have more intensive production systems as a result of the adoption of improved forages and in many cases have irrigation infrastructure (BID 1990).

In addition to this seasonal problem, most milk collected by artisan cheese factories during the rainy season is of poor quality with bacterial counts close to 1,000,000/ml. The pasteurization process, if there is any, does not correct this problem for raw milk with bacterial counts higher than 500,000 bacteria/ml. This is due to the fact that the pasteurization process only guarantees the elimination of pathogenic bacteria, remaining alive many others which affect the quality of cheeses (De Franco et al 1996).

It is not possible to make cheese of acceptable quality with this type of milk, a situation determined by the sanitary conditions during milking and the transport of milk to the cheese factories. The majority of milk producers in Honduras and Nicaragua do not have milking sheds nor running water. Milking is carried out in open corrals, by hand, with open buckets, and often surrounded by sludge. The milk cans are washed with any type of common detergent and chlorine is not always used to disinfect them (De Franco et al 1996). On the other hand, milk produced under these conditions during the dry season is of higher quality since there is no humidity in the corrals, the udders of cows are cleaner, and the arrival time to the rural cheese factories is reduced since country roads, for the most part of

ballast, are in better condition due to the lack of rains (García 1996). As a result, due to the problems of over-supply and poor milk quality during the rainy season, it is more attractive to produce higher milk volumes during the dry season since it benefits the producer, via better price, as well as the artisan cheese factories, via better milk quality.

Objectives

The objective of this study was to analyze the milk market provided by small-scale artisan cheese factories located in livestock watersheds of Honduras and Nicaragua in order to answer the following questions:

- Is there a market for additional milk production?, and if there is, how much milk can be absorbed by artisan cheese factories by season of the year?;
- Is there a market for milk of higher hygienic quality and accordingly, better price?, and if there is, what price would they be willing to offer?

Materials and methods

The data for this study were obtained through surveys during March 2000 of 10 and 13 small-scale artisan cheese factories in Honduras and Nicaragua, respectively. These rural cheese factories were located in the watersheds of Olancho, Catacamas and Juticalpa in Honduras and in Esquipulas and Muy-Muy in Nicaragua. In Honduras, the survey included about 18% of the existing 55 rural cheese factories in these watersheds (Argel 1999a). In Nicaragua the surveyed involved 43% of the existing 30 rural factories. Selection of the sites was based on information supplied by a dairy development project (Garcia 1996).

The interviews were performed on a person-to-person basis between the Tropileche technician and the owner of the rural cheese factory. Secondary information data from both countries was utilized in order to complement the survey.

Results and discussion

Milk Collection and Prices

Tables 1 and 2 contain the information synthesized from the surveys of the cheese factories. The average milk collected was about six times greater in Honduras than in Nicaragua in both the rainy season (6,200 vs 1,100 kg/day) and the dry season (3,600 vs 520 kg/day). In addition, milk collected during the rainy season was 73% greater than during the dry season in Honduras and 111% greater in Nicaragua. This factor disrupts the local market and has significant impact on the price of milk that the artisan cheese factories are willing to pay. Thus, the milk price during the rainy season relative to the dry season is reduced by 27% in Honduras and 38% in Nicaragua.

Table 1. **Amount of milk collected, cost of milk, types of cheese produced, sale price, milk yield to produce each cheese type, and potential market in both dry and rainy seasons of 10 small scale artisan cheese factories in the livestock basin of Olancho, Catacamas and Juticalpa in Honduras.**

Attribute	Dry Season	Rainy Season
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Milk collection		
Litres/day	3,600	6,230
Milk cost, \$/litre	0.33	0.24
Cheese types produced & sale price (\$/kg)		
- Queso Seco	3.60	2.40
- Queso Fresco	2.70	1.80
- Queso de Crema	2.40	1.94
- Quesillo	2.09	1.30
- Cream	2.40	1.80
Amount of milk required to produce each cheese type, litres/kg		
- Queso Seco	9.48	10.14
- Queso Fresco	6.00	6.76
- Queso de Crema	5.73	6.39
- Quesillo	5.62	6.45
- Cream	14.7	16.9
If this factory could buy more milk to make cheeses, how much more would it buy? (%)		
	55.5	0
Do you consider that the milk collected is of good hygienic quality? (%)		
- Yes	10	10
- No	90	90
How much would you be willing to pay for milk of higher hygienic quality?		
- \$/litre	0.361	0.266
- %	9.4	11.2

