Reproductive Characterization of The Bovine Lidia Called "Brava Dos Açores"

J Pacheco Lima and F Moreira da Silva*

Department of Agrarian Sciences and Environment - IITAA (Research Institute for Agricultural and Environmental Technology) Portugal

*Corresponding author: F Moreira da Silva, Department of Agrarian Sciences and Environment - IITAA (Research Institute for Agricultural and Environmental Technology) Portugal

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ABSTRACT

In Terceira Island – Azores – Portugal, agriculture and particularly the livestock sector is the mainstay of the economy, employing more than 50% of the total population. Besides the major farm resources include dairy cattle, a Lidia bovine population called "Brava dos Acores", destined to the typical Azorean street bullfighting "touradas à corda", as well as the traditional equestrian bullfight (in the ring), has an important place in cattle breeding in the Azores and particularly in Terceira Island. These farms are located essentially in the center of the island in areas where the edaphoclimatic conditions are poorer, integrating this livestock farming into the landscape and in the community. The system is characterized by land scarcity and the major livestock feed resources include grazing on marginal lands where animals are raised in special conditions, distinguished by its extensive management. For this reason, farm data-recording systems at the smallholder Lidia cattle level are either totally absent or incomplete, so it is usually difficult to get reliable data with which to evaluate the performance of smallholder cattle. Actually, about 2500 of Lidia animals are registered in the Zootechnical register of the bovine breed "Brava dos Açores" distributed to 42 breeders. From these animals, data related to the reproductive events of 94 females aged more than 24 months and distributed by four herds were followed and a database outlined created for each farm. Data of reproductive parameters included the number of registered cows, mean age of the breeding herd, the number of calving's, the average age at first calving, the apparent fertility rate, and the actual fertility rate, as well as the calving interval.

Results demonstrated that considering all animals, the mean age of females of the reproductive herd was 100.08 ± 23 months. As far as the first calving is considered it has been observed than, on average it occurs at 36 ± 8.5 months, ranging from 30-48 months. For the calving interval, on average cows only the gave birth almost every two years (680 ± 75 days). For apparent and real fertility, results were respectively 76.5% and 41%. Results obtained in the present study clearly allows concluding that, falling fertility rates are a big concern for Lidia farmers as these animals are very dependent on the environment, the fact of not there is a large amount of food during the spring and summer, can explain the low fertility observed. Moreover, measures to improve the reproductive performance in females, could pass throughout making sure herd's diet meets the necessary protein, fat, energy and mineral requirements, besides in practice, getting it right is a little trickier. As normally the body condition score of this females are very low, supplementation with protein and energy could solve part of the problems as it is well known that certain fats increase progesterone – a hormone that plays an important role in facilitating healthy pregnancies.

Introduction

The breed of cattle called "Brava de Lied" originates in Uro or Auroque (Bos Primigenius), a primitive bull that lived in Asia, Africa and Europe. This ancestor of the brave bull arises abundantly portrayed in the rock art of Lascaux, Altamira or Foz Côa.

It was named Uro, first applied by Julius Caesar by Latinizing the term auroque as the peoples of Gaul [1] designated it. Its etymological meaning can be translated as wild bull. There are authors who claim that, arrived in the Iberian Peninsula from North Africa through the Strait of Gibraltar [2]. Nowadays the Lidia bovine breed is mainly distributed in the west and southwest of Spain, Portugal, south of France, and in South America [3] The arrival of bovines in the Azores began in the 15th century with the colonization of the islands, by the Portuguese population. Also, at the beginning of the 20th century, different Lidia lineages, that also included the "Casta Portuguesa", began to be selected on Terceira Island (Azores) for a cultural event called "Tourada à Corda" [4-6]. Besides there is no reliable information about the origin of Lidia cattle in Terceira, [4] refers that in the mid-twentieth century, was an uncharacteristic herd by the free cross-checks which have taken place over the years, 22 new types, such as Turino, Dutch and other less influential bovine breeds such as Shorthorn, Norman, and Jersey.

This cattle population located on Terceira Island is nowadays recognized as "Toiro da Terra or Brava dos Açores". A study previously published by our team about the genetic relationships of the Portuguese Lidia bovine populations showed that high levels of genetic diversity in Brava dos Açores populations are probably due to the crossbreeding of different bovine lineages at origin, and genetic flow among herds. Within herds genetic variability in Brava dos Açores evidenced an excess of heterozygosity [7]. Moreover, it is well documented that the importation of animals, from 1910, with greater aptitude for the arena, made Terceira Island one of the main centers of production of this type of cattle in Portugal, and the rearing of these animals assumes, for the Region [8]. Nogueira [9] refers that the characters of the Brava dos Açores cattle are different from those that distinguish bullfight cattle from Ribatejo in the mainland, being however similar to the characters of the cattle which have always been present in the Azores. The bullfight bull on Terceira Island is thus, not only the result of this breed management but also the result of the introduction, in this island, of wild animals originating in the Iberian Peninsula, which over the years have undergone adaptations giving rise to a morphological animal and behaviorally different from its predecessors.

