



Original Research Paper

DIAGNOSTIC ASSESSMENT OF THE DAIRY CATTLE FARMING SYSTEM IN NORTH-EASTERN ALGERIA (EL TARF WILAYA)

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Abstract

Our work present a diagnostic assessment of the dairy cattle farming system of El Tarf wilaya (north-eastern Algeria), linking the technical structure of farms to their integration into formal collection and to the dynamics of that integration over time. A cross-sectional survey of 112 farms (2022–2023) provided the basis for a typology built by multiple correspondence analysis and clustering, complemented by an ordinal regression of the degree of formal integration; the collection register of the Directorate of Agricultural Services (443 farmers, 2014–2023) traced its trajectory. The typology distinguishes three systems ordered along a single intensification gradient extensive, semi-intensive and intensive with which milk yield is closely associated, unlike the agro-ecological zone. Integration into the formal channel appears decoupled from performance: it has a single structural correlate, the land-tenure constraint (OR 0.31; 95% CI 0.11–0.81). The register, finally, reveals unstable participation marked by pronounced intermittency: 28 to 53% of farmers present for several years leave the channel and later return to it. Because the survey centred on active formal suppliers, the diagnosis characterises this segment rather than the sector as a whole. These findings place the main obstacle not in production but in access to land, and in the trade-off between the premium offered by the formal channel and the liquidity of the informal one.

Keywords: dairy cattle system; farm typology; formal collection channel; land-tenure insecurity; intermittency; El Tarf (Algeria).

1. Introduction

In Algeria, national milk production falls short of domestic demand. In 2022 it reached 2.5 billion litres across all species, of which 1.75 billion came from cow's milk alone. With requirements estimated at 4.5 billion, production covered only about 55% of them (USDA-FAS, 2024). The remainder is imported as powder, reconstituted into fluid milk for mass consumption; the sector remains dependent on world markets (Kacimi El Hassani & Belmahdi, 2025).

To curb this dependence and support local supply, the State subsidises several links in the chain, notably 14 DA per litre to the producer and 5 DA to the collector (MADR, n.d.). The scheme is nonetheless ambivalent: it also funds the imported powder that supplies the dairies. Over the period they examined, Lazereg et al. (2020, p. 240) estimated that half of the subsidies earmarked for the sector went to this powder. The cost advantage thus granted to dairies weakens their incentive to collect and integrate local raw milk (Mamine et al., 2021).

Raising national output therefore calls for characterising the dairy cattle farming systems that sustain it on the ground.

These systems are highly heterogeneous. Nationally, they range from extensive operations built mainly on local or crossbred cattle and the use of rangeland to semi-intensive and intensive forms, set apart by their degree of specialisation and their management of feed resources (Kacimi El Hassani & Belmahdi, 2025). In north-eastern Algeria, this diversity takes the form of pastoral herds dominated by poorly resourced local cattle, more diversified systems in which crossbred animals loom larger, and dairy farms whose operation varies with herd size and reliance on concentrates (Yozmane et al., 2019).

A diagnosis of the dairy cattle system bears as much on its technical dimensions as on how the milk is marketed. Marketed milk flows either through a formal collection channel, supplying the dairies under contract, or through informal channels of direct sale (Belhadia et al., 2014). Yet work that connects the technical and structural characterisation of farms with their integration into formal collection remains scarce. The studies of Bousbia et al. (2010) and Matallah and Abbas (2015) bear mainly on farm typology, access to resources and management practices. Although Bousbia et al. (2010) record the destination of the milk here and there (home consumption or sale), recent regional typologies rest on cross-sectional surveys: they cannot follow trajectories over time or analyse their determinants.

This gap motivates the present work, devoted to the dairy cattle farms of El Tarf wilaya. It pursues three objectives: (i) to establish a structural typology of the farms and analyse the factors associated with

their milk yield; (ii) to identify the structural factors associated with their degree of integration into the formal collection channel; and (iii) to characterise, over 2014–2023, the trajectories of participation in this channel, distinguishing entry, persistence, exit and intermittency. By combining a cross-sectional analysis of the farms with a longitudinal reading of collection, this study offers a descriptive and analytical diagnosis that may inform the development of the local dairy sector.

