




## Profile of dairy cattle farmers in the Northwest of Minas Gerais and the perception about the use of artificial insemination

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**ABSTRACT** - This study aimed to characterize the profile of milk cattle farmers of the Northwest region of Minas Gerais State regarding the use of artificial insemination (AI) and see the most relevant factors in the perception of farmers for the adoption process of AI. From January to April 2014, 97 milk cattle farmers associated to milk cooperatives of the municipalities of northeastern Minas Gerais were interviewed. Of those interviewed farmers, 61.3% did not use artificial insemination. The majority (92.48%) of respondents were male and 48.88% were over 53 years of age, with low schooling, incomplete primary education (28.57%), or complete primary education (25.97%). Among the respondents, 66.67% had over 20 years experience in dairy farming. The average breeders by property were 99, and the average size of properties was 73 hectares (ha). In general, it was found that personal motivation is the main driver for the adoption of AI, and it is more linked to positive expectations generated by the phenotype of the animals than to economic factors. The prerequisites for adoption of AI are in the background and, among them, manpower, infrastructure, and animal handling are prominent, followed by social influence, evidenced by entities and persons involved in AI and in the daily life of farmers. Little emphasis on human resource management and use of scientific knowledge may have affected the adoption of biotechnology, resulting in low utilization. It is also possible to associate the advanced age of farmers to the resistance to the use of reproductive biotechnologies.

Key Words: breeding cows, dairy cattle, reproductive technology, Unai

### Introduction

The production of cow milk in Brazil in 2016 was 33.6 billion liters, and the state of Minas Gerais contributed 26.6% to the national production (IBGE, 2017). As Minas Gerais presented a growth of 3.09% in milk production between 2005 and 2014, the northwestern region of this state presented a growth of 4.26% for the same period, more than the state itself, and this increase was mainly due to the cities of Arinos, Buritis, Paracatú, and Unai (Pinto and Perobelli, 2016). The city of Unai was prominent in this regard, with production of around 104.5 million liters of milk (0.4% of the national production), which made it

the sixth largest city for cow milk production in the state of Minas Gerais (IBGE, 2017).

To increase the productivity of dairy herds in Brazil, improvement of the efficiency of the production process through use of technologies for upgrading livestock characteristics is required (Barbosa and Machado, 2008). One of these technologies is artificial insemination (AI), which, according to Felipe et al. (2017), when used correctly and associated with management such as the detection of estrus, improves reproductive rates of dairy farms when compared with farms that use natural reproduction.

Use of AI in dairy breeds in Brazil increased by 34.0% between 2009 and 2014. However, this large increase was from a very low starting point. Thus, only 11.9% of the cows already at a reproductive age were artificially inseminated in 2014, while 88.1% conceived through natural mating systems (ASBIA, 2015).

This low rate of AI use in Brazilian herds can be attributed to several factors: low degrees of Brazilian cattle upgrading, predominance of traditional production systems,

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high social inequality (Barbosa and Machado, 2008), predominance of farms with low levels of technification (Bourroul, 2010), lack of controlled reproductive management strategies (Torres-Junior et al., 2009), limited number of people with qualifications to observe estrus and insemination of females in heat, technological costs, and cost of artificial insemination (Pfeifer et al., 2009).

In Brazil, the future of AI of cattle is uncertain and depends on many factors (Abramovay, 2009), including possible improvements caused by some animal reproduction technologies. Agricultural research of a dynamic nature, directed towards this complex rural setting with types of technology to meet the specific needs of people in these regions, is being conducted (Andreatta and Miguel, 2009). Reference points such as age, education level, type of income, and length of experience may be indicators of farmer profiles (Gewehr et al., 2010). These can be used to transform or adjust the ways in which agricultural policies are put to operation, so as to encourage the use of biotechnology, especially in relation to animal reproduction. The technological profile of one farmer may be very different from that of another (Carrer et al., 2010). One farmer may develop livestock as a strategy for storing value, or for social status, while another may depend on the monthly income generated.

