SEASONAL TRENDS AND BREEDING PRACTICES THAT INFLUENCE THE PERFORMANCE OF IMPORTED DAIRY COWS IN NORTH OF ALGERIA

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ABSTRACT

The aims of this study was to determine and evaluate zootechnical performance in Prim' Holstein and Montbeliard cows imported. A total of 2421 records, collected between 2018 and 2021, from 155 herds, were used for this study. The zootechnical traits studied were: body score condition (BCS), calving rank (CR), lactation length (LL)daily milk production (DMP), heifer age at first calving (HC), days from calving to first insemination (DCFI), days from first insemination to conception (DFIC), calving interval (CI), number of inseminations per conception (NIC) the success rate at first insemination (SRFI). The factors examined were BCS, calving season. Data shows that the BCS was of 3.03 ± 0.17. The heifer age at first calving was 36.52 ± 5.70 months, a calving rank of 3.5±1.25, calving interval was 423.17 ± 13.58 days, the number of inseminations per conception was 3.07±1.05, an average summer and spring daily milk production of (30.84 ± 12.80 versus 52.77 ± 9.50) liters respectively. Results showed that the DCFI, CI and DMP traits were significantly influenced by year and season of calving (P<0.01); whereas; NIC and SRFI were significantly (P<0.001) affected by season and year. Furthermore, the breed affect significantly DCFI, SRFI, NIC and MP (P<0.05). Accordingly, the reproductive performances were poor and several points need to be reviewed regarding of the breeding management, the improvement of which can help correct these founds.

KEYWORDS:
Algeria, Dairy cattle, Fertility, Management, Performance

INTRODUCTION

In Algeria, milk self-sufficiency has become a topical problem because of the distortion between needs and production. According to this new census, we will note a decline in the latter, in this case the cattle herd, which goes from 700,000 to 663,563 heads between 2011 and 2019. Algeria imports more than 70% of the available milk and dairy products. It is ranked 2nd world importer of whole milk powder [1]. The livestock sector in Algeria is of prime socio-economic importance and contributes significantly to guaranteeing the country's food security. Following an ever-increasing demand, the dairy world is faced with several constraints and is called upon to achieve several objectives. To do this, several means are available but the results always remain difficult to obtain [2] . Thus, effective management of dairy herd reproduction is undoubtedly one of the most difficult aspects of work to manage to obtain a pregnant cow in the shortest possible time and under the best economic conditions [3].

Reproductive performance is among the most important traits af¬fecting profitability in dairy cattle industry. Poor fertility results in an increase in calving interval, inseminations and veterinary costs, involuntary culling rate and herd replacement cost, as well as a decrease in milk production, and hence a reduction in the herd income [4].

To improve local milk production, Algeria has focused on the importation of pregnant heifers with high genetic potential. However, the expression of this genetic potential remains modest, whether in terms of milk production, reproductive performance or productive life, which is still below the world average, all breeds included [2], [5]. The situation of dairy cattle farms in Algeria is particular due to the fact that the majority of farms are located in semi-arid areas affected for a good part of the year by drought [6]. The search for a compromise between milk production and energy balance, particularly for high-producing dairy cows, is essential The well-being and productivity of cows largely depend on targeted feeding [2]. For this production to be optimal, it is necessary to ensure that water needs are correctly covered and that the supply is suitable.

With this in mind, our study aims to determine and evaluate the zootechnical performance of dairy cows. In addition, we will seek to estimate the influence of reproduction parameters likely on milk production. The results of this study will help the development of a routine collection of fertility and milk production data towards an evaluation system for cow breeding management well.

MATERIALS AND METHODS

Study area. This study was carried out between March 2018 and September 2021 in Souk Ahras, Tebessa and Guelma departments at the North-East Algeria. The study region is located at semiarid bioclimatic stage, they are exposed for good part of the year to desert influences. It is characterized by a hot and dry summer (25° to 40°C) and cold and wet winter (-1° to 15°C).

Data Collection. This study was conducted out in the form of a survey during four years. The choice of farms was essentially based on availability of data and records. Data were obtained from herds composed by animals imported from Europe as well as by those born locally. Cows were raised mainly under a semi-intensive breeding, forages (green or dry), corn silage and concentrates in general compose the ration. It varied according to milk production and stage of pregnancy of cows.

