

Original Research Paper

Typology and practices of dairy cattle farming in northwestern Algeria

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Abstract

A survey of dairy cattle farms was carried out on the basis of a representative sampling over a radius of 80 km from two large dairies in north western of Algeria in the Wilayas of Mascara, Mostaganem, Oran, Relizane and Sidi Belabbès. It aims to identify the situation of dairy cattle farming to understand the technical running of the farms and then analyze different practices and strategies put in place for their management. More than one hundred breeders responded to a questionnaire allowing the collection of a large amount of data on structural variables and breeding practices in relation to the hygienic conditions of milking. The final study sample counted 2127 head of cattle, including 1146 dairy cows, of which 1025 were in the lactation stage. The average number of dairy cows per farm was 21.91 ± 15.15 . The average number of lactating cows was 10.67 ± 7.67 . It was noted that 96% of farms have imported cattle breeds, in particular Prim' Holstein (75%) and Pie-rouge des Plaines (20%). Daily milk production varied from 30 to 740 liters/day per farm, with an average of 179.71 ± 14.94 liters/day per farm. The minimum quantities observed varied from 6 to 25 liters/day per dairy cow with an average of 10.77 ± 0.43 liters/day per cow, and the maximum quantities recorded varied between 10 and 45 liters/day per dairy cow with an average of 18.28 ± 0.92 liters/day per dairy cow.

Keywords: Dairy cattle; Farms; Breeding practices; Questionnaire; Milking.

المخلص

تم إجراء دراسة استقصائية لمزارع الأبقار الحلوب من خلال عينة ممثلة على مدى 80 كم من اثنين من أكبر مصانع الألبان في غرب الجزائر في ولايات معسكر، مستغانم، وهران، غليزان وسيدي بلعباس. ونهدف إلى تحديد الوضع الحالي لتربية الأبقار الحلوب من أجل فهم تقنيات عمل المزارع ثم تحليل الممارسات والاستراتيجيات المختلفة الموضوعية لإدارتها. أجاب أكثر من مائة مربي على استبيان يسمح بجمع كمية كبيرة من المعلومات حول المتغيرات الهيكلية وممارسات الإنتاج الحيواني المرتبطة بالظروف الصحية لإنتاج الحليب. وبلغت عينة الدراسة النهائية 2127 رأس بقر منها 1146 بقرة حلوب و 1025 في مرحلة الإرضاع. كان متوسط عدد الأبقار الحلوب لكل مزرعة 21.91 ± 15.15 . كان متوسط عدد الأبقار المرضعة 10.67 ± 7.67 . لوحظ أن 96% من المزارع قد تستغل سلالات بقر مستوردة، ولا سيما Prim' Holstein (75%) و Pie-rouge des Plaines (20%). (تراوح إنتاج الحليب اليومي من 30 إلى 740 لترًا / يوم لكل مزرعة، بمتوسط 179.71 ± 14.94 لترًا / يوم لكل مزرعة. تراوحت الكميات الدنيا التي تمت ملاحظتها من 6 إلى 25 لترًا / يوم لكل بقرة حلوب بمتوسط 10.77 ± 0.43 لتر / يوم لكل بقرة، وتراوحت الكميات القصوى المسجلة بين 10 و 45 لترًا / يوم لكل بقرة حلوب بمتوسط 18.28 ± 0.92 لتر / يوم لكل بقرة حلوب.

الكلمات الرئيسية: أبقار حلوب؛ مزارع؛ ممارسات الإنتاج الحيواني؛ استبيان، إنتاج الحليب.

Introduction

In Algeria, milk and its derivatives constitute basic products in the consumption model (Djemali, 2020) and are essential to compensate the deficit in animal proteins in human alimentation (Timeridjine and Chitti, 2023). With a continuously increasing annual consumption estimated at 157 kg/inhabitant/year (Lazereg *et al.*, 2020), which represents more than 6 billion liters-equivalent-milk per year, Algeria is the second largest milk importing country in the world (Bessaoud *et al.*, 2019). Knowing that local milk production is largely ensured by cattle (more than 80%) (Bencharif, 2001), and that the national production of cow's milk comes up against many problems of technical management (Yozmane *et al.*, 2019), our country sees itself obliged to invest rigorously in the quantitative and qualitative improvement of this production to satisfy daily consumption needs of its inhabitants, especially when we know that local milk production depends on a dairy cattle breeding system which is not clearly identified (Madani and Mouffok, 2008; Belhadia *et al.*, 2009),

