Transition management and dairy cow performance: insights from dairy farms in Argentina

Manejo de la Transición y Desempeño de las Vacas Lecheras: Perspectivas de Establecimientos en Argentina

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Abstract

This study aims to describe nutritional strategies, management practices, and health events in transitioning cows on 28 commercial dairy farms in Argentina, selected based on their association with graduate students. During 2022, we surveyed herd management, feeding, health events, and milk yield, based on local research and validated recommendations. Most cows were housed in dry lots, with 97% of farms having far-off and close-up groups, but only half had a fresh group. The average dry period was 59±11.4 days. The mortality and culling rate were 1.2% and 1.4%, respectively. The herd incidence rates were 1.8% for milk fever, 0.3% for clinical mastitis, 2.7% for metritis, and 1.4% for retained placenta. All farms used anionic diets and monitored urinary pH, with corn silage included in all diets, and soybean meal/expeller as the main protein source. Lactating cows produced an average of 33.8±10.43 kg of milk on the first test day and 38.2±10.05 kg at peak. Primiparous cows produced 75% of the milk of mature cows. Bulk tank milk averaged 3.9±0.19% fat and 3.5±0.07% CP. This report highlights strengths and areas for improvement in Argentina's dairy transition programs.

Keywords
dry cow • prefresh • dairy cow performance • health and nutrition

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Resumen

El objetivo del estudio fue describir estrategias nutricionales y de manejo, eventos de salud y producción de vacas en transición en 28 establecimientos argentinos seleccionados por su vinculación con estudiantes de posgrado. Durante el año 2022 se relevaron aspectos de manejo, alimentación, salud y producción, según recomendaciones validadas y estudios locales. La mayoría de las vacas se alojaban en dry-lots y 97% tenían rodeos de seca y preparto, pero solo la mitad tenía rodeo de vacas frescas. La duración del período seco fue de 59±11,4 días. La mortalidad y descarte fueron del 1,2% y 1,4%, respectivamente. Las incidencia de hipocalcemia, mastitis, metritis y placenta retenida fueron 1,8%, 0,3%, 2,7% y 1,4%, respectivamente. Los establecimientos utilizaban sales aniónicas y monitoreaban pH urinario preparto; incluían silaje de maíz, y harina o expeller de soja como fuente proteica. La producción promedió 33,8±10,43 kg/vaca/día al primer control lechero y alcanzó un pico promedio de 38,2±10,05 kg/vaca/d. Las vacas primíparas produjeron el 75% de las vacas adultas. La leche de tanque presentó 3,9±0,19% de grasa y 3,5±0,07% de proteína. Este informe resalta los puntos fuertes y áreas de mejora en los programas de transición lechera en Argentina.

Palabras clave
vaca seca • preparto • performance de vaca lechera • salud y nutrición

Introduction

The transition period in dairy cows spans from the last 3 weeks prepartum to the first 3 weeks postpartum (10). This critical phase has been emphasized as pivotal in the lactation cycle by Drackley (1999), primarily due to its influence on health disorders, production outcomes, and subsequent profitability. This latter author highlights several essential aspects, including nutritional strategies to support dry matter intake and metabolic adaptation, environmental comfort to reduce stress, monitoring of body condition to avoid excessive reserve mobilization, and timely detection of clinical and subclinical health issues.

Recent literature has highlighted various aspects of transition cow management in commercial settings. Heuwieser *et al.* (2010) surveyed German farmers on fresh cow management practices, while Espadamala *et al.* (2016) examined methods for identifying postpartum health disorders in California dairy farms. Both studies underscored the challenge of implementing specific and objective observation systems in fresh groups to enhance transition cow care. More recently, Kerwin *et al.* (2022) investigated the management and herd characteristics of the transition period in freestall dairy herds in the northeastern United States. Their findings highlighted the industry's adherence to prevailing recommendations from both academia and practical experience.

Effective management and nutrition during the transition period aim to reduce metabolic disorders, enhance milk yields, lower culling rates, and improve reproductive performance throughout lactation (8). However, while numerous dietary and management recommendations exist, their implementation varies based on practical considerations (2). Furthermore, Kerwin *et al.* (2023) noted that not all recommendations are equally adopted, often due to financial constraints or insufficient research support. Understanding the influence of nutritional and management factors on commercial dairy farms can shed light on how these elements contribute to transition cow success across diverse farm practices (15).