Given the above, it is possible to identify different possibilities for dairy farm profiles. Firstly, the profiles of farmers and production systems need to be characterized so that the degree of understanding and technification can be estimated. In this manner, technology transfer activities can be addressed. Therefore, the objectives were to analyze and characterize the socioeconomic profile of dairy farms and to analyze the discourse of farmers regarding application of artificial insemination technology to dairy herds in the northwestern part of Minas Gerais.

## Material and Methods

Two questionnaires were developed and applied during technical visits to dairy farmers in the northwestern Minas Gerais. They were adapted from Gordo et al. (2013). The first questionnaire consisted of questions about biodemographic information, while the second asked about the concepts involved and the points of view, influences, and expectations of interviewees relating to AI. For standardization, the conventional AI method and the more recent fixed-time method were considered to be the same. The interviews were conducted between January and April 2014.

The questionnaires were applied in the following cities: Arinos, Bonfinópolis de Minas, Brasilândia de Minas, Buritituba, Cabeceira Grande, Dom Bosco, Formoso, Natalândia, Riachinho, Paracatu, Unaí, and Uruana de Minas. They were applied at the end of the visit by the veterinarians.

The biodemographic information was analyzed using descriptive statistics within Microsoft Excel®. Discourse information was analyzed using the classical model of context analysis (Bardin, 2004). This was defined as a mix of quantitative and qualitative methods, in which the written answers from the questionnaires were starting points for discourse evaluation (Franco, 2007).

The data analyses were divided in three stages: pre-analysis, analysis, and inferential stages, as described by Gordo et al. (2013). In these, questions were sequentially deleted, and the responses were grouped to originate a new spreadsheet. At this point, the answers were read attentively and repeatedly (corpus impregnation) so that the inferential stage could begin.

In the second stage (analysis stage), the information was divided in the corpus using the symbol (\) to separate words and sentences and yield elemental context units (ECU). Thus, this marking was used to divide all the complete sentences that constituted the corpus, into smaller phrases or even into single words that represented a specific or very succinct idea, i.e., ECU. For example: “Workmanship \ unpreparedness for insemination \ good vets in the region \ quality of young heifers \ AI is a way to move towards a better-quality herd and thus produce ever greater milk yields \ training for people who are working with AI. Subsequently, the fragments were gathered together into similar thematic groups to produce categories, for example: “AI courses \ lectures on the subject \ good service \ good follow-up by the cooperative \ availability of semen from suppliers \ technical knowledge for the farmers”.

When convenient, the categories were divided into secondary and even tertiary subcategories (corpus categorization) to enable quantification (% , *f*) of ECU in all structures and substructures.

In the final stage of the data analysis (inferential stage), the categories were organized and discussed collaboratively among the reviewers. Interpretations were made based on theoretical milestones for rural development and livestock science, observations on samples of answers gathered during the interviews, and skills acquired during methodological training. All the procedures were managed in such a way that the data were categorized in the final stage of the analysis. This means that the ECU were firstly sorted according to similarity,

and from these ECU, categories and subcategories were then obtained. Finally, the categories were named according to their content (*a posteriori* category naming).

## Results

Demographic data showed that most farmers were male members of their families (92.41%) and presented a broad range of ages, education levels, and experience in dairy production. Income levels also varied among the families: they were either pluriactive or financially dependent on farm activities.

Seventy-six percent of the farmers had over twenty years of experience in rearing dairy breeds of cattle. Although 23.38% of the farm respondents stated that they had completed high school, this level of education is still low. Regarding diversification of sources of income, 48.80% of the farmers reported that their income came exclusively from dairy cattle rearing, 34.52% obtained income through their livestock and from another type of activity, and 9.52% worked with a combination of dairy and crop productions.

Only 7.14% of the farmers obtained income through a wide range of activities that included dairy cattle rearing, development of crop production and also other activities such as crafts, hiring out of manpower, pensions, real-estate rental, public or private employment, or rearing of other kinds of animals. The farmers with AI experience formed two distinct groups: 38.7% used any reproductive biotechnology and 61.3% did not use any technique. Most farmers in the first group (47.22%) used conventional AI, while some used fixed-time artificial insemination (FTAI) (16.66%), and 36.11% used both conventional AI and FTAI. In addition, 66.67% of the farmers did not practice any breeding season management.