Table 2. Amount of milk collected, cost of milk, types of cheese produced, sale price, milk yield to produce each cheese type, and potential market in both dry and rainy seasons of 13 small scale artisan cheese factories in the livestock basin of Esquipulas and Muy-Muy in Nicaragua.

Attribute	Dry Season	Rainy Season
Milk collection		
Litres/day	523	1,103
Cost (\$/litre)	0.29	0.18
Cheese types produced & sale price (\$/kg)		
- Queso Puro	2.49	1.78
- Queso Media Sangre	2.13	1.60
- Cuajada	1.78	1.24
- Queso de Crema	1.78	1.24
- Cream	1.60	0.89
Amount of milk required to produce each cheese type (litres/kg)		
- Queso Puro	7.71	8.82
- Queso Media Sangre	6.61	7.71
- Cuajada	5.51	6.61
- Queso de Crema	5.51	6.61
- Cream	11.03	13.23
If this factory could buy more milk to make cheeses, how much more would it buy? (%)		
	75.7	0
Do you consider that the milk collected is of good hygienic quality? (%)		
- Yes	80	70

- No	20	30
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How much would you be willing to pay for milk of higher hygienic quality?

- \$/litre	0.29	0.211
- %	0	17.0

In addition, the milk price paid by cheese factories is 33% higher in Honduras than in Nicaragua during the rainy season (\$0.24/kg vs. 0.18) and 14% greater in the dry season (\$0.33/kg vs. 0.29).

Cheese Types and Yields

Four types of cheese are produced in each country by artisan factories. In addition, they all make cream as a by-product because most cheeses are made with skim milk. Thus, the sale of cream is a net profit. In addition, in both countries each type of cheese has a different price. Therefore, the marketing strategy is similar in both countries, being segmented to four different tastes associated with the purchasing power of consumers. Even though all cheese types that are produced are fresh and have short shelf life, the difference between them lies in the amount of moisture. Thus, in order to produce a cheese with a low moisture content, a larger quantity of fluid milk is required and as a result, its price is higher (ie: Queso Seco in Honduras and Queso Puro in Nicaragua). This fact is demonstrated by the amount of fluid milk necessary to produce a kilogram of cheese and this in turn is directly related to the consumer price. In addition, the higher the moisture content, the lower the shelf life. Therefore, low-cost cheeses are also those with the shortest shelf life because they contain high moisture levels.

In addition, the quantity of milk necessary to produce each cheese type varies according to the season of the year. During the rainy season, milk production per cow is greater but the total solids content in milk is lower and, as a result, more milk is required to produce the same quantity of cheese than during the dry season. For example, in Honduras the artisan factories require 7% more milk during the rainy season in order to produce the same kilogram of Queso Seco (ie: 10.1 kg vs. 9.48 kg, Table 1) and up to 15% additional milk to produce a kilogram of Quesillo (ie: 6.45 kg vs. 5.62 kg, Table 1). In Nicaragua, artisan factories required 14% more milk during the rainy season to produce the Queso Puro (ie: 8.82 kg vs. 7.71 kg, Table 2) and up to 19% additional milk to produce the same kilogram of Queso de Crema (ie: 6.61 kg vs. 5.51 kg, Table 2). This reduction in yield efficiency during the rainy season forces artisan factories to pay a lower milk price to producers.

Potential Market and Milk Quality

The potential growth of the cheese market is large and unsatisfied. The artisan cheese factories interviewed in Honduras could purchase up to 55% more milk during the dry season but this supply is not available. In Nicaragua the potential is still greater since artisan factories are willing to purchase up to 76% more milk than is currently being collected during the dry season.