This study aims to describe nutritional and management strategies, as well as the productive performance and health events of transitioning cows in commercial dairy farms in Argentina. By identifying areas for improvement within these transition programs, this research seeks to enhance overall herd health and productivity. In Argentina, there is limited available information on the nutritional and management strategies applied during the transition period, making this type of research essential for designing evidence-based interventions to improve animal performance and farm profitability during this critical stage.

As has been highlighted for cow-calf systems, the systematic characterization of management practices and the identification of areas for improvement are key steps to increase efficiency and profitability in livestock production (10).

Materials and methods

Study Design

A cohort of graduate students specializing in bovine nutrition at the National University of Villa Maria facilitated the selection of 28 dairy farms across the provinces of Cordoba (19%), Santa Fe (50%), and Buenos Aires (31%), Argentina. These farms primarily housed Holstein cows, averaging 470 milking cows each, with herd sizes ranging from 180 to 1,200.

Farm visits conducted in August involved interviews with farm owners or managers, supplemented by observational assessments. The survey was developed based on nutritional and management recommendations from the literature, expert opinions, and insights gleaned from local studies (27, 29). It encompassed risk factors affecting milk yield and health during the transition period, drawing on recent research (1, 6, 7). Data collection focused on health events during the first 21 days in milk (DIM) and milk yield and quality metrics from cows calved between April and May 2022 due to operational and logistical limitations. Body condition scores in dry-off, close-up and fresh (< 30 DIM) cows and ketonemia in fresh cows (3-14 DIM) were evaluated in a stratified sample of cows based on group size: 20% of the cows in groups with more than 60 cows, 12 cows in groups with 12 to 60 cows, or all cows in smaller groups where the number was insufficient.

All animals involved in this investigation were cared for in accordance with the International Guiding Principles for Biomedical Research Involving Animals (CIOMS-ICLAS, 2012).

Survey Structure

The survey comprehensively addressed four main areas:

Herd Management: This section focused on dry cow and fresh cow programs, including criteria for grouping, frequency of management interventions, facilities, and cow comfort. Consultants also assessed the duration of the dry period for cows calved between April and May 2022. Body condition scores (BCS) were evaluated using a 1 to 5 scale (31) at different stages of the transition period.

Feeds and Feeding Management: Information regarding feed formulations for far-off, close-up, and fresh cow diets was collected. The survey also gathered data on feed sample frequency, feed bunk management practices, intake estimations, and monitoring of urinary pH when formulating acidogenic diets in pre-fresh stages.

Health Events: Defined health events included milk fever, retained placenta, mastitis, and metritis as they are among the most common and impactful health disorders during the transition period (2). Diagnosis criteria were standardized, with milk fever diagnosed based on symptoms and response to treatment, retained placenta noted if not expelled within 12 hours postpartum, mastitis identified through mammary gland inflammation or milk changes, and metritis detected via abnormal vaginal discharge and clinical signs. Blood samples from the coccygeal vessels assessed ketonemia, with hyperketonemia defined as blood BHB concentrations ≥1.2 mmol/L, measured by the consultant the day of the visit using handheld devices following manufacturer guidelines (23).

Milk Yield and Quality: Data on milk yield during startup (10 to 30 days in milk, DIM) and peak lactation (75 to 105 DIM) were obtained from individual cow records. Bulk tank milk quality parameters, including fat and protein content, somatic cell count (SCC), and colony-forming units (CFU), as reported primarily by industry standards, were documented.

Data Analysis

Descriptive statistics were employed to characterize general management practices during the transition period across the surveyed farms. Incidence rates of health events during early lactation were calculated as the proportion of new cases relative to the total number of calvings in April and May. Dietary composition, feeding management practices, and milk yield and quality traits were analyzed using positional and dispersion statistics to identify trends and variations across the surveyed farms.

Results and discussion

A total of 28 dairy farms across the provinces of Cordoba, Santa Fe, and Buenos Aires, Argentina, were selected for the study based on the availability and willingness of farmers to participate. The study encompassed all cows calved in these farms during April and May 2022, totaling 3,267 animals (1,223 multiparous and 2,044 primiparous cows). The median of calvings per farm was 32 for multiparous cows (range: 10 to 120) and 64 for primiparous cows (range: 12 to 204).

