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Causes of culling in dairy cows in the central region of Santa Fe, Argentina

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Research Article

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Abstract

This study investigated the annual culling rate and its main causes on dairy farms in the central region of Santa Fe, Argentina. A cross-sectional study was conducted between February and April 2025 on 77 farms located in the central dairy region of Santa Fe province, Argentina (Castellanos and Las Colonias departments). On each farm, an in-person survey was conducted with the farm manager. Information was collected regarding the farm demographics, the number of culls and mortalities and the causes of culling. The average annual total culling rate for pasture-based systems was 22.3% (range: 10–34%), while for confined systems it was 31% (range: 22–54%). The proportion of cows culled in pasture-based systems was 15.6% (range: 2–30%) compared to 23.6% (range: 14–43%) in confined systems. The annual mortality rate in pasture-based systems was 6.7% (range: 2–20%), while in confined systems it was 7.4% (range: 4–17%). The main causes of culling were reproductive problems, udder health issues, hoof diseases, infectious diseases and low milk production. The main causes of mortality on the farms were traumatic injuries, infectious diseases, mastitis and metabolic disorders, among others. Average cow longevity in pasture-based systems was 4.3 (range: 2–9) lactations compared to 2.9 (range: 1.4–4) lactations in confined systems. Productivity, animal welfare and dairy herd longevity are shaped primarily by management practices rather than by production system type alone, and both pasture-based and confined systems can be optimized to achieve sustainable outcomes.

In 2024, Argentina recorded a total of 9,735 dairy farms with 1,465,557 dairy cows. Approximately 82.8% of these farms were in three provinces: Santa Fe with 3,165 farms (34.7% of the national total); Córdoba with 2,566 farms (28.1%) and Buenos Aires with 1,830 farms (20%). The number of dairy cows in these provinces was 473,646, 457,516 and 404,285, respectively. The total annual milk production amounted to 10,590 million litres.

Dairy production systems in Argentina are predominantly pasture-based. The typical diet of lactating cows consists of approximately 45% pasture, 26% silage and 29% concentrate, primarily corn and soybean meal (Gastaldi *et al.*, 2015). In 2024, the average annual milk yield per cow was 7,138 l, with an average stocking rate of 1.4 cows per hectare (Datos claves de la lechería Argentina año, 2024).

Culling is defined as the removal of animals from the herd either through sale, death or slaughter (Doncel-Díaz *et al.*, 2025). Culling has important economic and animal welfare implications. Dairy farm income is affected by the costs of raising or purchasing replacements. The replacement rate influences milk production, since incoming animals generally produce less milk than the cows they replace in the short term (Compton *et al.*, 2017). Ideally, cows should remain in the production system at least until their fifth lactation, when they reach their full productive potential and offset the costs of rearing and maintenance (De Vries, 2020). In subsequent lactations, milk yield gradually declines (Vergara, 2019). Moreover, a high culling rate, particularly when due to mortality, may indicate deficiencies in animal welfare (de Vries *et al.*, 2011).

Recent surveys indicate that the average annual culling rate (ACR) of dairy cows in Argentina was 19.5%, with an average mortality rate (MR) of 6.6% (Roskopf *et al.*, 2025a). Additionally, a study conducted on 126 farms from Argentina reported total culling rates (TCRs) ranging from 25.9 ± 8.1% in small grazing herds (<200 cows) to 41.1 ± 10.1% in large, intensive free-stall systems (501–1,000 cows) (Abdala and Molineri, 2023).

Culling of dairy cows is an inevitable event, influenced by economic, social, health and management factors (Compton *et al.*, 2017). Identifying and understanding the causes of culling is essential, as this knowledge serves as a scientific basis for designing herd management strategies that help improve production and health indicators and reduce unnecessary losses of productive

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animals (Thomsen and Houe, 2023). The objective of this study was to describe the ACR and its main causes on dairy farms in the central region of Santa Fe, Argentina.

Materials and methods

A cross-sectional study was conducted between February and April 2025 on 77 dairy farms located in the central dairy region of Santa Fe, Argentina. The information analysed covered the period from January to December 2024. The sample size was calculated based on an estimated culling rate of 26% (Abdala and Molineri, 2023), with a 95% confidence interval and an acceptable absolute error of less than 10%. Farms were randomly selected from a database that included all registered dairy operations within the study area. A formal invitation to participate in the study was sent to dairy farms, offering the benefit of receiving a written report with the study results and guaranteeing the confidentiality of the information provided. Of the total number of farms invited, 5% declined participation for various reasons. The high acceptance rate may be attributed to the institutional relevance and recognition of the research institute within this major dairy production region.