and it is essential to clearly identify it today by referring to a vision that considers as closely linked, within a complex system, human activity and the bio-technical functions of animal production unit (Dedieu *et al.*, 2008) to manage it well by improving breeding practices that guide and regulate the production process by acting on it at various levels, from upstream (interventions on the farming environment and the resources operated) to downstream (productions)(Landais, 1994). Identifying the situation of dairy cattle farming can help to understand the technical running of the farms and then analyze different practices and strategies put in place for their management, it provides initial data required to develop dairy cattle breeding in the framework of national programs and political mechanisms that aims to build a self-sufficient and solid dairy sector, by improving farm performance to increase production and reduce the bill import of powder milk.

Materials and Methods

Structured Questionnaire

To understand how dairy farmers define farming practices and their notion of farming systems, a simple questionnaire was designed and simple questions were selected to facilitate the collection of data about qualitative and quantitative variables concerning both the structure and the operation of the farms.

Sampling

The sampling of farms was designed mainly to respond to the objective of representativeness of the diversity of local dairy cattle farms supplying two major dairies in the north of western Algeria. Our sample was composed of 100 farms located in five major dairy basins in western Algeria, on five wilayas (Mascara, Mostaganem, Oran, Relizane, and Sidi Bel Abbès) (Fig. 1).

Conduct of the interviews

Surveys were carried out with the help of officials from major dairies in the west, in particular (Sidi Saada from Relizane and Tessala from Sidi Bel Abbès) but also from ONIL (National Interprofessional Office for Milk and Dairy Products) and local agricultural officers. Visits were organized along 2014 to 2017 period, during which questionnaires were completed by data on the typology of the farm, feeding, herd management, reproduction, milk production, conditions for milking, storage and transport of milk, and the health status of the herd on the farm. The presence on the farms also made it possible to collect certain data by simple visual observation in order to be able to complete the questionnaires as fully as possible.

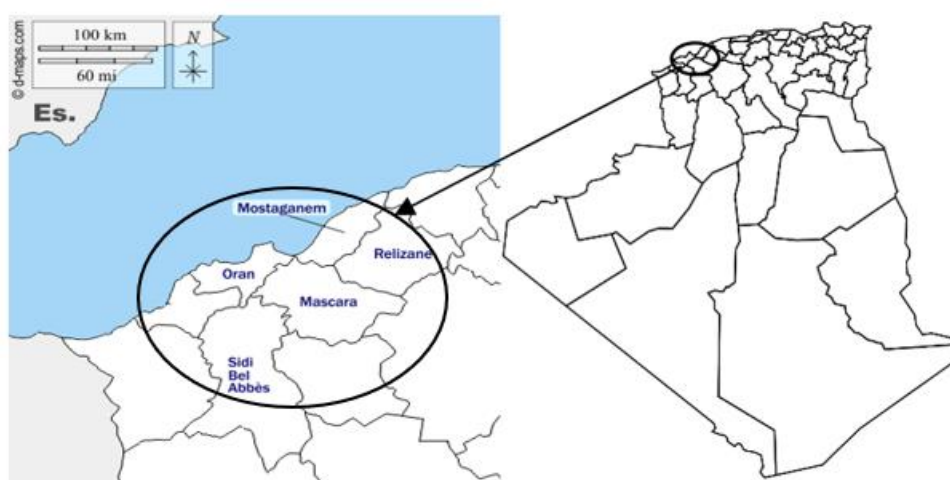


Figure 1. Geographical location of sampling areas in western Algeria

Questionnaire analysis

Data collected on the questionnaires were statistically processed with the XLSTAT software with R version 2021. The answers were grouped according to the main axes of the questionnaire to study the structure of the breeding, the size and composition of farms, the design, layout and hygiene of livestock

premises, livestock feeding, reproduction, production, storage and transport of milk, milking conditions and health status of the herd and prophylactic measures.

Results

Structure and administrative situation of dairy cattle farms

Results show that the majority of farms are conducted on agricultural land whose legal nature can be private or state property as family farms (92%) practicing intensive cattle breeding. All the farms visited implemented animal identification by ear tags and had the health approval issued by the competent veterinary authorities required to deliver the milk produced to processing units. None of them belongs to any associative organization or had a breeding or an animal identification registers, and no insurance was taken out for their breedings (Table 1).