Herd Management

Most cows (85.7% groups) in the study were housed in dry-lots, the remaining groups were grazing. Ninety-seven percent of the farms had separate far-off and close-up groups. Yet, only half of them had fresh group, in line with observations reported by Heuwieser *et al.* (2010). Nearly all herds (27 out of 28) segregated far-off cows from close-up dry cows, with regrouping occurring at varying frequencies: monthly (1 farm), bi-weekly (13 farms), and weekly (13 farms). This two-group strategy during the dry period is commonly associated with nutritional management practices, particularly the use of anionic diets in the close-up group. While regrouping can affect feeding behavior and intake, studies indicate minimal impact under favorable conditions of feed access and resting areas (4, 26). Primiparous cows were housed together with multiparous cows in most herds (n = 22) for more than 20 days; only 6 herds separated primiparous from multiparous cows in the close-up period.

Regarding facilities, most farms allocated far-off and close-up dry cows in dry-lots (21 and 26 farms, respectively), with the remainder on pasture. Dry-lots generally provided adequate space without significant cost implications. They were in good condition, with a low depth of mud and good access to feed bunks and waterers, although it is highly dependent on rain events. Thirty-six percent of the farms did not provide shade to their far-off cows, whereas 93% of the close-up groups ensured shade provision. As demonstrated by Laporta *et al.* (2020), heat abatement provision to dry cows is important to prevent milk losses in the subsequent lactation and in the progeny.

A common practice is to have fresh cow groups to identify sick cows (9), considering that 30% to 50% of dairy cows affected by metabolic and infectious diseases are detected around parturition (18). The intensive monitoring of fresh cows to detect disorders at an early stage and to treat the cows if necessary is an important factor in promoting good performance of the cow during future lactation (28). In this context, accounting with fresh cow groups and daily management protocols can optimize fresh cow management efficiency.

Concerning consultancy, most herds (n = 27/28) were assessed by feed company consultants, and some by private consultants (n = 20/28) on weekly visits. Farmers prefer to act in response to information provided to their contexts. Referents may vary for each producer, but veterinarians often influence farmers' decision-making about infectious disease prevention (24).

The average length of the last dry period for multiparous cows was 59 days (SD = 11.4). This duration aligns closely with recommendations from previous studies advocating a 60-day dry period, aimed at optimizing milk production income and minimizing metabolic disorders (12). However, recent research suggests potential benefits in shortening or even customizing dry period strategies to balance milk yield and metabolic health (3, 16). In this study, although intentions behind these shorter periods were not explicitly confirmed, 20% of the farms implemented shorter dry periods, averaging 50 days or less.

Evaluations of BCS across far-off, close-up, and fresh cows revealed average scores of 3.2 (SD = 0.38), 3.6 (SD = 0.32), and 3.6 (SD = 0.37), respectively. While far-off cows exhibited similar average BCS as reported in previous studies (14), 25% of them scored 3.5 or higher, potentially impacting metabolic health outcomes (5). More on, close-up cows were evidently fatter than far-off cows. Although controlled energy diets were meant to be fed to the latter (see nutrient composition in *Feeds and feeding management* section), maybe the net energy for lactation (NE_L) content should be even lower (1.4 Mcal/kg) (2). According to these authors, a greater decrease in BCS after calving is expected in these cows, increasing metabolic disorders and impairing reproductive performance. Probably, shortening the dry period to 45 d could improve energy balance in the transition period.

Feeds and Feeding Management

Considering the initial 28 farms, diet composition data were successfully gathered for far-off dry cows from 22 farms, close-up cows from 26 farms, and fresh or lactating cows from 27 farms. However, some farms were excluded due to missing data, particularly those using pasture diets exclusively.