At each farm, a survey was conducted with the person responsible for herd management. During the survey, information was collected on general farm characteristics, including the total number of cows, number of lactating cows, number of dry cows, and the primiparous-to-multiparous ratio, as well as the type of production system (confined or pasture-based) and the calving interval in days (CI). Production and health records provided by the farmers were obtained from dairy herd management systems, from which individual data on culled cows were recorded and evaluated. Reasons for culling were classified according to the proposal for the National Animal Health Monitoring System (2002) into the following categories: udder problems (mastitis, conformation), reproductive problems (infertility, abortions), lameness (hoof disorders, trauma to limbs other than the hoof), other diseases, low production, age, behaviour and phenotype.

The ACR was defined as the proportion of cows removed from the herd by sale only. The ACR was calculated as follows:

$$ACR = \frac{\text{Number of cows sold in 2024}}{\text{Average total number of cows in 2024}} \times 100$$

The MR was calculated as follows:

$$MR = \frac{\textit{Number of cows dead in } 2024}{\textit{Average total number of cows in } 2024} \times 100$$

TCR was defined as the proportion of cows removed from the herd for any reason (sales + deaths). The average TCR was calculated as follows:

$$TCR = \frac{\textit{Number of cows sold in } 2024 + \textit{Number of cows dead in } 2024}{\textit{Average total number of cows in } 2024} \times 100$$

Finally, cow longevity (CL) was calculated as follows:

$$Cl = \frac{100}{TCR} \times \frac{365}{CI}.$$

A descriptive statistical analysis was conducted to identify the frequencies and distributions of the variables TCR, ACR, MR and CL. Results were expressed as absolute and relative frequencies. The outcome variables were: the ACR (expressed as the number of cows sold in 2024 out of the average total number of cows in the herd), the MR (expressed as the number of cows dead in 2024 out of the average total number of cows in the herd) and the TCR (expressed as the number of cows sold, culled and dead in 2024 out of the average total number of cows in the herd). The effect of production system types (pasture-based and confined systems) on the outcome variable was evaluated using a generalized linear model with a binomial distribution and logarithmic link function. All statistical analyses were performed using the Infostat software (National University of Córdoba, Córdoba, Argentina).

Table 1. Descriptive characteristics of dairy farms from Santa Fe region (Argentina) according to production system

	Pasture-based systems	Confined systems
Number of farms, *n* (%)	55 (71.4)	22 (28.6)
Total cows	11,245	10,356
Holstein cows	7,551 (67.2)	8,957 (86.5)
Holstein crossbred cows	3,694 (32.9)	1,399 (13.5)
Herd size distribution, %		
<100 cows	10.9	4.5
100–199 cows	52.7	9.1
200–499 cows	34.5	68.2
500 or more cows	1.8	18.2
Average daily milk yield per cow (l)	19.2 (13–26)	26.5 (13–37)

Results

Characteristics of the surveyed dairy farms

A total of 77 dairy farms located in the central dairy region of Santa Fe Province were surveyed. The main characteristics of the different dairy production systems are presented in Table 1. Confined production systems (drylot) were used by 28.6% of dairy farms, while 71.4% operated under pasture-based systems with supplementation.

Confined dairy production systems of the drylot type in Argentina are characterized by the permanent housing of cows in open-air pens, generally without direct access to pasture. These pens have compacted dirt floors, often improved through slopes and drainage systems to minimize mud formation. In addition, they are equipped with basic welfare infrastructure, including artificial shade, water troughs and linear feed bunks, where total mixed rations (TMR) are provided as the basis of the diet.

Pasture-based dairy production systems in Argentina are characterized by the predominant use of pastures as the basis of feeding, complemented with varying levels of energy and protein supplementation. Cows access pastures daily under rotational grazing management, supported by infrastructure such as paddock subdivisions, water points and laneways. Supplementation is mainly provided in the milking parlour or at external feed bunks and may include concentrates, silages and, in some cases, partial mixed rations.

The number of animals per farm included in the study, stratified by production system, is presented in Table 1. Most of the included dairy farms used only Holstein cows and the average daily milk yield per cow was 24 l (range: 13–37 l) (Table 1).