2. Materials and methods

Study area. El Tarf wilaya occupies the far north-east of Algeria, bordering Tunisia to the east, opening onto the Mediterranean to the north and adjoining Annaba to the west. Its subhumid to humid climate combines heavy rainfall, concentrated in the winter season, with hot dry summers (Matallah et al., 2017). The relief traces three broad agro-ecological units (plains and low piedmont, mountain and forested piedmont, coastal dune belt), rounded out by the humid depressions around the lakes (Attia et al., 2019). Forest dominates land use and makes the wilaya a largely silvopastoral area, where local cattle the Atlas Brown breed in particular find a foremost forage resource in the cork-oak groves (Madani et al., 2002). According to the most recent publicly available edition of the Agricultural Statistics Series B (MADR, 2021; 2019 campaign data), the wilaya's herd numbered 82,630 head, of which 46,027 were dairy cows; local and improved breeds dominated by far (44,036 cows), modern breeds making up only 4% of the dairy stock (1,991 cows).

Sample and data. The study draws on two complementary sources from a single frame. The structural, cross-sectional component rests on a survey carried out in 2022–2023 of 112 dairy cattle farms, spread over fifteen municipalities covering the agro-ecological zones retained for the survey (plain, mountain, wetland). Sampling deliberately targeted the farms genuinely engaged in dairy production and its marketing, listed as such by the Directorate of Agricultural Services (DSA), the most complete frame for identifying them. It covered 94 of the roughly 116 active formal suppliers on record (a coverage rate of about 81% of that census), together with 18 farmers registered with the DSA but not delivering to the formal channel and, for that reason, classed as informal. This choice favours farms that are identifiable and active on the market. The questionnaire covered the setting, herd structure, management practices, land-tenure status and integration into the collection channel.

The second, longitudinal component draws on the DSA's formal-channel collection register over 2014–2023 (10,518 deliveries for 443 farmers), which allows the surveyed farms recorded in it to be followed over time. The analysis tracks each farmer year by year: presence in the register

indicates that their milk was collected by the formal channel that year, absence, that it was sold informally.

Variables. Each farm was described by its setting (agro-ecological zone: plain, mountain, wetland), the structure and management of its herd, its land-tenure status, the constraints reported and its integration into the collection channel. The herd was characterised by its dominant genetic type local dairy cattle (BLL), improved or crossbred (BLA) or modern (BLM) and by the number of lactating cows, the milk yield (L per lactating cow per day) and the calving interval; practices, by the mode of management, the supplementation profile, the milking system, health monitoring and the type of forage grown. Integration into the formal channel was measured by the share of marketed milk delivered to it, then summarised into three levels ordered by the channel's role: outside the formal channel (0%), formal channel secondary (>0 and <50%) and formal channel primary ($\geq 50\%$). The 50% threshold separates the farms for which the formal channel is a secondary outlet from those for which it is the main one. To check that this threshold does not force the conclusions, the exact share of milk delivered to the formal channel was also analysed without categorisation (see Analyses). Finally, a theoretical annual milk output was estimated per farm, by multiplying the daily yield per cow by the number of lactating cows and then by the length of a standard lactation (305 days), the reference bound of the International Committee for Animal Recording (ICAR, 2023).

Analyses. The sample profile was first described: counts and frequencies for the qualitative variables, median and interquartile range for the quantitative ones, whose distribution departs from normality. The technical typology was built by a multiple correspondence analysis (MCA) on four active practices (mode of management, supplementation, milking system and health monitoring), with breed, zone and degree of integration projected as supplementary variables; the partition was established on the first two dimensions by hierarchical ascending clustering (HAC), yielding three classes (Lê et al., 2008). Bivariate associations relied on the Kruskal–Wallis test for a quantitative variable against a group, and on the χ^2 test (or Fisher's exact test at low counts), supplemented by the bias-corrected Cramér's V (Bergsma, 2013), for two qualitative variables.

The degree of integration into the formal channel was modelled by a proportional-odds ordinal regression, with milk yield and the farmer's main reported constraint as predictors; the parallelism assumption was checked with the Brant test (1990). The small number of events per variable led us to test its robustness with a Firth-penalised two-part model (1993). Sensitivity to the categorisation of the integration variable was further examined by

modelling the continuous formal share directly with a fractional logit (quasi-likelihood, robust standard errors).