Far-off cow diets, excluding those on pasture, generally contained lower dry matter (DM), crude protein (CP), starch, and ether extract (EE) compared to close-up and fresh/lactating cow diets (table 1). This difference primarily stems from higher forage inclusion in far-off diets, with most being total mixed rations (TMRs) featuring corn silage. In contrast, a subset of farms utilized pasture-based diets for far-off cows, resulting in lower DM content. Close-up diets maintained similar NE_L levels to far-off diets but included higher starch and EE content, often supplemented with high-fiber ingredients such as wheat straw to mitigate health disorders during the fresh period. Notably, far-off diets exhibited higher NE_L than those reported by Kerwin *et al.* (2023), potentially contributing to an increased BCS during this period. Excessive energy consumption is known to accumulate in adipose tissue, increasing the risk of metabolic issues (2). Regarding dietary cation-anion difference (DCAD), all close-up diets included anionic salts as a strategy to reduce the incidence of hypocalcemia, an important practice supported by regular urinary pH measurements in these farms. In fresh/lactating diets, carbohydrate balances were maintained to achieve 15-28% of fNDF, 15-19% CP and 20-32% starch levels across diets. In these diets, DCAD values were generally positive, with a few farms achieving values greater than 350 mEq/kg, which is recommended to enhance dry matter intake and fat-corrected milk (20).

Table 1. Nutrient composition means (SD) of far-off, close-up and fresh or lactating groups in dairy farms in Argentina.

Tabla 1. Composición nutricional promedio (DE) de vacas secas, preparto y frescas o en lactancia en establecimientos lecheros de Argentina.

Group, n	DM, %	CP, %	NE_L, Mcal/kg	NDFom, %	fNDF, %
Far-off, 22*	38.1 (11.8)	13.3 (1.7)	1.49 (0.11)	43.3 (5.6)	41.4 (6.7)
Close-up, 26	46.7 (6.6)	14.6 (2.0)	1.49 (0.09)	43.0 (4.5)	36.0 (6.1)
Fresh/Lactating, 30	47.4 (6.2)	17.1 (1.2)	1.69 (0.09)	30.3 (2.9)	20.0 (3.8)

Group, n	Starch, %	Fat, %	Ash, %	DCAD, mEq/kg
Far-off, 22*	12.9 (4.3)	2.7 (0.4)	8.3 (1.6)	285.5 (65.2)
Close-up, 26	16.9 (2.8)	3.1 (0.7)	8.9 (1.4)	-150.6 (85.7)
Fresh/Lactating, 30	25.8 (2.6)	4.2 (0.9)	7.0 (1.2)	249.5 (83.1)

*Far-off groups fed only pasture were not included.

DM= dry matter; CP= crude protein; NE_L= net energy for lactation; NDFom= neutral detergent fiber, organic matter-based; fNDF= forage NDF; DCAD= dietary cation-anion difference.

*No se incluyeron los rodeos de vacas secas en pastoreo.

DM= materia seca; CP= proteína cruda; NE_L= energía neta de lactancia; NDFom= fibra detergente neutro base materia orgánica; fFDN=FDN de forraje; DCAD= diferencia catiónica-aniónica dietaria.

All farms fed different diets during the dry period (far-off and close-up diets). Table 2 (page XXX) summarizes the ingredient compositions for far-off, close-up and lactating cow diets.

Every farm included corn silage in at least one of their diets. Concentrates predominantly comprised corn and soybean meal, aligning closely with nutrient compositions reported by Kerwin *et al.* (2022) from dairy herds in the northeastern United States.

Far-off and close-up cow diets were typically delivered once daily, with most farms (93%) monitoring feed bunk refusals in close-up groups but less in far-off (74%). Most fresh/lactating cows were fed twice daily, with daily monitoring of feed bunks. Sampling and analysis practices for forages and concentrates varied significantly across farms. Forages were sampled and analyzed only when a new bag or ingredient was used on most farms. Wet concentrates were not sampled and analyzed in most farms (64%), although wet forages were sampled and analyzed every 3 months (24%) or when a new ingredient was

used or a new bag opened (62%). Dry concentrates were not sampled in one-third of the cases, and hays were sampled when a new lot came to the farm or every 3 months in 2 thirds of the farms. Sampling schedules often fall short of optimal frequencies recommended for small and large herds (30).

Table 2. Ingredient composition means (SD) of far-off, close-up and fresh or lactating groups in dairy farms in Argentina.