This situation is not the same during the rainy season, where the potential for growth is null in both countries due to an excess supply of milk in the market. As a result, the artisan factories in both countries would be willing to purchase more milk only during the dry

season, which has significant implications in the type of technologies to promote to producers in both regions.

On the other hand, 90% of artisan factories interviewed in Honduras consider milk collected during the rainy season to be of low hygienic quality, this figure being only 10% during the dry season. Thus, there is a direct relationship between low hygienic quality of the milk and the rainy season, which agrees with the conclusion of De Franco et al (1996). In Nicaragua, 30% of artisan factories consider milk during the rainy season to be of low hygienic quality.

Artisan factories in Honduras and Nicaragua that consider milk collected as being of low hygienic quality would be willing to pay a higher price if they had the option. In Honduras this price would be 9.4% higher during the dry season and 11.2% higher during the rainy season. In Nicaragua the artisan factories would be willing to offer a 17% higher price, but only during the rainy season.

Needs of Small Scale Artisan Cheese Factories

Table 3 indicates the needs or expectations of artisan factories in both countries. The main need was the improvement of factory infrastructure through the expectation to acquire more equipment (eg: creameries, freezer rooms, etc). Thus, future prospects seem good in both countries.

Table 3. Needs of artisan cheese factories in Honduras and Nicaragua.

	Honduras (%)	Nicaragua (%)
Acquire more equipment to expand ¹	80	62
Improve the hygienic quality of the milk ²	60	15
Technical training to produce new types of cheese	50	15
Improve the quality of cheeses ³	40	23
Expansion and search for new markets	10	46

¹ Acquisition of creameries, freeze rooms, stainless steel tubs, and/or burners.

² Technical training to producers to improve the hygienic conditions at milking time and reduce the transport time from the farm to the factory.

³ Includes improving the hygienic conditions of the artisan factory and packaging of product.

The second need in order of importance in Honduras was to purchase milk with higher hygienic quality, which agrees with the results of Table 1, while in Nicaragua the need number two was the search for new markets. Nicaragua began to export fresh cheeses to El Salvador and Honduras in 1990 with a gross value of US\$ 128,000. Since then, exports have been on the rise, reaching 8,400 tonnes of cheese with a gross value of US\$ 14 million during 1998 (MAGFOR 2000) and all factors considered indicate that this trend will continue in the coming years.

The third need in Honduras was training to produce new types of cheeses in order to diversify the market and not so much the search for new markets for the same types of cheeses, while in Nicaragua the need was to improve the quality of cheeses produced within the artisan factories.

Technological Implications

The results of this survey have two types of technological implications for the Tropicheche Consortium: animal feeding and genetic improvement.

Animal Feeding

In the animal feeding component these results suggest producers would benefit from adopting low cost feeding alternatives for the dry season. Currently, the use of chicken manure and concentrate feeds is common, but it is an expensive alternative. Other strategies, such as the adoption of shrub legumes such as *Cratylia argentea* with sugarcane are more profitable options because *Cratylia* and sugarcane can substitute by up to 70% the use of feed concentrates without reducing milk yield. In addition, *Cratylia* is well adapted to low fertility soils where other forage options such as *Leucaena leucocephala* do not thrive well.

Holmann and Ibrahim (2001) estimated that the adoption of *Cratylia* with sugarcane can reduce the current milk production cost by 25% in Honduras (ie: from \$0.16/kg to \$0.12/kg) and by 12% in Nicaragua (ie: from \$0.16/kg to \$0.14/kg) without sacrificing milk production. This technological change would reduce the need for purchasing feed concentrates to supplement the herd, thus improving the cash flow of producers and would increase the total solids content in milk by about 4% (Lobo and Acuña 1999).