Table 1. Structure and administrative situation of dairy cattle farms

	Familial	Other
Nature of exploitation	92	08
Administrative organization	Presence	Absence
Breeding approval	100	00
Insurance	00	100
Breeding register	00	100
Breeders Association	00	100
Animal identification records	00	100
Ear tag identification	100	00
Presence of other animal species	96	4

Farm size and composition

The study sample counted 2127 head of cattle, including 1146 dairy cows, of which 1025 were in lactation. The number of young was 559 including 295 male and 264 female calves. Farms also had 133 breeding animals and 289 heifers (Table 2). The average number of dairy cows per farm is 21.91 ± 15.15 , with 75% of farms having less than 25 dairy cows (Fig 2). The average number of lactating cows was 10.67 ± 7.67 , and 75% of farms had fewer than 12 lactating cows. It should be noted that 96% of farms have imported cattle breeds, in particular Prim' Holstein (75%) and Pie-rouge Des Plaines (20%).

Table 2. Number of animals on the farms surveyed

Component	Numbers			
Cows	1146 of which 1025 in lactation stage			
Heifers	289			
Breeders	133			
Male calves	295			
Female calves	264			
Total	2127			
Breeds exploited (percentage)	Prim' Holstein 75%	Pie rouge 20%	Tarentaise 1%	Others 4%

Design, layout and hygiene of livestock premises

Results (Table 3), show that 99% of the farms are run in tie-stalls with no foot-baths. Visual observation showed that in 92% of the farms the environment was not very clean, even if 97 barns were well concreted and the breeders made extensive use of dry litter (95%). It was also noted that the majority of the barns did not have calving premises (96%), and the young calves are separated in boxes defined as a nursery (96%), subsequently the young cattle do not have specific premises and are mostly left with the rest of the herd in spaces considered as exercise areas (Zriba) present in 98% of farms.

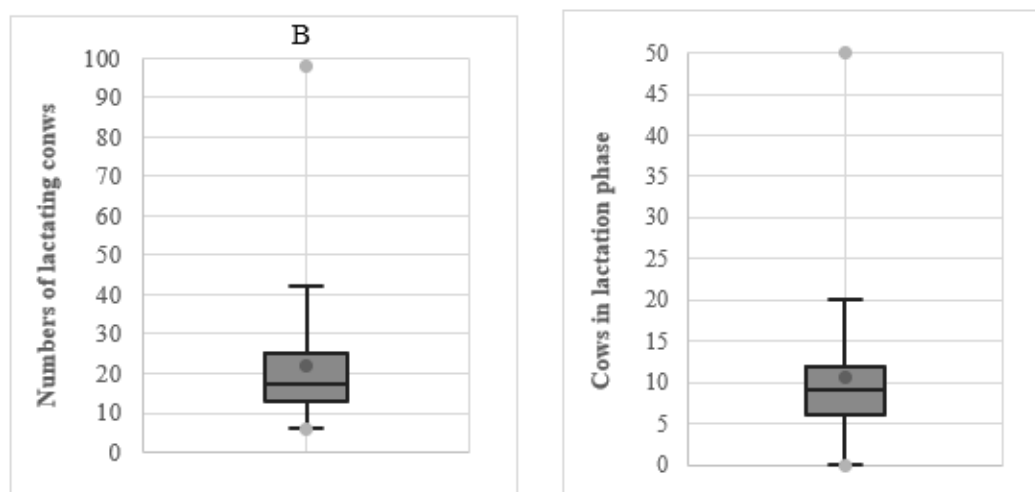


Figure 2. Box plot of numbers of lactating cows and cows in lactation stage

Area of barns

The surface area of the barns shows very variable values from 30 to 1500m² depending on the size of the farms, with an average of 236.89 m², 75% of breeders have barns with an area of less than 252.5m² (Fig 3).