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Table 2. Causes of culling and mortality in dairy cows according to production system[a]

Causes of culling	Production system type	Pasture-based systems	Confined systems	*P*-value	OR[a]
Culling	Reproductive problems	33.8 (29.8–38)	31.9 (28.1–35.7)	<0.001	1.6 (1.5–1.9)
	Udder problems	20.5 (18–23)	22.5 (19.8–25.2)	<0.001	2.2 (1.9–2.6)
	Hoof disorders	9.2 (7.4–11.1)	14.9 (12–18)	<0.001	3.1 (2.6–3.8)
	Infectious diseases	13.5 (11.5–15.6)	4.5 (3.8–5.2)	<0.001	1.6 (1.3–2.1)
	Low milk production	7.6 (6.1–9.2)	6.51 (5.2–7.8)	<0.001	1.8 (1.4–2.4)
	Cow age	5.7 (4.3–7.1)	1.7 (1.3–2.1)	0.008	1.7 (1.1–2.5)
	Unreported causes	5.8 (3.8–7.8)	11.6 (7.5–15.7)	<0.001	4.8 (3.7–6.3)
	Other causes	3.8 (2.7–4.9)	6.4 (4.5–8.3)	0.023	1.3 (1–1.6)
Causes of mortality	Traumatic	16.9 (13.6–20.4)	27.9 (22.4–33.6)	< 0.001	3 (2.3–4)
	Infectious diseases	20.7 (17.6–23.8)	7.2 (6.1–8.3)	<0.001	1.7 (1.2–2.5)
	Mastitis	5.2 (3.9–6.5)	12.7 (9.5–15.9)	<0.001	4.2 (2.6–6.7)
	Metabolic diseases	10.9 (8.2–13.6)	2.1 (1.6–2.7)	<0.001	3.7 (2–6.7)
	Digestive disorders	3.1 (0–4)	8.7 (6.1–11.3)	<0.001	3.6 (2.1–6.6)
	Poisoning	2.8 (0–4)	6.4 (3.8–9)	<0.001	4.4 (2.3–8.3)
	Cow age	5.7 (4.0–7.4)	0.8 (0–1)	0.12	3.5 (1.3–8.9)
	Heat	2.2 (0–2.9)	5.3 (3.7–6.9)	0.001	3.3 (1.6–7.1)
	Unreported causes	20.3 (13.2–27.4)	17.8 (11.6–24)	<0.001	1.7 (1.3–2.2)
	Other causes	12.2 (8.5–15.9)	11 (7.7–14.3)	0.480	1.4 (0.8–1.5)

[a]Odds of culling or mortality: pasture-based vs. confined systems.

Dairy cow culling

Pasture-based systems had a lower overall TCR compared to confined systems ($P < 0.001$). The average total ACR in pasture-based systems was 22.3% (range: 10–34%), whereas in confined systems it was 31% (range: 22–54%). Cows in confined systems had an odds ratio (OR) of 1.9 (95% CI: 1.8–2.1) of being culled from the herd compared to cows in pasture-based systems.

Pasture-based systems also had a lower ACR compared to confined systems ($P < 0.001$). The ACR of cows culled in pasture-based systems was 15.6% (range: 2–30%), while in confined systems it was 23.6% (range: 14–43%). Cows in confined systems had almost two times higher odds of being culled from the herd, compared to cows in pasture-based systems (OR = 1.9; 95% CI: 1.9–2.1).

Confined systems exhibited a higher MR compared to pasture-based systems ($P < 0.001$). The MR in pasture-based systems was 6.7% (range: 2–20%), while in confined systems it was 7.4% (range: 4–17 %). Cows in confined systems had almost 1.3 times higher odds of dying on-farm compared to cows in pasture-based systems (OR = 1.29; 95% CI: 1.16–1.4).

No significant differences in culling were observed among breeds ($P > 0.05$).

Causes of culling and mortality

The main causes of culling in confined systems were reproductive disorders (31.9%), udder problems (22.5%) and hoof disorders (14.9%). The main causes of culling in pasture-based systems were reproductive disorders (33.8%), udder problems (20.5%) and infectious diseases (13.5%). The main causes of culling in different production systems are shown in Table 2.

The main cause of culling for both systems was reproductive problems ($P < 0.001$). Cows in pasture-based systems had 1.7 times higher odds of being culled for this cause than cows in confined systems (OR = 1.7; 95% CI: 1.5–1.9; Table 2).