This subpopulation has own characteristics, ideal for "rope bullfights", a cultural phenomenon very typical in this island. At the present time, according to data from the Regional Directorate for Agriculture, up to now a total of 5482 bovine animals were registered in the Zootechnical book (Herd book) of the bovine breed "Brava dos Açores", from which 2493 are still alive. These 2493 alive animals are distributed to 42 breeders as follow: 72 Females less than six months old, 281 females between six to twenty-four months; 1118 females older than twenty-four months and 1022 males. Besides it is essential to promote technically organized actions promoting, the registration and appropriate identification of these animals, farmers may be encouraged to use measures to the good use of the biological value of this bovine population, providing a cattle management that favors the correct occupation of the ecosystem that these animals use and that other cattle cannot valorize it. It is thus essential to validate the processes for the identification and registration of the Bovina Brava Population of the Azores started on 2003 by the competent regional departments of the Region's cattle ranches.

In the present study data of reproductive parameters included the number of registered cows, mean age of the breeding herd, the number of calving's, the average age at first calving, the apparent and the actual fertility rate, as well as the calving interval has been assembled to perform the Reproductive characterization of this bovine Lidia breed.

Materials and Methods

The present study was carried out in four farms of Terceira Island using a total of 94 females aged more than 24 months, all of them located in a geographical area with a higher concentration of fighting cattle. In these areas, the animals are raised using the extensive system in which herds try to get the most out of natural food resources. Color, which is not an important trait in the selection process were usually black or gray, avoiding brindled, roan red or chestnut animals. As all timid and docile animals of both sexes are culled out after special tests and sold for beef, they were not considered as fighting animals and thus excluded from the study. Concerning data for the characterization of the reproductive indexes was the reproductive registers made by the animal's owners as well as data obtained through the sanitary visits and reproductive consulting of our team. Moreover, for each animal, all data inserted in the National Bovine Register System (SNIRB), namely parturitions and dead animals, were also considered. Then all information was inserted in a database and all reproductive parameters were calculated according Potter and Anderson [10], including the number of registered cows, mean age of the breeding herd, the number of parturitions, the average age at first calving as well as the apparent and the actual fertility rate. Briefly, data of the mean age of the reproductive herd was calculated including the age of all females in the right time for breeding, confirming their ovarian cyclicity by their estrous behavior or by echography made during the reproductive visits. Non-breeding individuals (mainly immatures) were searched for, their identity determined from the ring number, and in case of pathologic problems such as cystic ovaries, were treated. Having in account the way in which these animals are elevated, fertilization rate could not be measured, as it is impossible to distinguish between fertilization failure and embryonic mortality. As far as the number of parturitions, the data were mainly obtained from the individual records in the SNIRB, which are compulsorily filled by farmers, allowing these data also calculating calving intervals.

Concerning fertility rate defined as the number of cows that gave birth to those placed on mating, the fertility rate considered was the annual fertility rate, many times confused with the apparent fertility rate that is often referred to by the owner. In fact, if the

farm's calving interval is 450 days, for example, the cow will produce a calf every 450 days (not 365 days) and for that mode the annual fertility value can be adjusting by dividing the 365 days by 450 days, which corresponds to a correction factor of 0.81 [11]. The apparent fertility rate was consequently obtained by multiplying the fertility rate by the correction factor, which has been calculated by dividing 365 by the interval between parturitions. Statistical analysis was performed using the software SPSS and the results are presented as mean ± standard deviation.

Results and Discussion

The present study has been implemented to perform the Reproductive characterization of a bovine Lidia breed called "Brava dos Açores". Besides the routine of reproductive technologies varies widely in livestock production, in some particular breeds such as the Lidia cattle present particular morphological traits, as the smaller size, posing challenges to the application of assisted reproductive techniques such artificial insemination or embryo transfer [2]. Moreover, as Lidia breed animals are normally selected for aggressiveness [12], this behavioral trait may also be a complicating factor in reproductive technologies procedures. Additionally, as they are animals unaccustomed to human treatment and therefore with an easy tendency to stress [7], the Lidia cattle breed, in general, has resisted to reproductive techniques for bovines, such as fixed-time artificial insemination, estrus synchronization or gestational diagnoses. Moreover, for any treatment animals must be moved in the fences, enclosed in the corrals, and the sleeves, being subjected to stress peaks that condition the rate of fertility [13]. To maintain an easier sexual season higher part of bullfighting, as happens in our conditions, breeders opt for a specific reproductive period, with the sudden introduction of the stallion into the breeding stock favoring the estrus in the cows, as it releases pheromones triggering synchronization of sexual activity in the females [14]. Besides the male's sexual behavior remains constant throughout the year, becoming more exuberant in the spring and summer, the availability that the male presents, contrasts with the receptivity of the wild cow. The Lidia female demonstrates receptivity in heat and this manifestation depends on several factors.