The greater use of AI than of FTAI is certainly related to the fact that AI has been available on the market for longer, or to the apparent economic advantage of one over the other. Most farmers had between 31 and 100 ha of land (30.26%) and between 31 and 90 adult cows (36.7%). Fifty-six percent of farmers reported that they made use of family labor and about 70.0% of the milking was done in a mechanized manner.

The corpus was made up of 1,021 ECU, of which 20.7% were discarded (answers without nexus, illegible handwriting, and duplicated answers). According to Gordo et al. (2013), three main categories can originate from corpus analysis: basic necessities for adopting AI (30.24% of all ECU), personal motivation for adopting AI (43.26% of all ECU), and social influence for adopting AI (26.46% of all ECU).

The dairy farmers considered that labor was a major need for adoption of AI (44.88%) (Table 1). They perceived that the problem in implementing AI was not related only to service providers (6.93%) and were aware that labor is needed in all sectors involved, both inside and outside the farm (37.95%).

The dairy farmers of the present study pointed out that for them to adopt AI, they would need to modify and increase the time devoted to managing the feeding, reproduction, and health of animals (11.42%). To a lesser degree, they would also need to improve the genetic quality of the herd (aptitude for milk production) (5.71%). These factors were highlighted by many farmers (30.2%). The fact that the ECU in the subcategory of infrastructure, facilities, and instruments were quite short suggests that there is an evident need to understand the farmers in this regard.

The need to raise awareness and educate people who might become involved in AI, so that they would start using it, was not common in the discourse of farmers (only 7.75%). However, satisfaction of people in doing the work was identified as critical to the competitiveness of the production system.

The personal motivations of farmers for adopting AI (Table 2) were mainly related to their positive expectations regarding the potential results from AI (77.98%). However, for the specific case of AI, the results suggest that improvements relating to animals provided greater motivation (57.42%) than did those related to economics (20.56%).

The motivation towards improvements provided through adoption of AI is not necessarily based on quantitative factors from profitability and productivity calculations. In the present study, qualitative improvement of subjective perceptions was more highlighted (53.13%) than indicators based on numbers or biological indices (24.85%). This can be explained by the type of dairy farming, which is predominantly family-run (55.68%) in this region. Thus, it can be suggested that appealing to qualitative factors should be given greater consideration in AI adoption programs in the northwestern region of Minas Gerais.

The proportion of farmers who had been motivated to use AI (Table 2), which was highlighted in the present study (16.57%), does not explain why the majority of respondents (66.67%) were not using controlled breeding seasons. Health improvements among the cows of farmers through AI provided motivation (0.85%). This perception may have been due to the low educational level among the farmers in this region, given that they probably remain unaware of the

benefits from prevention of diseases and the damage caused by low health status among the animals in the herd.

Although 66.67% of the respondents had more than 20 years of experience in the cattle industry, their level of experience in using AI was low. The importance of the perceptions and experiences of farmers to motivate them towards adopting AI was also low (4.57%).

Social influence comes from opinion-formers who are involved in the AI adoption process (Table 3). The highest proportion of social influence came from prominent individuals within public and private entities (51.40%),

especially within the cooperative of milk farmers. Secondly, professors in agriculture, technicians, and veterinarians had an influence (17.75%), followed closely by the families of farmers and the production environment (17.28%), and, to a lesser extent, by the mass communication media (internet, television, magazines, and radio – 7.94%).

Personal motivation (Category 2) was the main theme in the discourse of the dairy cattle farmers of the region studied when they were approached with questions about their use and adoption of AI. Their motivation related primarily to positive expectations regarding the use of AI.

Table 1 - Arrangement and percentages of subcategories and similar elemental context units obtained from discourse of farmers relating to adoption of artificial insemination in the Northwest of Minas Gerais, Brazil (Category 1)

Category 1: Basic necessities for adoption of artificial insemination				
Primary subcategory	Secondary subcategory	Observed frequency	Relative frequency (%)	Total (%)
Workforce	Inside and outside of the farm	93	37.95	
	Related to service providers	17	6.93	
Actions within the production system	Human resource management	19	7.75	30.24
	Animal handling	28	11.42	
	Herd type	14	5.71	
Infrastructure, facilities, and instruments		74	30.20	
Subtotal		245	100.00	