The main causes of mortality were traumatic (27.9%) in confined systems and infectious diseases (20.7%) in pasture-based systems ($P < 0.001$; Table 2). Cows in confined systems had three times higher odds of death due to trauma than cows in pasture-based systems (OR = 3; 95% CI: 2.3–4). Cows in pasture-based systems had 1.7 times higher odds of death due to infectious disease than cows in confined systems (OR = 1.7; 95% CI: 1.2–2.5; Table 2).

Cow longevity

The overall average calving interval for all farms was 441.6 days (range: 380–450 days). No significant differences were found in the calving interval between the different production systems ($P = 0.964$). In pasture-based systems, the average calving interval was 441.9 days (range: 380–549), while in confined systems it was 440.6 days (range: 397–503).

On the other hand, pasture-based systems had greater CL compared to confined systems ($P < 0.001$). The average longevity of cows in pasture-based systems was 4.3 lactations (range: 2–9), whereas in confined systems it was 2.9 lactations (range: 1.4–4).-4

Discussion

Studying the causes of culling in dairy cows in Argentina is complex due to the lack of standardized classification criteria and nomenclature, as well as the scarcity of individual animal health

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records on farms. On the other hand, data entry is often performed retrospectively, sometimes during periods that differ from those in which the events actually occurred. In this context, the present study aimed to establish methodological bases for future local prospective studies with greater specificity in identifying the causes of culling. However, the results should be interpreted considering the potential biases inherent to observational interview-based studies, particularly selection bias associated with voluntary farm participation, which could affect the estimation of culling and MRs.

In this study, pasture-based dairy systems predominated (70%) over confined systems (30%), reflecting the traditional structure of Argentine dairy production, in which grazing constitutes the nutritional base, complemented by varying levels of supplementation (Lazzarini *et al.*, 2024). However, this proportion differs from national estimates, which indicate that approximately 90% of dairy farms operate under pasture-based systems and 10% under confined systems (Lazzarini *et al.*, 2024). This discrepancy may be attributed to regional differences, as factors such as climate, pasture availability, farm size and the degree of production intensification influence the adoption of either production system. Confined systems also exhibited higher average daily milk yield per cow, likely associated with a greater level of management of intensification and the use of higher energy-density diets (White *et al.*, 2002).

In this study, culling and MRs differed from those reported by other authors from Argentina. Abdala and Molineri (2023) reported a higher TCR (25.9%), a similar culling rate, and a higher MR (9.1%) than those observed in our study (22.3%, 15.6% and 6.7%, respectively). These differences may be partly explained by the data source, as the study by Abdala and Molineri (2023) relied on records from farm management software companies, thereby restricting the analysis to farms with formal recording systems and potentially higher levels of intensification and production control. A non-randomized study carried out on 12 dairy farms in Uruguay reported similar values for total culling (22.6%) (Doncel-Díaz *et al.*, 2025). However, it documented higher culling (18.1%) and lower mortality (4.5%) (Doncel-Díaz *et al.*, 2025). These differences may be attributable to more effective diagnostic services, identification of odds factors and the implementation of appropriate control and prophylactic measures (Doncel-Díaz *et al.*, 2025).

Approximately 53% of culling in the region was attributed to reproductive disorders and mammary health problems, with no marked differences between production systems. This value is lower than those reported in Uruguay and Canada, where these causes accounted for 61% and 58% of total culling, respectively (De Souza *et al.*, 2023; Doncel-Díaz *et al.*, 2025). However, the value observed in our study is higher than those reported in predominantly pasture-based dairy systems, such as New Zealand (45.4%) and Australia (30.6%) (Kerslake *et al.*, 2018; Wondatir Workie *et al.*, 2021), as well as in mainly confined systems, such as the United States (24%) (Lozada-Soto *et al.*, 2024) and Denmark (41%) (Thomsen and Houe, 2023). In contrast, studies conducted in Iran reported intermediate values, with approximately 40% of culling associated with these causes.

In this study, reproductive problems accounted for 33.9% of culling in pasture-based systems and 31.9% in confined systems. These values are comparable to those reported in Spain, where reproductive causes represent approximately 30% (Armengol and Fraile, 2018) of culling in dairy herds. However, they are higher than those reported in the United States and Canada, where reproductive problems generally account for 20–25% of total dairy cow culling (Moreira *et al.*, 2021). The United Kingdom reported a culling rate of 37% due to reproductive problems (Taylor *et al.*, 2024). Overall, these results confirm that reproductive failures are among the main determinants of culling in dairy systems, regardless of the production system.