Records had details on breed, identification number, season of calving, body score condition (BCS) at calving, calving rank (CR), heifer age at first calving (HC), days from calving to first insemination (DCFI), days from first insemination to conception (DFIC), calving interval (CI), number of inseminations per conception (NIC) and the success rate at first insemination (SRFI), lactation length (LL), daily milk production (DMP) and herd size.

The body condition score is assigned to the animal based on the appearance of tissue covering bony prominences in the lumbar and caudal regions. Tissue coverage can be estimated by palpation and/or visual inspection [7]. According to a rating grid established by the Technical Institute of Cattle Breeding [2].

Statistical methods. The data were entered into Excel®, then processed by SPSS software version 20. The numerical observations were condensed in the form of arithmetic mean, coefficient of variation and standard deviation. The difference was considered significant at a 5% risk of error, the asymptotic p-value was calculated using an approximation to the true distribution.

RESULTS AND DISCUSSION

The Table 1, the Figures 1, and 2 reports the descriptive statistics for the breeds and reproductive traits studied.

The size of the herd varies from one farm to another, ranging from 8 heads to 52 heads. The rates values of the breeds shows, a dominance of Montbeliard imported (46%) over than the others breeds (29%, 17% and 8%) respectivly for Holstein imported, Montbeliard born locally and Holstein born locally (Figure 1).

The herd in this study is relatively old, with an average calving rank of 3.5 (Table 1). Most of the animals are in their third lactation: 40.% of the total number of cows, and 29.55% are between the first and second lactation, while the percentage of animals with a calving rank of more 3 remains average with 30.45%

The AC of the heifers of this research was of 36.52 months, while the ideal age at first calving accepted is 24 months. It is higher than the founds published by [4], [8] in the Czech Holstein population and [9] in Iranian Holstein cows. The major causes of calving age in heifers include, low growth rate, breeding practices during the pre-pubertal growth puberty and management errors that acts on the development of reproductive organs Dairy farmers profit more when cows calve for the first time at 2 years of age [2].