Table 2 - Arrangement and percentages of subcategories and similar elemental context units obtained from discourse of farmers relating to adoption of artificial insemination (AI) in the Northwest of Minas Gerais, Brazil (Category 2)

Category 2: Personal motivation for adoption of AI					
Primary subcategory	Secondary subcategory	Tertiary subcategory	Observed frequency	Relative frequency (%)	Total (%)
Strong points relating to use of AI			58	16.57	
	Improvement of quantitative indicators	Animal component	34	9.71	
		Economic component	53	15.14	43.26
Positive expectations concerning potential results	Improvement of qualitative indicators	Animal component	167	47.71	
		Economic component	19	5.42	
	Sanitary improvements		3	0.85	
Perceptions and experiences			16	4.57	
Subtotal			350	100.00	

Table 3 - Arrangement and percentages of subcategories and similar elemental context units obtained from discourse of farmers relating to adoption of artificial insemination (AI) in the Northwest of Minas Gerais, Brazil (Category 3)

Category 3: Social influence relating to adoption of AI				
Primary subcategory	Secondary subcategory	Observed frequency	Relative frequency (%)	Total (%)
Opinion-formers acting in relation to dairy farmers towards the process of adopting AI	Absence of opinion-formers	12	5.60	26.46
	Prominent individuals in public and private institutions	110	51.40	
	Family, friends, neighbors, employees, and other farmers	37	17.28	
	Teachers, veterinarians, and technicians	38	17.75	
	Digital and printed media	17	7.94	
Subtotal		214	100.00	

Most of the expectations expressed by the farmers were directed towards the phenotype of their animals rather than towards financial factors. The basic requirements for AI adoption (category 1) formed the second major theme in the discourse of farmers, with emphasis on manpower, infrastructure, and management of the animals. This was followed by social influence (category 3), with emphasis on institutions and people involved with AI and the daily lives of farmers.

## Discussion

Based on our literature review, it was not possible to find many studies evaluating the profile of dairy cattle farmers in the northwestern region of Minas Gerais, and this characterization could help agricultural technology companies to make decisions regarding the approach and the type of products that are lacking in the region.

Most dairy cattle farmers are male and had over twenty years of experience of rearing dairy breeds of cattle. According to Brumer (2004), in the division of labor established between the sexes, men are generally the only individuals who perform tasks that require greater levels of physical strength and use of more sophisticated agricultural machinery. On the other hand, most routine activities relating to agricultural tasks of lighter nature are performed by women. Women perform virtually all domestic activities and deal with smaller animals (chickens, pigs, dogs, and cats). They may also be included in dairy production activities and yard care, including the orchard and garden.

Besides, the results indicated that the region is still dominated by traditional farmers. According to Azevedo (2011), this may give rise to delays in acquisition of new technologies, because these farmers (who are often older individuals) may not want them. Without using biotechnologies, opportunities for technological innovation in this sector are lost. According to Russi et al. (2010), the educational level of farmers is possibly correlated with the use of reproductive biotechnologies, considering that, in Brazil, the higher the professional level of the farmer, the longer their use of AI/FTAI. These mechanisms increase herd productivity.

According to Schneider (2009), combinations of agricultural activities with non-farming activities (pluriactivity) are considered a social reproduction strategy for farmers because they remain active in rural areas. However, 48.80% of the farmers reported that their income came exclusively from dairy cattle rearing.

Despite the large number of farmers that work exclusively with milk cattle, the use of reproductive

biotechnology such as FTAI is scarce. These results confirmed the reports of Gordo et al. (2013), who analyzed the use of AI among beef or dairy cattle in the state of Goiás, Brazil, and also found that more farmers only used conventional artificial insemination. The farmers perceived that the difficulties in implementing AI went beyond simply depositing semen in the genital organ of the cows.

The main problem points reported by the farmers are labor-related, not only within the farm; they reported a need for a skilled workforce inside and outside the dairy cattle production. These results contrast those reported by Russi et al. (2010), who found that the major cause of dismissal of inseminators are problems of interpersonal relationships. The lower percentage of ECU in the subcategory "human recourse management" (7.75%) in the present study may have been due to the principles of good practice regarding coexistence and participatory communication. Farmers in the Northwest of Minas Gerais had a cooperative system.