The longitudinal component was treated descriptively: annual presence of the farmers registered in a reference year, annual switching rate and intermittency (understood as alternation between the formal and informal channels); the comparison of the surveyed farms with the rest of the register served to gauge their representativeness. Because the structural component is cross-sectional in design, interpretation remains strictly associative. Analyses were carried out in R 4.6.0 (R Core Team, 2026), at the 5% level, with the packages FactoMineR (Lê et al., 2008) and factoextra (Kassambara & Mundt, 2020) for the MCA and clustering, MASS (Venables & Ripley, 2002) for the ordinal regression and brant for the parallelism test (Brant, 1990), logistf for the penalised regression (Firth, 1993), and sandwich (Zeileis, 2006) and lmtest (Zeileis & Hothorn, 2002) for robust inference.

3. Results and discussion

3.1. Sample profile

Of the 112 farms surveyed, 61 (54.5%) lie in the plain, 40 (35.7%) in the mountains and 11 (9.8%) in the wetland. Reported management is most often semi-intensive (67; 59.8%), ahead of extensive (32; 28.6%) and intensive (13; 11.6%). The herd's dominant genetic type is split between improved or crossbred (BLA: 49; 43.8%), modern (BLM: 35; 31.3%) and local (BLL: 28; 25.0%). Herds hold a median of 20 head (IQR 15–28) and 10 lactating cows (IQR 7–15). Median milk yield reaches 11 L per lactating cow per day (IQR 6–15; mean 11.2 ± 5.2), and the calving interval a median of 14 months (IQR 14–15; mean 14.3). Set against a standard 305-day lactation, the theoretical milk output per farm has a median of $\approx 31,900$ L/year (IQR 18,900–50,600), commensurate with the spread in herd sizes and yields. Most farms deliver part of their milk to the formal channel (94 of 112; 83.9%), but usually as a secondary outlet: for 69 of them (61.6%) the formal channel receives less than half the milk, it is the main outlet for only 25 (22.3%), and 18 (16.1%) stay outside it altogether. The median share delivered to the formal channel is 24.3% (IQR 10.4–44.2; mean 29.2%): for the median farm, this channel absorbs less than a quarter of the milk sold. All told, it is not the main outlet for 87 farms (77.7%). The most frequent land-tenure status, moreover, is undivided owner (38; 33.9%), ahead of individual ownership (19; 17.0%); the other forms of tenure appear in Table 1.

Table 1. Descriptive profile of the sample (n = 112).

Qualitative variable	Categories — n (%)
Agro-ecological zone	Plain 61 (55); Mountain 40 (36); Wetland 11 (10)

Qualitative variable	Categories — n (%)
Management (reported practice)	Semi-intensive 67 (60); Extensive 32 (29); Intensive 13 (12)
Breed	BLA 49 (44); BLM 35 (31); BLL 28 (25)
Milk system	Mechanical 70 (63); Manual 42 (38)
Health monitoring	Preventive 84 (75); Curative 28 (25)
Supplementation	Moderate 49 (44); High 33 (29); Low/occasional 15 (13); None 15 (13)
Type of forage grown	None 71 (63); Barley 30 (27); Alfalfa 7 (6); Sorghum 3 (3); Other 1 (1)
Land-tenure status	Undivided Melk 38 (34); Individual ownership/Melk 19 (17); Landless 17 (15); EAC/EAI/concession 17 (15); Public domain 14 (13); Tenancy 7 (6)
Integration into the formal channel	Outside the formal channel 18 (16); Formal channel secondary 69 (62); Formal channel primary 25 (22)

Quantitative variable	Value
Total herd (head), median	20
Lactating cows, median	10
Milk yield (L/LC/day), mean $\pm$ SD (median)	11.2 $\pm$ 5.2 (11)
Calving interval (months)	14.3
Share of milk to the formal channel (%), median (mean)	24.3 (29.2)
Milk output standardised to 305 days (L/year), median (IQR)	$\approx$ 31,900 (18,900–50,600)

Percentages may not total 100 owing to rounding. Abbreviations: BLL/BLA/BLM = local / improved or crossbred / modern dairy cattle; LC = lactating cow; SD = standard deviation; EAC/EAI = collective / individual farming holding; IQR = interquartile range. Land-tenure statuses: Melk = traditional private ownership (undivided = not partitioned among heirs; individual = own title); Landless = farmer without land of their own; EAC/EAI and concession = holdings on national-domain land (right of use); Public domain = State land farmed without title.