A calm and adequate environment, with abundant food availability are significant factors to which the wild cow has reproductive behaviors. Moreover, a more nervous and restless female than normal, without eating in a relaxed way, may be the few possible signs of identifying an angry cow in heat, being difficult to perceive this behavior in the bush. The wild cow is an animal that seeks isolation and the manifestation of heat is less exuberant in human presence. It is generally advised that each bull be with a group of 30 to 40 cows due to the constant interaction of the male with the cows in the phase of estrus. Each mating requires on average 5 to 6 copulations with associated physical wear. Under the influence of thermal stress, the duration and intensity of estrus are reduced, with a clear decrease in activity and other manifestations such as

the acceptance of copulations [15]. It should, moreover, be noted that the higher incidence of anestrus and silent heats are one of the most common observations in cows exposed to high temperatures [16]. In the Azores as in the interior of the island the pastures are abundant from the end of May to the beginning of July, deliveries occur mostly in this period occurring the mating in September and October, at which point the pasture still has enough fodder to trigger estrus behavior in females. Bulls and cows must be carefully chosen because the calves take after their parents.

In Terceira Island, as it is common to recruit the bulls having better performances in the arenas, as breeder, it happens often that when the committees choose these sires, they are already quite old, and their physical faculties may no longer be suitable for procreation. Not only the males are put to breeding very late, happening the same with the females. In the present study it has been observed that the average age at first delivery is 36 ± 8.5 months and that 25 to 75% of the females has an age at first calving between 30-48 months. Besides in our opinion, it can be considerate too late, as the first calving marks the beginning of a cow's productive life, being thus closely related to generation interval and, therefore, influences response to selection [17], these values are similar with age observed in Spain and in Portugal mainland. Data published by Caballero de La Calle and Buxade [18], demonstrated that in Spain and mainland Portugal, mean age of the first calving for Bullfight breed cattle heifers was 37.4 (±3.2) months. It has also been observed that in this type of cow the age at which animals undergo the functional selection process called "tenta" is a fundamental information to understand the later age of the animal to reach the first calving. The functional test of selection of future breeders of "Brava dos Açores" in the Azores is performed when heifers are between 18 and 26 months, being in the case of approved, placed in the group of breeding cows [19]. Another important fact is that the age at first calving of the heifers in the Iberian Peninsula is influenced by the geographic area and climatological characteristics of the cows, being related to the expected in a breed essentially produced in an extensive way [20].

Another aspect considered in this study was the interval between deliveries. Calving interval can be divided into three periods: gestation, postpartum anestrus (from calving to first estrus) and the service period (first postpartum estrus to conception) [21]. This is often considered as the "open day's period" and is the part of the calving interval that can be shortened by improving herd management [22]. For such way, the calving interval is, probably, the best index of a cattle herd's reproductive efficiency. Resumption of ovarian activity in the postpartum period does not necessarily lead to conception and methods of stimulating estrus must be considered in relation to their effect on conception and, indirectly, calving intervals [23]. The estimates of the duration of the various phases of the calving interval are based on averages in the literature for cows raised under traditional management [17]. According to

Caballero de la Calle and González [17], in Spain Lidia cattle, the average duration of the gestation period is 285.94 ± 5.24 days, ranging from 272 to 296 days and that there is no relationship has been found among the sex of the calf and the duration of the gestation. In the Portuguese mainland, values are, up to now not available yet. Nevertheless, the time of pregnancy is significantly affected effect by the season in which cow become pregnant: the period is shortened in the deliveries of spring and summer and lengthens in those of autumn and winter. In fact, as known, these are animals that are very dependent on the environment, which are supplemented only in the difficult seasons (winter and autumn). The low amount of food during the spring and summer, can explain the lower duration of pregnancies. Sanchez and collaborators [24] postulated, however that is the food's supplementation that produces the elongation of pregnancy period. For the interval between calves, in Spain it has been presented of 432.69±28.16 days [25], and in Portugal mainland this interval is, on average of 535.08±196 days [13].