According to Zoccal et al. (2005), shortages of full-time skilled employees in rural areas of Brazil is a recurring theme, and this reality is also observed in Minas Gerais. The attention of dairy farmers towards labor can be explained by the fact that, in conventional AI, in addition to inseminating the cows, workers are responsible for observing estrus among females that are to be inseminated (Pfeifer et al., 2009). This activity directly determines the success of AI programs.

The dairy farmers of the present study pointed out that for them to adopt AI, they would need to modify and increase the time devoted to managing the feeding, reproduction, and health of the animals (11.42%). To a lesser degree, they would also need to improve the genetic quality of the herd (aptitude for milk production) (5.71%). This result contrasts previous findings of imbalance between rapid advances in genetic improvement and the low quality of animal housing systems, which leads to physiological stress among the cows and hampers the interaction between the genetic potential and fertility of the herd (Dobson et al., 2008). In addition, according to Torres-Junior et al. (2009), this is a worrying statistic, given that FTAI practices organize the dates of birth of calves better, improve productivity, and also lead to better health status of the group. Adoption of AI requires more elaborate farm management practices and techniques, with the development of production and nutrition, investment in technical assistance, and improved facilities (Santos, 2001).

It should be noted that there was concern of the dairy farmers reacting to the opinion of neighbors and family members regarding the adoption of animal breeding

techniques. According to Zuin et al. (2011), neighbors and other farmers may have a great influence through collective experiences, in which improvements on other farms lead farmers to want to use the same technology.

Opinions of farmers are poorly grounded in the literature. This may be due to lack of publications in appropriate formats, i.e., a lack of mechanisms to make these documents available, for cultural reasons, or because farmers prioritize investments in other activities. These situations result in low levels of professionalized activity, without use of scientific knowledge (Gordo et al., 2013). According to ABMR&A (2015), the mass communication media are more efficient for developing knowledge of users, while interpersonal channels are more efficient for convincing people, raising their awareness or changing their attitudes. This would explain the findings among the farmers of our study regarding the third category, especially for the farmer who preserves old habits, has greater resistance to use of new resources, and sees the activity as something that goes from father to son. More than a business, property is an extension of its roots, its history, and must be managed by the owner.

From the analysis of the three categories presented, it can be seen that the discourse was variable and that it went beyond technological or economic characteristics, such that it also took into account issues of personal satisfaction. These categories were also built up from biological, environmental, and social issues. According to Franco (2007), the various subjective answers given by the interviewee group must be understood and, thus, categorized in a cohesive manner.

The interaction between the biological and economic aspects of adoption of agricultural technologies was previously reported by Rodrigues et al. (2008). These results also corroborate the reports from Gordo et al. (2013), who noticed that the motivation of farmers towards improving the herd was higher than their motivation towards better economic returns. However, according to Okano et al. (2013), one of the motivations that lead dairy farmers to modernize the production process is the financial rewards, in the form of bonuses for volume or quality of the milk produced.

Controlling the breeding season makes it possible to organize the time of birth, which enables increased productivity among the cows and improves their health and performance attributes (Torres-Júnior et al., 2009). It should be noted that the primary subcategory comprised bulls. Given that the number of semen doses marketed in Brazil remain small, it is clear that farmers will continue to insist on using natural mating (Villela, 2010). It needs to be borne

in mind that adoption depends on a set of behaviors relating to the own experiences and sense of traditionalism of farmers (Rocha et al., 2009). Traditionalism could have been breastfed if the own sons and daughters of farmers returned to the farms, bringing new agricultural technologies; in this context, mainly reproductive biotechnologies.

## Conclusions

The profile of the dairy farmers in the Northwest of Minas Gerais is very variable. Rural extension educational initiatives and application of reproductive biotechnology policies should take into consideration the sources of personal motivation, basic necessities (such as manpower), and social influence. In particular, phenotypic improvement of the herd is one of the main points to be considered.

Regarding basic needs, investments in manpower and infrastructure are the most frequently mentioned issue in the discourse of farmers. Social influence is also important in the adoption process, and it stems mainly from research institutions, followed by the influence of friends and neighboring farmers.

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