Several studies have reported that infectious agents, including *Neospora caninum*, bovine viral diarrhoea virus, infectious bovine rhinotracheitis virus and *Brucella* spp., are important causes of abortion and impaired fertility, with effects extending beyond the abortive event, compromising subsequent pregnancies, and reducing conception rates (Asmare *et al.*, 2013; Softic *et al.*, 2018). In addition, inadequate nutritional management during the transition period may induce postpartum energy deficits that, together with other predisposing factors, increase the odds of endometritis and reproductive failure (Roche, 2006). The lack of reproductive protocols adapted to the production system may also contribute to increased infertility.

The specific characteristics of production systems in our region, such as a high dog population, frequent use of natural service, the introduction of animals from multiple herds to maintain stock, nutritional deficiencies associated with inadequate technical advice or adverse climatic conditions, may have favoured culling due to reproductive causes. Finally, the possibility of reporting errors due to limited diagnostic confirmation and the lack of a systematic investigation of the underlying causes of culling cannot be ruled out (Yanga and Jaja, 2022)

Udder problems accounted for 20.5–22.5% of total culling in our study, depending on the production system. These values are comparable to those reported in Estonia and Brazil, where udder disorders explain approximately 20–23% of culling in dairy herds (Rilanto *et al.*, 2020; Almeida *et al.*, 2025). In contrast, studies conducted in the United States, Canada, and Spain report lower proportions (McCluskey, 2002; Armengol and Fraile, 2018; CDIC, 2020), generally ranging between 10% and 15%. In contrast, Uruguay has reported higher values, close to 30% of total culling attributed to udder problems (Doncel-Díaz *et al.*, 2025). Mastitis constitutes the main component of this category and has a significant impact on milk yield and milk quality, resulting in substantial economic losses associated with reduced productivity and increased treatment and management costs. In severe cases, mastitis can lead to premature culling or even death of affected cows (Seegers *et al.*, 2003). In addition, unfavourable udder conformation, including low udder height and reduced rear udder width, has been associated with an increased likelihood of culling, as these traits can hinder milking practices and increase the odds of injuries and intramammary infections (Bretschneider *et al.*, 2015). In Argentina, the available information on mastitis prevalence and its contribution to culling is limited. In a study conducted in Argentina, Roskopf *et al.* (2025b) determined that for 47.5% of producers, mastitis represents a major problem. This lack of data, together with the heterogeneous implementation of mastitis control programmes, deficiencies in hygiene practices, pathogen-contaminated environments, and the inappropriate use of antibiotics, may help explain the relatively higher culling rates due to udder problems observed compared with other countries.

Culling due to hoof disorders was significantly more frequent in confined systems than in pasture-based systems, with a lower relative odd observed in the latter. These findings are consistent with studies conducted in the United States, Canada, Denmark and the United Kingdom, where hoof disorders account for approximately 10–20% of culling in dairy herds (Cook *et al.*, 2004; Randall *et al.*, 2015; Solano *et al.*, 2016; Thomsen and Houe, 2023). In contrast, countries with predominantly pasture-based production

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systems, such as New Zealand and Ireland, report proportions of culling attributable to hoof disorders below 10% (Mason *et al.*, 2023; Conneely and Ryan, 2024). The higher culling rate observed in confined dairy farms in this study may be attributed to inherent characteristics of this production system, including greater exposure to wet and high stocking density, reduced exercise due to shorter walking distances compared with pasture-based systems and nutritional imbalances that predispose cows to hoof lesions. Conversely, pasture-based systems are characterized by greater physical activity and surfaces with lower moisture or mud accumulation, conditions that favour hoof health and reduce the incidence of these disorders.

Mortality due to traumatic causes was significantly higher in confined systems compared with pasture-based systems (27.9% vs. 16.9%), with lower relative odds observed in the latter. These results are consistent with those reported in countries where confined production systems predominate, such as the United States and Canada, where traumatic causes account for approximately 20–30% of total mortality in dairy herds (Miller *et al.*, 2008; McConnel *et al.*, 2009). In confined dairy systems in Denmark and the Spain, traumatic causes account for between 15% and 25% of total mortality in dairy cows (Thomsen *et al.*, 2004; Armengol and Fraile, 2018). In contrast, the values observed in the pasture-based systems of this study are comparable to those reported in countries with similar production systems, such as New Zealand and Ireland, which report lower proportions of mortality due to traumatic causes, generally below 15–20% (Ring *et al.*, 2018; Cuttance *et al.*, 2024). Overall, these findings reinforce the evidence that confinement increases the odds of traumatic mortality in dairy cows. This may be attributed to the fact that confined systems often feature pens or alleys with slippery flooring, which increases the odds of falls and injuries (Valkova *et al.*, 2021). Additionally, confined systems typically exhibit higher rates of assisted calving, which further elevate the odds of injuries that can result in mortality or necessitate culling of affected cows.