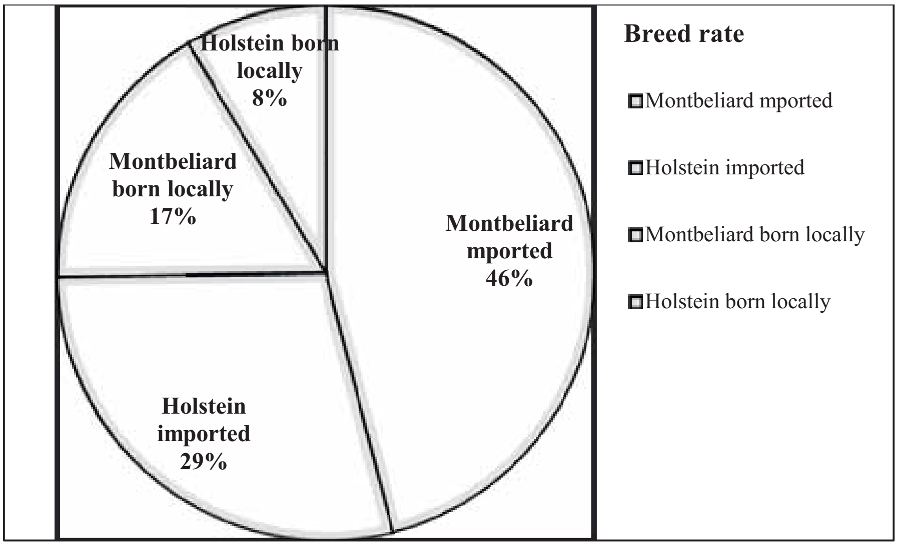

FIGURE 1
Rates of the breeds

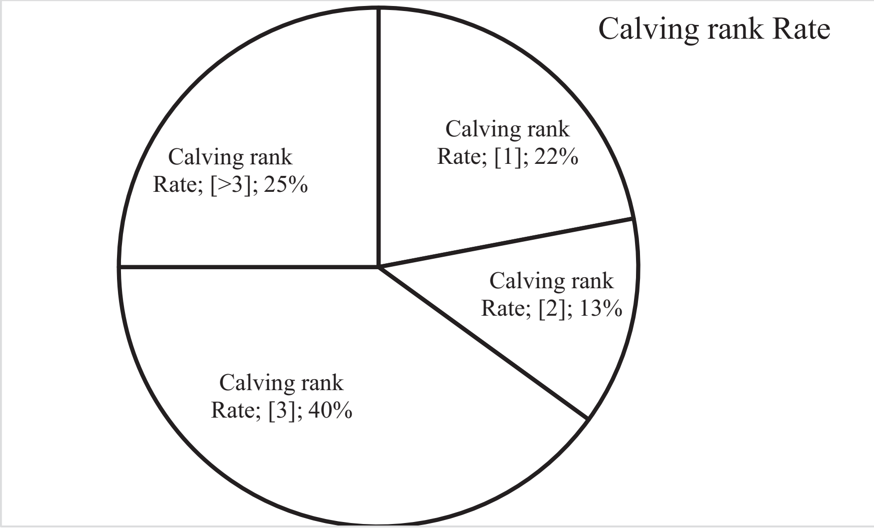

FIGURE 2
Calving rank rate

TABLE 1
The descriptive statistics for the reproductive traits studied

Trait	Mean	Standard deviation	Coefficient of variation (%)
AC (month)	36.52	5.70	54.25
CR	3.51	1.25	1.14
BCS	3.03	0.12	2.25
DMP (liter)	42.22	10.35	21.71
LL (days)	225	10.82	45.26
DCFI (days)	75.72	29.41	33.58
DFIC (days)	100.28	17.73	42.6
CI (days)	423.17	13.54	21.54
NIC	3.07	1.05	47.11
SRFI %	36.00	6.50	27.74

AC: age at first calving, CR: calving rank, BCS: body score condition, DMP: daily milk production, LL: lactation length, DCFI: days from calving to first insemination, DFIC: days from first insemination to conception, CI: calving interval, NIC: number of inseminations per conception and SRFI: success rate at first insemination.

According to [10], the quantity and quality of food at the start of lactation are decisive in expressing production potential. A significant increase in the quantity of milk during the ascending phase is favored, both by a good diet during drying off and at the start of lactation and by a strong capacity to mobilize body reserves.

The BCS of the cows of this study was of 3.03±0.12, scoring body condition makes it possible to indirectly assess the energy status of an animal, by evaluating its surface fattening state [10] reported that cows needs to have a BCS>2.5 in the 1st and in the 2nd months of lactation. Indeed, in lactation as well as in the dry period, scoring body condition at regular intervals of 30 days constitutes a good method for understanding and detecting changes in body condition during these 2 periods, in a meaningful and precise manner, which illustrates the practical interest of such a method [11].. This commonly used method has the advantage of being inexpensive in terms of investment and time. Its reliability remains higher than that of weighing the animal, subject to variations depending on the weight of the digestive reservoirs and the uterus, but also milk production. [12]. A one-point change in body condition score represents approximately 56 kg of change in body weight and 400 Mcal of net energy, on a score scale of 1 to 5 [7]. [13] determined that an increase in calving condition score of 2 to 3 points corresponds to an additional 322 kg of milk produced during the first 90 days of lactation. This growth is less strong (+33 kg) when we go from 3 to 4 points. Beyond that, one state rating point corresponds to a reduction in production of 223 kg. Thus, the female's adipose reserves at calving may be a limiting factor in the ability to express milk potential in cows capable of producing more than 9000 kg of standard milk in 305 days of lactation. For the same authors, the level of milk production is more linked to the use of body fat reserves at the start of lactation than to their level at calving.

[14] described that milk potential and previous milk production have no effect on the risk of the appearance of endometritis or embryonic mortality (EM) at the following calving. Calving rank is, in general, not a significant risk factor for EM [12] and only certain authors find it associated for certain parity ranks. It is mainly first-time cows and cows in second lactation who see their risk of EM increase [14]]. [12] showed that embryonic losses between day 21 and day 42 after insemination are higher in a multiparous cow than in a primiparous one. The BCS appears to be an interesting means for estimating the quantity of metabolizable energy, stored in fat and muscles, and the mobilization of tissue reserves [15]. On the other hand, the condition score itself or its variations are associated with numerous health disorders such as lameness, metabolic disorders (ketosis, milk fever) and numerous reproductive disorders: metritis, ovarian cysts, dystocia, retained placenta and reduced fertility [7].

[14] noted that body condition at calving determines the frequency of difficult calving's, which are more numerous in lean or fat cows compared to cows whose body condition is considered satisfactory (3-3.5). Excessive fat reserves at the time of calving expose the cow to multiple disorders, particularly genital ones, including prolonged gestation, difficult births, uterine inertia at the time of calving or even more retained placentas frequent. According to several research, the body condition score can decrease the insemination rate, influence the success rate of first insemination, fertility and affect the milk production [16], [17], [18]. [12] reported a higher EM prevalence among multiparous females (21%) compared to 12% for primiparous.