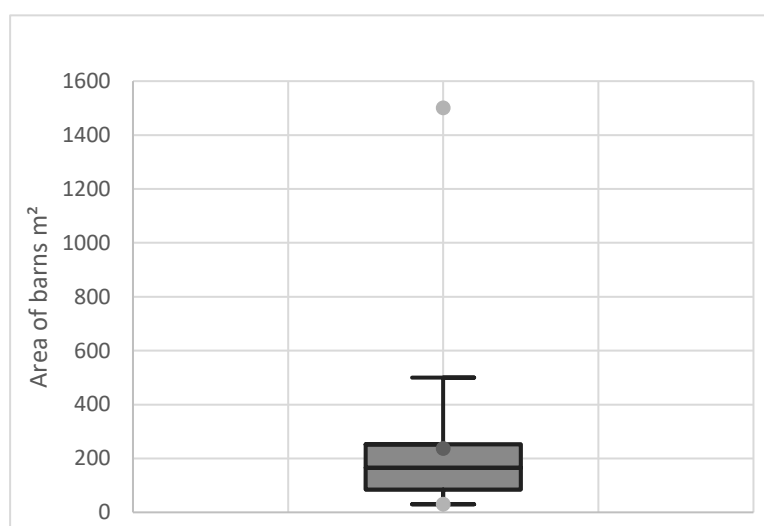


Figure 3. Area of barns

Livestock watering and feeding

Survey (Table 3) shows that trough watering is practiced by 96% of farms that are totally dependent on wells. The number of meals is 02 per day. Grazing is practiced by only 15% of farms. The basic ration is essentially made up of green maize (33%), sorghum (72%), hay (100%) and straw (30%) depending on the season and the availability of the food in question, whereas the production ration is essentially composed of concentrate feed (100%) and soya (22%). Finally, it turns out that only one farm uses a salt lick for dairy cows.

Milking conditions, production, storage and transport of milk

Even no milking parlor was found in 99% of farms (Table 3), almost totally breeders affirmed the use and observance of good hygiene practices such as washing the teats with hot water, disinfecting the teats before milking, the wiping of the teats with cloths and the elimination of the first jets of milk. The use of a teat soaking gel after milking is a practice observed in only 4 farms. Data on milking and milk production show that recording of milk production is lacking in 99% of the farms. Mechanical milking by trolley is practiced in 74% of the farms which have refrigerated tanks for 48% of them. The use of drums for storage is a common practice among 58% of farmers. It is also noted that almost all the milk

produced is delivered to local dairies (97%). Overall daily milk production was varying from 30 to 740 litres/day with an average of 179.71 ± 14.94 litres/day. The minimum quantities observed varied from 6 to 25 litres/day per dairy cow with an average of 10.77 ± 0.43 litres/day per cow, and the maximum quantities recorded varied between 10 and 45 litres/day per dairy cow with an average of 10.77 ± 0.43 litres/day per cow. average of 18.28 ± 0.92 litres/day per dairy cow. Fig. 4 shows the variation intervals for these observations. We can clearly see that 75% of the population studied has an overall daily production per farm of 230 liters, with a minimum quantity of 14 liters and a maximum quantity of 25.25 liters with medians respectively of 140, 10.00 and 15.50 liters.

Table 3. Watering, feeding, design, layout and hygiene of livestock premises

Aspects	Answers	
Stalling	Free	Restrained
	01	99
Footbath	Presence/Yes	Absence/No
	00	100
Environmental cleanliness	08	92
Concrete stall	97	03
Litter presence	95	05
Farrowing room	04	96
Nursery	96	04
Young cattle room	01	99
Exercise area	98	02
Milking parlor	01	99
Food storage room	99	01
Trough watering	96	04
Grazing	15	85
Basic ration	Green Maize, Sorghum , Hay and Straw	
Production ration	Concentrate feed, Soya	
Milking Parlor	01	99