In the present study it was observed that the mean value of the interval between births is 680 ± 75 days and that 75% of the cows presented a mean interval between calving of 730 ± 37days. These animals are known are more adapted animals, more rustic and with much less human care [19]. In herds of beef cattle such as "brava dos Açores" Cattle, the weaned calf is the main source of revenue. Table 1 shows the parameters key to assess reproductive performance

[16]. Reproductive efficiency has long been recognized as one of the most important aspects of a bovine holding regardless of type. In fact, if only 50 percent of the cows wean a calf, crossbreeding, genetic gain and sound management become insignificant [26]. Breeding efficiency may be lowered seriously by increasing the age of first breeding. Sexual maturity in heifers is related to weight rather than age; therefore, heifers born earlier in the calving season are likely to be heavier at bulling and are genetically more fertile. In order to achieve first calving at 24 months, management practices should ensure that heifers are of adequate size (65% of mature weight) for successful mating at 15 months. Heifers need to grow at an average live weight gain of 0.85-1.0kg/day from birth to hit target weights for mating [27]. Females bred at a lower age are likely to appear stunted during after the first calving, but their mature size is affected little by their having been bred early [26]. Buck and collaborators [22] found that fertility rate increased from 69% in 2.5-year-old cows to a maximum of 82% in 6- to 7-year-old cows and then declined. In Bolivia, Plisse and collaborators [28] also recorded an increase in pregnancy rate from 50% in 3-years-old purebred crossbreds to 75% in 7-yeasr-old. Fertility then declined to 50% among 12-years-old. Causes of these age-related differences include lactation stress in young growing animals and the ability of older cows to gain bodyweight and condition quickly after calving [17].

Table 1: Parameters key to assess reproductive performance [16].

Parameter	Goal
Extension of the breeding season	< 90 days
Pregnancy rate (35 days after the end of the riding season)	> 90%
Percentage of calves born alive (of pregnant cows)	> 93%

In Spanish Lidia cattle, the cow's calving number has a very significant influence on the duration of her gestation. It has been found that the youngest animals (1st and 2nd calving) present the gestations shorter and that they are lengthening as the age of the animals increases due to its greater degree of physiological maturation and adaptation to the environment [29]. In the Azores, it has been observed that the mean age of females of the reproductive herd ranged between 71 to 126 months with an average of 100.08 ± 23 months.

As far as fertility in cattle is concerned, it can be affected by several factors such as environmental, genetic, disease and management, among others, influencing the reproductive process at ovulation, fertilization or implantation or during gestation and parturition. Beyond these factors, maintaining herd health and particularly parasite control should be planned ahead of time to ensure burdens of stomach worm; lungworm or fluke are not present. Furthermore, control of infectious diseases such as BVDv, IBR and Leptospira Hardjo is critical to ensure good artificial insemination results. Handling facilities are essential, as cattle will need to be gathered on several occasions during the program and for AI. Ideal-

ly, the gathering should be covered, as synchronizing a large batch of heifers/cows when raining. Body Condition Scores (BCS) is also an important tool to help farmers to optimize health, welfare and fertility, while minimizing calving difficulties and production costs. Energy deficiency leading to poor BCS and prolonged anestrus is by far the most common cause of poor fertility in many herds whereas fatter cows have more difficulty calving, increasing the risk of caesareans and calf mortality. Therefore, forward planning is essential to ensure cows are calved at target BCS to ensure most are cycling prior to synchronization. Beyond that, trace element supplementation such as copper, selenium and iodine, if required should be administered in advance of breeding.

Another parameter evaluated was the annual fertility rate, as calculated by two distinct ways: the apparent fertility rate and the actual fertility rate. It has been observed 360 births out of a total of 94 animals with a calving interval of 680±75 days. For this way, the apparent fertility rate defines the reproductive life time of the animals in our sample, which would translate into the difference between the mean age of the herd and the age at first calving, which would give the result of 64 months. Dividing the number of calv-

ing's by the reproductive period of the cows in study would obtain the value of we would have 72 annual deliveries, representing an apparent fertility value of 76.5%. For the real fertility, the correction factor may be 0.3, which would translate into a result in the order of 41%. Our study clearly show that results obtained for Brava dos Açores, can be compared to those obtained for Lidia in Spain and Portugal mainland as well. On average the mean age of cows is quite old. It has been found that the mean age of females of the reproductive herd ranged between 71-126 months with an average of 100.08 ± months. Also, the mean age for the first calving is quite late, being o 37.4 (±3.2) months and the interval between calving's is 22.7 ± 2.5 days. For the real and apparent fertility, the values were respectively 76.5% and 23.0%.

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