3.2. Yield orders itself along an intensification gradient

The multiple correspondence analysis, built on the four management practices (mode of husbandry,

supplementation, milking, health monitoring), brings out a clear structure: the first axis concentrates 95.2% of the variance. The farms range along a single intensification gradient, which the clustering divides into three well-separated classes three segments of one progression rather than watertight categories (Figure 1).

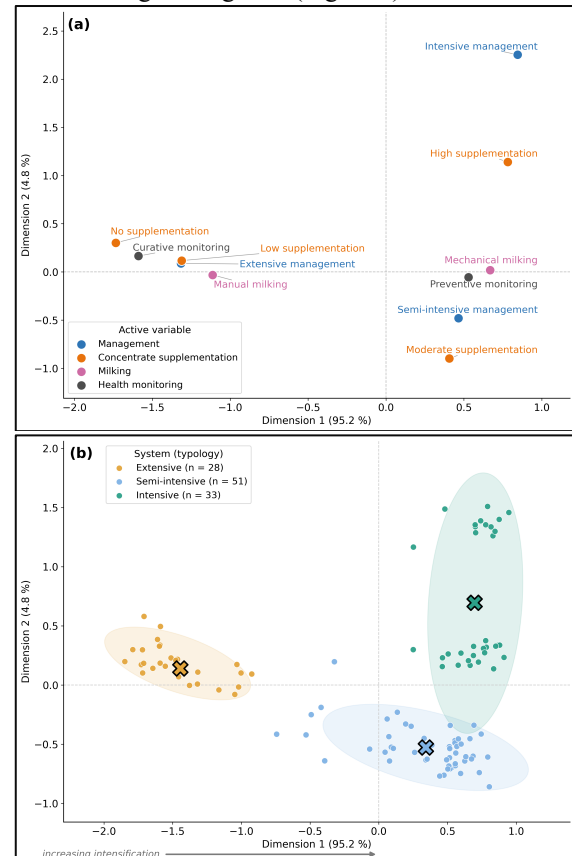


Figure 1. Multiple correspondence analysis (MCA) of the four management practices (axis 1: 95.2% of the variance). (a) Map of the active modalities (management, supplementation, milking system, health monitoring). (b) Positioning of the 112 farms by the three systems derived from clustering (extensive, semi-intensive, intensive); centroids as crosses, dispersion ellipses at 2 standard deviations, point dispersion added for legibility. Breed, zone and degree of integration projected as supplementary variables (not shown).

The extensive system (28 farms, 25%) combines low or no supplementation, curative monitoring and manual milking, almost always of the local BLL breed; the semi-intensive one (51) rests on moderate supplementation, preventive monitoring and mechanical milking, around the crossbred BLA; the intensive one (33) brings together high supplementation, intensive management and the modern BLM breed (28 of 33).

Milk yield follows this bundle closely: it is most strongly associated with breed, ahead of supplementation, management, milking, forage type and health monitoring, all these associations being highly significant ($P < 10^{-9}$); the median yields of

the three systems order themselves accordingly, at 5, 11 and 17 L (Figure 2). The agro-ecological zone, by contrast, is not associated with yield ($P = 0.057$).

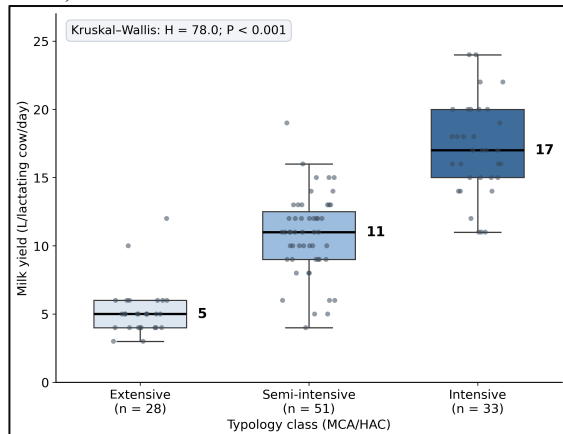


Figure 2. Milk yield (L per lactating cow per day) by typology class from the MCA/HAC ($n = 112$). Boxes show the median and interquartile range; points represent individual farms (horizontal dispersion added for legibility). Significant overall difference (Kruskal–Wallis: $H = 78.0$; $P < 0.001$).