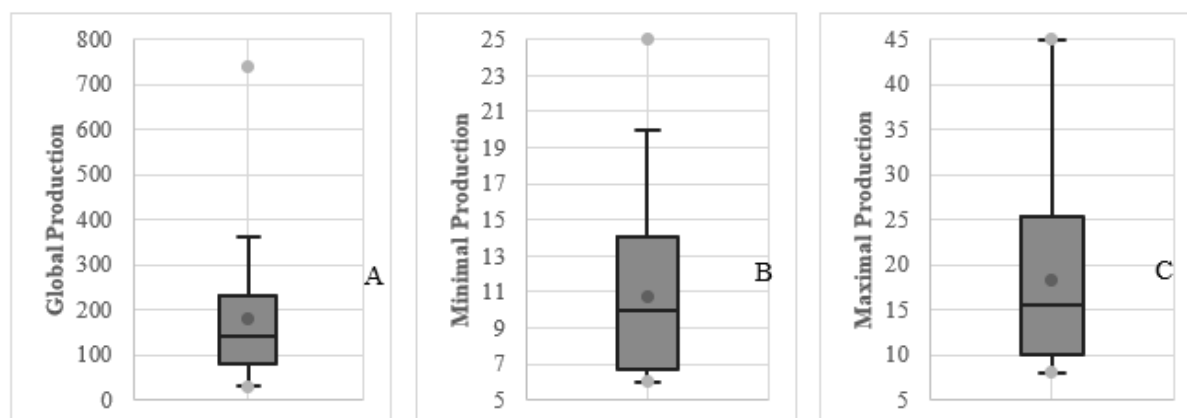


Figure 4. Box plot of the amounts of produced milk (A : Global, B : Minimal, C : Maximal)

The reproduction

Breeders do not keep records of matings and calvings for 98% of them. They mostly put the heifers to breeding at an age between 18 to 24 months, with a calving-calving interval of 12 to 15 months. They resort to natural mating in 85% of cases, by breeding stock in 93% of cases, against only 15% for artificial insemination.

Health status of the herd and prophylactic measures on the farm

Despite the absence of records of the state of animal health in 98% of the farms, the responses obtained report almost systematic screening for brucellosis and tuberculosis (96%). It is the same for the anti-

mouth disease vaccination practiced at 98%. External deworming is practiced as a preventive measure at 96% of farms. Mastitis is detected in 85% of farms. Cases of abortions, embryonic mortality and lameness have been reported without being able to quantify them.

Discussion

Among the most alarming findings of our work, we can cite the absence of animal identification registers, which constitute the starting point of any study of zootechnical and economic performance (Bouzebda, 2007), this situation is a serious obstacle to any desire to improve local breeding, because it makes the collection of animal-related events uncertain, and sometimes erroneous (Ghoribi *et al.*, 2015). This reality has a direct impact on the management of farms and therefore the conduct of livestock farming (Kadi, 2007).

Results found for the characterization of dairy cattle farming in our work are similar to those given in northern Algeria which defined it as an intensive farming model (Boubekeur, 2010) conducted on a family-type farm (Kadi, 2007) in areas with high irrigation potential around urban agglomerations (Kali *et al.*, 2011) with high availability of fodder resources (Djermoun *et al.*, 2018) and based on the exploitation of modern dairy cattle (Belhadia *et al.*, 2009; Boubekeur, 2010) or dairy cattle improved from crossing local breeds with modern imported breeds (Bencharif, 2001).

The great variability in the number of dairy cattle herds in the sample, is representative of local farms as noted through the studies carried out by (Abdeldjalil, 2005; Mansour, 2018; Yerou *et al.*, 2019). It is also established that the number of dairy cows often constitutes half of the total numbers (Bouzebda, 2007; Kaouche-Adjlane, 2015). In addition, several researchers consider that dairy farms in north western Algeria are mainly made up of the Pie Noire breed, represented largely by animals from the importation of the Prim' Holstein breed (Ghozlane *et al.*, 2003; Belhadia *et al.*, 2009; Kaouche-Adjlane, 2015) known for its milk production capacities (Ferrah, 2000; Dezetter *et al.*, 2019).

Very similar results confirm that animal housing is stables built all in solid and designed for cattle breeding where the rooms milking are absent, milking is practiced within the barn. Tie-stall is adopted in almost all farms (Ghoribi, 2011; Kaouche-Adjlane, 2015). The question of barn hygiene raises the same remarks (Mansour, 2018). Abdeldjalil (2005), notes that almost 80% of farms have only one livestock building in which it is impossible to separate animals of different ages or physiological stages (bulls, heifers, calves, cows lactating, postpartum cows, etc.), or to quarantine sick animals. In addition, the same scale of variability in barns' surface is also noted by (Mansour, 2018) within a sample of 120 farms where 60% of the barns were less than 100 m².