Thus, a loss of body condition score not exceeding 1.5 points at 120 days of lactation is associated with an increase in milk production. Beyond 1.5 points of loss, a reduction in production compared to milk potential is observed [13]. Livestock farming is mainly semi-intensive for the population studied. Moreover, according to [19] in most African countries, cattle breeding is conducted either according to the extensive, semi-intensive and/or intensive system.

The LL mean 225±10.82 liter, Indded, [20] reported that the crossbreeding lactation length (205–240 days), are shorter than the pure European cattle.

The literature identifies the postpartum energy deficit as major risk factor for infertility in dairy cattle farming. The causes of degradation are multiple and have not all been clearly identified; it seems that the genetic and phenotypic antagonism between milk production and reproduction plays a major role [2].

Means of the days from calving to first insemination (DCFI), the days from first insemination to conception (DFIC) and calving interval (CI) were 75.72±29.41 days, 100.28±17.73 days and 423.17±13.54 days, respectively. Mean of DCFI in the present research is closer than founds of Iranian Holstein cows (72.9 days) [21], but lower than value of 93.2 days of Tunisian Holstein cows [4], and of 110 days reported by [22] in Chinese Holstein. The DCFI is related to reproductive problems after calving that were not observed early, to poor estrus detection or to the strategy of farmer to delay the first insemination after calving, probably to save on insemination costsor or service inefficiency besides poor feed quality and health care. Mean of DFIC of this study is higher than mean values of 65.6 days [4] and 44.8 days [21]. The high DFIC might be attributed to the fact that cows don't conceiving after the first insemination or having. [12] reported that all females which are not concepted beyond 121 days should be destined for culling due to poor reproductive traits.

The CI found in the present study was higher than those reported by [23] (395 days) and [8] (400 days), but less than the CI observed by [4] on Holstein cows (437 days). It is also greater than the optimum value of 390 days recommended in dairy cattle. High DCFI leads to prolonged CI due to poor estrus detection and artificial insemination expertise, as well as reproductive issues leading to poor first birth performance. Additionally, longer CIs may increase lactation and decrease milk production, particularly in cows with lower milk production at the end of calving [24].

Mean number of inseminations per conception was 3.07±1.05. The result is higher thanfounds reported by [4] 2.10 and 2.13 published by [21]. NIC is one of the most important parameters for measuring dairy cow productivity. Thus, management level of farm, including heat detection, accurate time of insemination and health care, might explain the differences observed. To reduce NIC, [25] recommend four to five checks per day to determine the onset of true estrus, which will provide a better understanding of optimal insemination time.

The average for SRFI was 36%. well below the classic objectives: 60-70% for [26], ≥ 50% for [27] and around 54% [28]. This rate depends largely on the several other factors are also widely incriminated, notably the deficit in energy balance, linked to feeding problems, problems with uterine involution (most endometritis is only detected after the first insemination by the inseminator). Environmental variations, employment of an estrus detector and expertise of the inseminator may play a greater role in success of first insemination.

The Tables 2 nd 3 reports the effect of the season, the year and the breed on some reproductve traits and milk production. Several reproductive traits were significantly influenced by season and year. The CI, DCFI, and DMP traits were significantly influenced by year and season of calving ($P<0.01$). However, NIC and SRFI were significantly ($P<0.001$) affected by season and year.

In general, reproductive traits got poor as over the years ($P< 0.01$), indicating that reproductive traits of heifers were superior to those of cows. Cows of an advanced age, which their performance might be limited, were not evaluated in this research. The mean of DMP varies over the years and the season (P< 0.01), these ariations depend on the age but also on the breed, the season and the breeding conditions of the female. According to [29], cows calving at 26 months of age are characterized by the highest milk yield in the first lactation compared to cows calving over 30 months of age. According to [30], the age at the first calving affects the first lactation, but its effect on subsequent lactations is less significant. Some authors argue that the age at the first calving correlates with the milk yield and the length of the cows' productive life in the herd [31].