Tabla 2. Inclusión promedio (DE) de ingredientes de dietas de vacas secas, preparto y frescas o en lactancia en establecimientos lecheros de Argentina.

Ingredient	Dry-off Diet		Close-up Diet		Lactating Diet	
	Number of groups	Inclusion mean and SD, %	Number of groups	Inclusion mean and SD, %	Number of groups	Inclusion mean and SD, %
Corn silage	20	44.5 (16.2)	27	48.8 (8)	30	30.4 (7)
Wheat straw	6	28.9 (11.7)	20	20.7 (8)	-	-
Soybean meal	7	5.8 (2.9)	19	12.8 (5.5)	23	15.1 (4.3)
Corn grain	6	8.8 (4.0)	10	6.3 (2.0)	25	21.2 (5.6)
Alfalfa hay/silage	20	44.0 (16.5)	-	-	30	17.7 (10.6)
Cottonseed whole	-	-	-	-	14	8.4 (2)
Soybean hulls	2	11.9 (0.0)	-	-	11	6.2 (2.4)

Health Events

Data on milk fever, clinical mastitis, metritis, retained placenta, culling, and death events were recorded across 2,957 cows that calved during April and May 2022 (table 3).

Table 3. Incidence of health events during the first 21 days in milk at cow- and herd-level in dairy farms in Argentina.

Tabla 3. Incidencia de eventos de salud durante los primeros 21 días en lactancia a nivel de vaca y de rodeo en establecimientos lecheros de Argentina.

Health events	At cow level (n = 2,957)		At herd level (n = 24)
	Primiparous cows (n = 1,116)	Multiparous cows (n = 1,841)	
	n (%)	n (%)	Median, % (range)
Milk fever	0 (0)	65 (3.5)	1.8 (0-5.6)
Clinical mastitis	7 (0.6)	39 (2.1)	0.3 (0-6.5)
Metritis	54 (4.8)	72 (3.9)	2.7 (0-11.1)
Retained placenta	18 (1.6)	45 (2.4)	1.4 (0-20)
Culled	6 (0.5)	30 (1.6)	1.2 (0-5.1)
Death	6 (0.5)	33 (1.8)	1.4 (0-4.6)

In our study, we observed lower herd incidences and reduced variability in specific health events such as milk fever, metritis, culling, and death compared to recent data published by Kerwin *et al.* (2022). Our data fall below the achievable prevalence levels determined by Caixeta and Omontese (2021), which could be attributed to the selection process of these farms. Additionally, at the cow level, our data indicate higher incidences compared to those reported by Masia *et al.* (2022) and Ruprechter *et al.* (2018) in farms located in Argentina and Brazil. In the case of Masia *et al.* (2022), the database was provided by DairyComp - Clientes Ciale Alta, whose farms are generally considered well-managed or at least benefit from professional advice. Ruprechter *et al.* (2018) included data from only one farm. On the other hand, our data suggest significantly lower incidences of mastitis and retained placenta compared to the findings in other studies, which could indicate underreporting of these events, although this could also be the case in those other studies.

Blood sample results from 310 analyzed cows showed that 28 had hyperketonemia, representing a 9% overall incidence, with the majority being multiparous cows (n = 24). At the herd level, we found a median incidence of 8% (range: 0 - 30%). Similarly, Kerwin *et al.* (2022) reported that nearly half of the farms in their study had less than 15% of cows with values >1.2 mmol/L of BHB.

Our study, similar to surveys of German farmers (13) and farms in California (9), included assessments of fresh cows. However, both studies noted that the evaluation of fresh cows primarily relied on nonspecific observations, suggesting potential benefits from implementing more objective practices to identify health disorders.

Milk Yield and Quality

We recorded milk yield at start-up (10 to 30 DIM) and peak (75 to 105 DIM) from 2,064 and 2,084 cows, respectively, that calved during April and May 2022 (table 4).

Table 4. Milk yield at start-up and peak average (SD) for cows calved during April and May 2022 in dairy farms in Argentina.

Tabla 4. Promedio (DE) de producción de leche al inicio y al pico en vacas paridas durante abril y mayo de 2022 en establecimientos lecheros de Argentina.