Several studies have undertaken the issue of feed in Algerian dairy cattle farms, they have agreed on the fact that this issue is crucial for milk production and the reproduction of the herd (Ghozlane *et al.*, 2003) and constitutes the major constraint that opposes the extension of livestock farming (Djermoun *et al.*, 2018). But in reality, in the farms surveyed, there is no reasoning for the feed ration (Boubekeur and Benyoucef, 2014) which is different from one region to another and from one farm to another, with a dominance rations based on oat vetch hay and concentrate (Ghozlane *et al.*, 2003). Diet of dairy cows is highly dependent on concentrated feed, which represents a significant part of the overall energy intake (Belhadia and Yakhlef, 2013), but whose high prices generate financial difficulties responsible for the low levels of production (Boubekeur and Benyoucef, 2014). By other side, food systems depend on fodder production, which remains dependent on climatic conditions and cropping patterns (Ghozlane *et al.*, 2003). Zootechnical monitoring, local supervision and rationing are determining factors in improving dairy productivity and barn profitability, in a context marked by the scarcity of endogenous food resources on farms (Belhadia and Yakhlef, 2013).

Control of reproduction is a determining factor in the economics of breeding (Kaouche *et al.*, 2012), stemming from the know-how of the breeder (Abdeldjalil, 2005). The figures quoted above express poor breeding behavior which reduces the profitability of farms and slows down the renewal of livestock (Kaouche-Adjlane, 2015). This situation is aggravated by the absence of recordings of all the observations related to reproduction which make it possible to manage it (Bouzebda *et al.*, 2006).

The age of breeding of heifers, is still far from the desired goal of 12 months (Lefebvre *et al.*, 2004). To reduce the generation interval and the period of unproductive life and thus the expenses related to their

breeding which poses also the problem of staff renewal (Abdeldjalil, 2005).

The interval between two calvings collected is the most interesting technical and economic criterion in milk production; the objective being to produce one calf per cow per year (12 months) (Abdeldjalil, 2005). The results collected are rather acceptable, even if a delay of three months can cause losses in terms of milk production (Abdeldjalil, 2005). Studies published in Algeria report even longer calving-calving intervals (Bouzebda et al., 2006; Belhadia et al., 2009) far from the economic optimum, which highlights the management problem within herds (Abdeldjalil, 2005).

The data collected on the mode of insemination are confirmed by several authors who note that natural mating remains the dominant mode of insemination in the majority of farms and point to shortcomings for the practice of artificial insemination (Boubekeur, 2010; Boubekeur and Benyoucef, 2014; Mansour, 2018).

Data on milk production are significantly similar to those found in the literature on dairy production in Algeria (Ghozlane *et al.*, 2003; Mouffok, 2007; Ghoribi, 2011; Belhadia and Yakhlef, 2013; Mansour, 2018) who generally consider that these quantities are below the real potential of the dairy cows used (Kadi, 2007; Boubekeur and Benyoucef, 2014; Yerou et al., 2019) and generally attribute this situation of non-performance to a poor combination of the various production factors and a low level of supervision and technical support to breeders (Ghozlane et al., 2003), but also to poor breeding practices (Ghoribi, 2011; Mansour, 2018; Meskini *et al.*, 2021) and finally to a diet that is either deficient or of poor quality but essentially inefficient (Mansour, 2018).

Results about hygienic milking conditions are far from unanimous among some researchers who point the lack of hygiene practices as a major risk factor for the health status of the udder (Kadi, 2007; Ghoribi, 2011; Bouzid *et al.*, 2011; Ghazi and Niar, 2011; Boubekeur and Benyoucef, 2014).

The observations of the health status of the herd and prophylactic measures on the farm are very close to those published by (Ghoribi, 2011) who considers that more than 80% of breeders adopt a prophylaxis plan (deworming, disease screening and vaccination against foot-and-mouth disease). In Algeria, a health approval issued by the veterinary services of the Department of Agricultural Services of the Wilaya is required for each dairy cattle farm intended to deliver its milk production to a dairy processing unit (Belhadia et al., 2009) provided that screenings for brucellosis and tuberculosis are carried out by veterinarians from the competent agricultural department (Interministerial Orders of December 26, 1995, OJDPAR n°65 of 30-10-1996 setting the specific prevention and control measures for bovine brucellosis and tuberculosis and OJDPAR n°21 of 6 March 1999 relating to the control measures applicable in the event of foot-and-mouth disease).

Conclusion

Our study by survey carried out among a hundred of cattle breeders in northwestern Algeria confirms the knowledge already established across the country concerning the flagrant lack of training of breeders in the management skills of cattle farms which remain for to say the least, below the threshold of economic efficiency.

However, in order to be able to improve the situation, we must first bet on a human factor that controls the biotechnical functions of animal production unit to manage it well by improving breeding practices by acting on it at various levels, from upstream to downstream.

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