The decline of SRFI was seen with season 43 % in spring, and with year (from 44% in 2018 to 33% in 2021), (P<0.01), indicating that the success of first insemination is higher than in older cows. This result is not in agreement with the finding of [22] reported that first service conception rate in lactation 1 was significantly lower than for the other lactations. In cattle, high temperatures and humidity interfere with follicular development, peripheral hormonal concentrations, and uterine environment, thus impairing oocyte competence and early embryonic development [32]. Also, maternal exposure to heat stress during gestation can affect development of the conceptus with long-term consequences after birth. In dairy cows, maternal heat stress in late gestation induced low birth weight, reduced total plasma protein concentrations and hematocrit, and impaired the immunocompetence of the calves [33].

Cows had longer DCFI after their first calving than after their 2 nd, 3rd or 4th calving. After the first and last calving. The reason for the observed longer DCFI for cows after their first calving is not clear. However, [24], explained it by the effect of physiological stress of first calving

The NIC in the present study increased (P < 0.01) with year. The possible cause of the high NIC for older cows may be attributed to high reproductive disorders that affect them. [24] also reported an increase of NIC with increasing number of calving. In contrast, and [22] mentioned that the first lactation cows required more services than older cows

TABLE 2
The effect of year and season on some reproduction traits

Factors of variation	CI (day)	DCFI (day)	DMP (liter)	NIC(day)	SRFI %
	M±SE	M±SE	M±SE	M±SE	M±SE
Year	**	**	**	***	***
2018	395±10.25	67.21±18.57	37.82±9.18	1.05±0.52	44±5.35
2019	407±11.57	74.5±17.32	40.04±9.59	2.51±0.43	37±8.22
2020	420±11.172	85.0±20.44	44.78±12.36	2.92±0.33	30±10.04
2021	440±12.20	76.63±24.82	47.43±11.25	3.27±0.85	33±7.52
Season of calving	**	**	**	***	***
Winter	423±10.12	85.4±21.87	42.34±9.25	2.92±0.03	32±7.52
Spring	392±12.15	66.2±10.28	52.22±9.38	2.35±0.61	43±7.52
Summer	442±21.31	81.7±19.55	35.26±12.44	3.21±0.32	30±7.52
Fall	424±10.77	78.5±22.45	40.22±9.59	2.71±0.03	39±7.52

CI: calving interval, DCFI: days from calving to first insemination, DMP: daily milk production, NIC: number of inseminations per conception and SRFI: success rate at first insemination.different (P < 0.05);For traits abbreviations;**(P<0.01);***(P<0.001).

TABLE 3
Effect of the breed on reproduction traits of cows

Factors of variation	DCFI(day)	SRFI %	NIC	MP
	M±SE	M±SE	M±SE	M±SE
brreds	*	*	*	**
Montbeliar imported	67±9.04	42±5.58	1.69±0.73	40.81±9.38
Holstein imported	76±12.28	38±7.76	2.08±0.95	50.13±10.05
Montbeliar born locally	74±21.20	34±8.35	2.85±0.91	35.08±11.42
Montbeliar born locally	83±25.75	30±7.32	3.21±0.87	44.56±19.87

DCFI: days from calving to first insemination, SRFI: success rate at first insemination, NIC: number of inseminations per conception, DMP: daily milk production, significantly different *(P < 0.05); **(P < 0.01).

Some reproductive traits were significantly : influenced by breed MP (P<0.01) DCFI, SRFI and NIC (P<0.05). Management factors, in relation with estrus detection, the choise of semen or reproductor and skills of inseminator, might explain the large differences observed among herds. Similar results have been reported in the literature [24], [5]. In general, reproductive traits got poor as CI, DCFI, DMP, NIC and SRFI, indicating that reproductive traits of the breeding status of pure or crossbreeds of European cattle with Algerian indigenous cattle in order to improve milk yield in African tropical conditions. As the African indigenous breeds are characterized by small size, low body weight (300–450 kg) and low production performances (less than 1000 kg per lactation), short lactation length (205–240 days), the crossbreeding with pure European cattle was done in order to ameliorate production performances especially milk and beef production. As results, it was seen that F1 offspring improved output productions than their parents of tropical origin [20].

CONCLUSION

The aim of our study is to know the criteria which make it possible to evaluate the performance of dairy cows and possibly to evaluate the risk factors for the current deterioration of their fertility. The factors responsible for infertility have been divided into two categories, one bringing to individual factors : the breed and the body condition scoring , the other bringing together relating to its environment or the breeder and his ability to manage the various aspects of herd reproduction. the season plays an important role in fertility; Heat stress during hot summer months reduces the fertility of dairy cows. The use of cooling systems can help improve cow fertility.

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