Lactation number	Start-up milk yield		Peak milk yield	
	n	Average, kg	n	Average, kg
1	776	28.0 (7.3)	808	34.3 (8.1)
2	559	37.2 (9.6)	540	39.8 (9.7)
≥3	729	37.5 (11.1)	736	41.4 (10.8)
Overall	2064	33.8 (10.4)	2084	38.2 (10.1)

Our results show that primiparous cows produced 75% of the milk yield of mature cows (≥3 lactations) at the beginning of lactation. This proportion is slightly higher than the 71.3% reported by Kerwin *et al.* (2023), although absolute milk yield in our study was 1.5 kg lower. A greater disparity is evident in milk yield among mature cows, with almost a 4 kg difference, though standard deviations are similar. This highlights a clear opportunity to increase individual milk yield, particularly among primiparous cows.

In comparison to the national average milk yield in 2022, which was 24 kg/cow/day (21), these farms generally exhibit higher milk yields. Similarly, mean fat and crude protein content (3.9% and 3.5%, respectively) on these farms were greater than national average values (3.7% ± 0.18 and 3.4% ± 0.07 for fat and crude protein in milk, respectively) according to OCLA (2023), but lower than those reported by Kerwin *et al.* (2023) from farms in northeastern United States. While most industries in our country pay based on volume, some farms trade directly with factories, presenting different challenges in terms of milk composition.

The study has some limitations that warrant consideration. Firstly, dairy farms were chosen based on their receipt of professional consultancy from graduate students specialized in nutrition, indicating a likelihood of better-than-average management practice. Additionally, the herds surveyed had more cows per farm than the national average of 158 cows per farm (22), which may result in management practices and performance indicators that differ from those observed in smaller-scale operations. Secondly, measurements and records were gathered over a short period, which may not fully capture seasonal variations that could influence study outcomes. Thirdly, health event records relied on reports from farm personnel, potentially leading to variability in data accuracy and completeness. These limitations underscore the need for cautious interpretation of the findings, particularly regarding the generalizability and temporal applicability of the results. However, this study provides valuable insights into transition cow management practices, feeding regimes, health outcomes, and milk production characteristics across a sample of dairy farms in Argentina. Overall, while the studied farms generally exhibited good management practices, opportunities exist to enhance feeding management, health monitoring protocols, and data recording practices. Future research could explore the economic implications of implementing more intensive health monitoring and feeding strategies, focusing on milk yield and composition.

Conclusions

This study contributes valuable data on transition cow management and performance metrics in Argentine dairy farms, highlighting areas of strength and opportunities for refinement to support sustainable dairy production practices.

On the positive side, a key strength observed across the farms was the routine separation of far-off and close-up dry cows, which enables targeted nutritional and health management strategies during this critical period. Notably, the implementation of negative DCAD diets in close-up groups reflects a proactive approach to preventing hypocalcemia. Frequent bunk monitoring during the transition period also suggests a high level of attention to feed access and intake, which likely contributes to the low incidence of metabolic disorders, culling, and mortality recorded in these systems. In addition, milk composition data revealed higher-than-average solids content compared to national data, indicating effective nutritional strategies and potential for improved milk quality and value.

However, the study also identified several opportunities for refinement. One important area is the grouping strategy in the prepartum phase: primiparous and multiparous cows are often housed together, which may negatively affect younger animals due to social stress and competition. Additionally, the lack of shade for dry cows in some farms may compromise animal comfort, health and productivity, especially in warmer seasons. A second key issue is the length of the dry period, which in several cases exceeded 50 days. This extended duration, in combination with increased energy density in prepartum diets, was associated with undesirable increases in body condition, highlighting the need for more precise energy balance management during the transition. Moreover, the frequency of forage and wet feed sampling was often lower than recommended, limiting the accuracy of ration formulation and monitoring. On the production side, individual milk yield, particularly among primiparous cows, and milk solids content were identified as areas with potential for further improvement, suggesting that refinements in feeding, grouping, or overall cow comfort could yield better performance outcomes.

In summary, while transition cow management in the surveyed Argentine dairy farms shows solid foundational practices, the study underlines the importance of continued attention to grouping strategies, environmental aspects, feed monitoring, and precision nutrition to optimize both animal welfare and productive efficiency during this critical period of the lactation cycle.

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