The mortality due to metabolic diseases was significantly higher in pasture-based systems (10.9%) compared with confined systems (2.1%). These findings differ from those reported in the international literature, where in countries dominated by confined production systems, such as the United States, Canada and Italy, metabolic disorders account for approximately 8–21% of mortality in adult dairy cows (Dechow and Goodling, 2008; McConnel *et al.*, 2009; Fusi *et al.*, 2017). In contrast, in countries with predominantly pasture-based systems, such as New Zealand, mortality due to these causes is generally below 5% (Macdonald *et al.*, 2017; Mason *et al.*, 2020). Given that metabolic disorders are mainly associated with intensive production systems and nutritional management during the transition period, the results observed in this study may be explained, in pasture-based systems, by a potential over-reporting of metabolic causes due to the lack of precise veterinary diagnosis, as well as by nutritional imbalances related to adverse climatic conditions and insufficient technical advice. Conversely, in confined systems, an underreporting of cases by producers or farm workers may have occurred, together with more controlled nutritional management associated with greater standardization and monitoring of feeding practices.

The mortality due to mastitis in dairy cows in Argentina was also different between systems, with an observed rate of 5.2% in pasture-based compared with 12.6% in confined systems. Our results are consistent with previous studies, highlighting the importance of mastitis as a cause of mortality in dairy cows. In a study conducted in Finland, mastitis was reported as the leading cause of mortality based on necropsy findings, accounting for approximately 26% of cases (Hagner *et al.*, 2023). In countries with predominantly intensive production systems, such as the United States and Canada, direct mortality due to mastitis is generally lower, as severe cases represent a relatively small proportion of the total and benefit from timely diagnosis and treatment (McConnel *et al.*, 2008). Similarly, in pasture-based systems, such as those in New Zealand, mortality attributed to mastitis is also low (Compton *et al.*, 2017). The differences observed among countries may be explained by variations in early detection, herd health management, access to veterinary treatments and environmental conditions that influence the occurrence of severe mastitis.

A total of 20.3% and 17.2% of the deaths recorded in pasture-based and confined systems, respectively, lacked a reported cause. Necropsy is a fundamental tool for determining the immediate cause of death (Thomsen and Houe, 2006; McConnel *et al.*, 2009); however, in the present study, these animals were not subjected to post-mortem examination, which limited the accurate diagnostics of mortality causes. This limitation may be attributed to operational factors, such as veterinarian availability or willingness at the time of the event, delays in reporting deaths by farm personnel, or accessibility constraints for performing the procedure. Accurate determination of the cause of death is essential for the implementation of targeted management and health strategies aimed at preventing similar events and reducing involuntary herd losses.

In our study, pasture-based systems exhibited greater longevity compared to confined systems. These results are consistent with findings from Argentina, where Masía *et al.* (2022) reported longevity of four lactations for cows in pasture-based systems versus three lactations in confined systems. Similarly, Berry *et al.* (2011) reported that cows in pasture-based herds in Ireland had longevity of 4.2–4.5 lactations. In contrast, De Vries (2017) noted that cows in confined systems in the United States had longevity of 2.5–3 lactations.

Confined systems tend to maximize individual production, which is often achieved at the expense of longevity and overall system sustainability. Maintaining a low culling rate contributes to greater long-term productive and economic efficiency, as it allows the recovery of rearing costs and extends the productive lifespan of each cow (Dallago *et al.*, 2021).

Conclusions

The findings of this study provide a characterization of dairy farms in the central region of Santa Fe province across production systems. Confined systems generally exhibited higher average milk yields per cow, whereas pasture-based systems showed lower overall culling and MRs and greater CL. The main causes of culling and mortality – including reproductive problems, udder and hoof disorders, infectious diseases and low milk production – were common to both systems, underscoring the universal importance of effective herd health monitoring, reproductive management and disease prevention.

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