On the other hand, in farms where no feed concentrates are used during the dry season, the adoption of *Cratylia* with sugarcane can increase milk yields between 10% and 23% (Avila and Lascano 2000), depending on the management system used (ie: cut-and-carry or direct grazing).

These technological options require modest investments, equivalent to about \$40/cow. Thus, a farmer with 10 cows would need to invest about \$400 to establish a protein bank of *Cratylia* and an energy bank of sugarcane. The larger the herd, the larger the area needed to be planted. This investment cost includes the cost of seed, weed control, land preparation, and labor.

Genetic Improvement

The main input to produce cheese is the protein contained in the milk. Milk with a higher protein content yields more cheese. It is estimated that for each 0.1% increase in protein content, cheese yield is increased by 4% (Sozzi 1999).

Therefore, the other technological implication to improve the yield efficiency of cheese making is through the use of milk with higher protein content and this is mainly achieved with genetic improvement at the farm level through the promotion of crosses with breeds which produce milk with higher protein content. The type of cattle commonly found in Honduras and Nicaragua is the Zebu (mainly Brahman). The protein content of *Bos indicus* breeds such as Brahman, Guzerat, and Nelore is around 3.1% and little variability exists among them. In *Bos taurus* breeds there is more variability, the protein content ranging from 3.15% in the Holstein breed to 3.50% in Brown Swiss and 3.80% in the Jersey breed (Ruiz 1999). As a result, a genetic strategy that incorporates Jersey or Brown Swiss genes into the local Zebu gene pool will provide producers the possibility to offer the artisan factories milk with a higher protein content provided there is a transparent payment system that values milk protein.

Conclusions

The results and implications of this analysis lead to the following synthesis:

- The main buyer of milk from small and medium-scale producers in Honduras and Nicaragua is the small-scale artisan cheese industry, which absorbs almost 80% of the total milk produced in both countries.
- The production of milk in the livestock watersheds where the Tropileche Consortium operates is seasonal. Production during the rainy season is practically twice that during the dry season, which causes over-supply and scarcity of milk, respectively. This results in drastic changes in the milk price received by producers between one season and the other.
- The milk shortage that occurs during the dry season in both countries leads to a market potential for additional milk to be produced. The artisan factories would be willing to buy 76% more milk during the dry season in Honduras, and 55% more milk in Nicaragua, but this supply is not available due to the lack of adoption of technologies for animal feeding based on low-cost improved forages.
- This fact suggests that an aggressive program for the promotion of shrub legumes such as *Cratylia argentea* in combination with sugarcane to supplement the milking herd during the dry season would have more economic benefits to producers than the promotion of grasses and legumes for the rainy season. This technological change would reduce the need for purchasing feed concentrates to supplement the herd, thus improving the cash flow of producers and would increase the total solids content in milk.
- The adoption of improved legume-based forages for dry-season feeding allows producers to change the calving season of the herd in order to have a similar amount of milking cows during both seasons to produce a constant amount of milk throughout the year, thus reducing the risk of over-supply of milk during the rainy season.
- Artisan factories in both countries, but especially in Honduras, want to collect milk of higher hygienic quality, especially during the rainy season, and both countries would be willing to offer a higher milk price if this option existed. In Honduras this price would be 9.4% higher during the dry season and 11.2% higher during the rainy season. In Nicaragua the artisan factories would be willing to pay a price 17% higher, but only during the rainy season.
- The main need of the artisan factories is improvement of the infrastructure through the expectation to acquire more equipment (eg: creameries and freezer rooms). The second need in order of importance in Honduras was to purchase milk with higher hygienic quality while in Nicaragua the second need was the search for new markets. The third need in Honduras was training to produce new types of cheese in order to diversify the market and not so much the search for new markets for the same types of cheeses, while in Nicaragua the need was to improve the quality of the cheese produced within the artisan factories.
- The main input to produce cheese is the protein contained in the milk. A genetic strategy that incorporates Jersey or Brown Swiss genes into the local Zebu gene pool would provide producers with the possibility to offer the artisan factories milk with a higher protein content.

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