Two lessons stand out. First, the gradient owes nothing to location or to herd size: the zone does not separate the classes ($P = 0.63$), and neither does herd size ($P = 0.07$; medians of 8, 11 and 11 lactating cows, the extensive one slightly smaller). The divide rests on practices and the level of inputs, in the image of the Algerian typologies that order farms by resources and feeding rather than by territory (Yerou et al., 2019; Bousbia et al., 2024). Second, breed a supplementary variable follows this gradient without having served to draw it: the practices alone reproduce an almost identical partition. Genetic choice and management therefore covary closely. This intensification is nonetheless not enough to express the milk potential: even the intensive group reaches only a median of 17 L/lactating cow/day, below what the modern breeds within it allow. The Algerian literature reads this as a fallback on concentrate costly and poorly converted rather than a base of quality forage. At Tizi-Ouzou, yield reached only about 13.3 kg/lactating cow/day for a potential of 26.8 kg/day, with concentrates already covering 61% of the energy (Abdelli & Iguer-Ouda, 2017); in the semi-arid west, the group consuming the most concentrate combined the lowest yield with costs amounting to 80% of the production cost (Yerou et al., 2019). Socio-economic reading overlays this gradient. The intensive group stands out for more advanced education (only there are the farmers with higher education found, 8 of 33), more frequent land ownership (11 of 33) and constraints turned more towards the downstream (collection and price, 12 of 33). The extensive one, conversely, gathers 16 of the 17 landless farms in the sample, cites land

as its main constraint in 57% of cases and shows the shortest schooling (Table 2).

Table 2. Profile of the three systems derived from the typology (MCA + HAC).

	Extensive ($n = 28$, 25%)	Semi-intensive ($n = 51$, 46%)	Intensive ($n = 33$, 29%)
Milk yield, median (L/LC/day)	5	11	17
Lactating cows, median	8	11	11
Calving interval, median (months)	15	14	14
Dominant breed	BLL (26/28)	BLA (42/51)	BLM (28/33)
Supplementation	none/low	moderate	high
Milking system	manual	mechanical	mechanical
Health monitoring	curative	preventive	preventive
Median formal capture (%)	13.1	31.5	26.6
Socio-economic features	16 of 17 landless; land 57%; short schooling	intermediate profile	higher education (8/33); ownership (11/33); collection–price (12/33)

LC: lactating cow. 'Median formal capture': median share of milk delivered to the formal channel within the class.

Cultivated forage calls for caution. The crude gradient is clear (9 L without forage, 14 with barley, 22 with alfalfa), but it tracks the intensification hierarchy, alfalfa being the signature of the most intensive group (its seven growers are all BLM and heavily supplemented). The gap does not vanish under controlled intensification, however: within BLM breed and high supplementation (28 farms), forage still separates yields ($P = 0.004$), the advantage lying with alfalfa (median 22 L against 16.5 for barley, $P = 0.0014$); since barley there does no better than the absence of forage, the signal points to the quality of the legume rather than to the crop as such. With seven farms, we offer it as a lead, not an established result. This crop is, moreover, tied to land-tenure security: farms under individual ownership grow forage five times more often than the others (odds ratio ≈ 5.0 ; P

= 0.003), and the seven alfalfa plots all fall under ownership (5) or an EAC/EAI concession (2), never the landless or tenants. Alfalfa, being perennial, becomes profitable only after several years: without secure title all the more so under tenancy, where food crops take priority this investment stays out of reach. The weak autonomy of the 'forage' signal may thus reflect this coupling with land tenure as much as the small size of the sub-sample.

