



## Study on the practices of silage production and utilization on Brazilian dairy farms

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### ABSTRACT

Dairy farmers across Brazil were invited to participate in a study on silage production and utilization practices. Two hundred sixty farmers filled out a questionnaire, which was made available on a website. The questionnaire consisted of 14 questions, including information about the characteristics of the herd ( $n = 3$ ), the crop(s) used in the ensiling process, the use of additives, the harvest ( $n = 3$ ), the type of silo ( $n = 1$ ), aspects related to sealing ( $n = 2$ ), and management practices applied during feed-out ( $n = 3$ ). Farmers were also asked a final question about the main barriers they faced when producing and using silage. The main dairy-producing regions of Brazil had a strong influence on the number of participants. The profiles of farmers were heterogeneous and divided into 5 groups, which was considered a positive attribute of the study, allowing better analysis and assessment of current circumstances. Corn was the most widely grown crop for silage. Sorghum, tropical grasses, and sugarcane were the other species most cited. Additives were used by a small number of farmers (27.7%). Approximately 40% of farmers still depended on loaned equipment or outsourced services. The pull-type forage harvester was the main piece of equipment used on dairy farms (90.4%). Only 54.6% of respondents answered that they sharpen their harvester knives daily. Horizontal silos (bunker and stack) were the structures most commonly used to store silage. Most farmers sealed silos with double-sided plastic film (black-on-white) and with soil. However, almost one-fifth of all farmers still use black plastic. Manual removal of silage from the silos was practiced at most farms (i.e., the lack of equipment was also reflected in the stage of silage utilization). Disposal of spoiled silage before inclusion in the livestock feed was not a common practice on the farms. The main barriers encountered on the farms were lack of equipment, lack of manpower, and climatic variations. The results of

this research may guide researchers, industries, extension workers, and governments to seek efficiency in milk production on farms using silage in the diet of livestock throughout the year or during part of the year in Brazil. **Key words:** dairy industry, feeding practice, tropical silage, Brazil

### INTRODUCTION

Traditionally, the standard diet of dairy cattle in Brazil is based on pasture. However, forage conservation has been an important agricultural activity since dairy activity began at the beginning of the last century (Cotrim, 1913; Athanassof, 1943). In tropical environments, hay production presents certain obstacles due to high humidity and frequent rainfall (Adesogan, 2009). Artificial dryers are expensive for farmers, and buildings are often not available ('t Mannetje, 1999). Consequently, ensiling is the main method for forage preservation in countries with hot and humid climates (Adesogan, 2009; Reiber et al., 2009; Lima-Orozco et al., 2013). Since the implementation of silage as part of the dietary plan of dairy cattle over a hundred years ago, no data have been published in the literature describing practices of its production and utilization in Brazil. Brazil has no annual census for farmers or official statistics about this practice, as is found in countries where the dairy industry is more developed. The only Brazilian data on the production of silages are found in the book *World Silage* (Wilkinson and Toivonen, 2003); however, these data are limited to some characteristics of the Brazilian state of Minas Gerais.

Milk production in Brazil has increased by approximately 3-fold in the last 30 yr, from 11 billion liters per year in the early 1980s to over 30 billion liters in 2012 (USDA-FAS, 2012). In terms of volume production, Brazil is considered to be the fourth largest milk producer in the world and the second largest in the Americas (USDA-FAS, 2012). Considering the 5 countries that produce the most milk, Brazil, along with China and India, has demonstrated the greatest growth rate in milk production in recent years (FAO, 2013). However, this growth has been uneven and disorga-

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nized in the country, with the increasing adoption of intensive systems, although the family farm and low professionalization still dominate this production chain (IBGE, 2006). Dairy activity in Brazil also faces a geographic shift because production has migrated to the midwest region and lost strength in some states of the south-central region, especially São Paulo (EMBRAPA, 2011); in this region, sugarcane cultivation has become more attractive to producers. This new geography poses challenges for silage producers, especially with regards to climate, because the midwest region of Brazil has higher temperatures and a longer dry period than the south-central region.

Because silage is the main source of energy and fiber in the diets of dairy cattle in Brazil throughout the year in intensive systems or during part of the year in systems that use pastures (Costa et al., 2013), it is necessary to provide information to the dairy industry that depicts the management applied in farms across the country, with the objective of organizing the growth of this activity. Several studies have shown that the production costs of conserved forage are negatively correlated with the profitability of dairy farms (Haden and Johnson, 1989; Hansen et al., 2005). Adkinson et al. (1993) illustrated that in pasture-based milk production systems, as is the case for many farms in Brazil, the use of high-quality silage in the diet enhances milk production and income over feed costs. In addition to the economic issues, increased efficiency of nutritional management on dairy farms reduces the emission of greenhouse gases, especially in developing countries and among small farmers, as is the case for Brazil (Gerber et al., 2011).

Thus, the objective of the present study was to understand the practices of silage production and utilization on dairy farms in Brazil so that feeding strategies and management by the farmers and industries and lines of research and credit by the scientific community and governments may be defined and improved, thereby benefiting the dairy industry in Brazil.

## MATERIALS AND METHODS

### *Dairies*

A total of 500 dairy farmers located in 26 Brazilian states in which milk production was the sole or main agricultural activity on the farm were invited to participate in this survey. These farmers were specifically identified through a website database ([www.milkpoint.com.br](http://www.milkpoint.com.br)) to represent different regions of the country (south, southeast, midwest, northeast, and north) and were then contacted via e-mail to determine their interest in participating in this study. A total of 272

farmers completed the survey questionnaire; however, 12 responses were incomplete. Thus, 260 questionnaires were used in the study, which represented the 5 regions and 23 states. Only farmers in the states of Amazonas, Amapá, and Roraima (Amazon region) did not respond to our invitation, possibly because dairy farming is less important in these regions.

### *Survey Data Collection*

A webpage was used to complete the questionnaire and for data collection ([www.milkpoint.com.br/pesquisa-silagem](http://www.milkpoint.com.br/pesquisa-silagem)) and was available between the months of January and February 2012. These months were chosen because farmers are preparing to harvest crops at this time. When accessing the webpage, the user first registered and then received information on how to complete the form. All 260 farmers completed the survey in 50 d. The confidentiality of all participants was guaranteed.

### *Survey Questions*

Fourteen questions on the survey measured qualitative characteristics, as follows: (1) what is average daily production of the farm?; (2) what is average production per cow per day?; (3) which breed do you use?; (4) what forages do you feed?; (5) do you apply additives in the ensiling process (yes or no)?; (6) which service do you use (own or hired)?; (7) which type of forage harvester do you use (pull-type or self-propelled)?; (8) how often do you sharpen the harvester knives (in the beginning, daily, every 2 d, or more than every 2 d)?; (9) how is the silage stored (bunker, stack, pressed bag, or wrapped bale)?; (10) which type of plastic film do you cover (black or black-on-white)?; (11) what material do you place on top of the plastic film?; (12) do you unload silage manually or mechanically?; (13) what portion of the face width is removed daily (entire, half, a third, or a quarter)?; and (14) do you discard spoilage silage (yes or no)? Farmers were also asked one final question, which asked about the main barriers faced when making and using silage. This question was asked without pre-established alternatives so those farmers had the opportunity to mention the maximum range of possible barriers in silage production.

### *Data Analysis*

The differences between the qualitative data were compared using the Pearson  $\chi^2$  test for contingency tables. A cluster analysis was conducted, which allowed grouping of the farms showing similarities (less variance within groups) and differences (higher variance between groups), using the Ward method and smallest

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