3.3. Integration into the formal channel is decoupled from performance: the sole correlate is land tenure

The clearest result of the diagnosis is a decoupling. The degree of integration into the formal channel is associated neither with milk yield, nor with herd size, nor with technical class ($P = 0.58, 0.60$ and 0.33 , respectively): in the MCA, neither the zone nor the integration level characterises the classes. Producing more does not go hand in hand with delivering more to the formal channel herd performance and market integration follow distinct logics. This runs counter to approaches that tie marketing directly to the technical typology. In the same vein, at national level, Mamine et al. (2021) note that, despite public support measures, the collection of local milk remains limited. The question therefore shifts: what is access to the formal channel associated with?

Setting milk yield against the main reported constraint, the ordinal regression retains a single factor: the land-tenure constraint is associated with roughly 70% lower odds of a higher integration level (OR 0.31; $P = 0.019$), whereas milk yield plays no part the decoupling thus holds within the model itself (Figure 3). The proportional-odds assumption is not rejected (Brant, $P = 0.27$), and the land-tenure effect keeps the same direction under both robustness specifications (fractional logit and Firth decomposition; details in Figure 3 and the robustness note below).

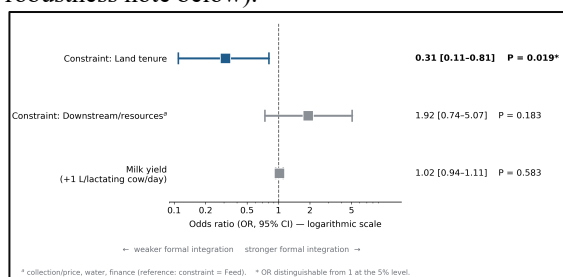


Figure 3. Factors associated with the degree of integration into the formal channel (proportional-odds ordinal model, $n = 112$). Odds ratios (OR) and 95% confidence intervals (profile likelihood); the 'Feed' constraint serves as the reference; an OR < 1 indicates weaker formal integration. Land-tenure constraint OR 0.31 [0.11–0.81] ($P = 0.019$); downstream constraint OR 1.92 [0.74–5.07] (n.s.); milk yield OR 1.02 [0.94–1.11] (n.s.). Brant omnibus test not significant ($P = 0.27$), consistent with the proportional-odds assumption.

Note (robustness). Fractional logit on the continuous formal share (binomial quasi-likelihood, robust standard errors): the land-tenure constraint remains associated with a lower formal share, including after controlling for milk yield ($P = 0.033$); predicted shares: land-tenure constraint 19% [13–27], feed 31% [24–38], downstream 37% [30–45]. The Firth-penalised two-part decomposition confirms the direction of this effect at the entry threshold into the formal channel.

This correlate calls for a cautious reading, one the cross-sectional design cannot settle. The two ways of capturing land tenure the reported constraint and tenure status overlap unambiguously: the 35 farms that cite land as their main constraint are all under insecure tenure, and no titled owner does so; the converse does not hold, since only some insecure-tenure farms (mostly the landless and tenants) perceive it this way. The reported constraint therefore captures the most acute form of land-tenure insecurity. The absence of a property title discourages long-term investment, complicates access to support and development programmes (FAO, CIHEAM-IAMM and INRAA, 2021) and restricts access to credit where land-based collateral is lacking (Baroud et al., 2018); yet durable entry into the formal channel is precisely what calls for upgrading investments a cooling tank, compliance works, approval. The adjusted formal share is markedly lower here ($\approx 19\%$, against 31 to 37% under the other constraints). Land-tenure insecurity, moreover, weighs not only on market access: the farms concerned also post a lower milk yield (9 against 12 L/lactating cow/day; $P = 0.005$), precarious tenure curbing investment in forage and leaving irrigated land to more remunerative crops. It thus burdens both production and market integration two penalties decoupled from each other, since yield and integration do not vary together. Financial support, however, does not suffice to lift the land constraint: the National Agricultural Regulation and Development Fund (FNRDA) was associated with a 69.9 % rise in beneficiaries' milk production (Ghozlane et al., 2010), whilst the absence of titles and land fragmentation continue to hold back programme uptake and investment (Akerkar, 2015); support stimulates production, but does not replace the securing of land tenure.

3.4. Unstable participation in the formal channel over time (2014–2023)

The cross-sectional diagnosis fixes an image at a single moment; the collection register allows its trajectory to be followed over ten years, and reveals a channel that is not only shallow but unstable, on three levels that echo one another. The collection landscape is, first, shifting. Eleven dairies operated in the area over the period, but rarely for long: four appear in only one or two years before vanishing, as agreements are signed and then not renewed. The

number of farmers actually captured each year reflects this volatility: from close to 200 in 2014 to 132 in 2023, with a marked contraction in 2020 and 2021 (90 then 48 farmers), coinciding with the health crisis and corresponding to a real retreat of collection. Presence in the formal channel then erodes quickly, and above all by fits and starts (Figure 4A). Among the farmers registered in 2018, 86% still are in 2019, but only a third in 2023, after the 2020–2021 trough; a year after registration, between 14 and 43% have already reverted to informal channels depending on the year. The clearest fact, however, is not exit but the coming and going: among the farmers present in at least two years, at least 28% and up to 53% if the 2020–2021 contraction is included make at least one formal → informal → formal round trip. Participation is therefore not an acquired status but a decision renewed year on year. The truly stable core, finally, is a minority within the register: since the survey targeted active formal suppliers, the surveyed farms listed in the register make up a near-census of it; compared with the rest of the register, they stand clearly apart (Figure 4B): 80% were still delivering to the formal channel in 2023, against 17% of the other farmers, for a median presence of five years against two. The stability read in cross-section thus characterises this segment, not the sector as a whole; and the weak integration observed only stands out the more for it: even among farmers chosen for their link to the formal channel, the share delivered stays a minority (median 24%).

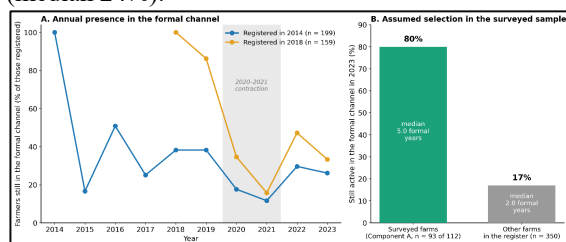


Figure 4. Participation in the formal channel (DSA register, 2014–2023): (A) annual presence, over the following years, of the farmers registered in a reference year; (B) comparison of the surveyed farms with the rest of the register (share still active in 2023, median duration of formal presence).

This irregularity in deliveries to the formal channel is, in our view, the mark of a financial calculation, an interpretation consistent with the workings of the sector and one our longitudinal data illustrate. The informal channel pays cash, and often at a higher price: in 2023, uncontrolled raw milk sold at between 80 and 90 DA/L, whereas the formal channel, represented by the dairies, offered a producer price of 30 to 80 DA together with a premium raised to 14 DA/L for the producer and 5 DA/L for collection, but subject to payment delays and compliance requirements (Cour des comptes, 2024). On the processors' side, the reckoning is much the same: subsidized imported powder works

out cheaper than buying local raw milk, which turns the dairies away from collection, and this has not reversed despite the schemes supporting national production (Makhlouf and Montaigne, 2016; Mamine et al., 2021). The farmers' intermittency and the processors' disengagement thus emerge as two sides of a single trade-off.

4. Conclusion

The analysis of the dairy cattle system in the wilaya of El Tarf reveals three largely independent patterns. Milk yield follows a gradient of intensification (breed, supplementation, management, milking), unrelated to location or herd size. Integration into the formal channel does not follow technical performance: it has only one structural correlate, namely the land-tenure constraint, which discourages long-term investment, restricts access to support and development programmes, and limits financing particularly credit whilst sustainable entry into the formal channel precisely requires such upgrades. Finally, this integration is not a permanent state but a decision renewed year on year; the register reveals pronounced intermittency, reflecting a trade-off between the premium of the formal channel and the immediate liquidity offered by informal sales. Focusing on active formal suppliers, the survey first describes this segment; relative to the register as a whole, this core group is in the minority, which limits the scope of the analysis to this fringe of the sector. For the sector, the key to integration is not primarily productive but structural: securing land tenure and access to finance, ensuring regular collection and prompt payment these are the factors that would underpin sustainable integration into the formal channel, more reliably than support for production alone; support for forage self-sufficiency, on the other hand, would primarily boost yields. By linking the technical assessment of farms to their trajectory within the collection system, this study sheds light on a blind spot in Algerian dairy typologies; a longitudinal study of the individual determinants of this intermittency would be needed to explore this further.

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