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SHORT NOTE [NOTA CORTA]

STAYABILITY IN THE HERD AND CULLING CAUSES OF BOARS IN FOUR PIG FARMS OF YUCATAN, MEXICO

[PERMANENCIA EN EL HATO Y CAUSAS DE DESECHO DE VERRACOS EN CUATRO GRANJAS PORCINAS DE YUCATÁN, MÉXICO]

J.C. Segura-Correa*, A. Alzina-López and R. Santos Ricalde

Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Yucatán, Km 15.5, Carretera Mérida-Xmatkuil, Mérida, Yucatán, México, Tel. 01(999) 9423200, Email: scorrea@uady.mx
**Corresponding author*

SUMMARY

The stayability and causes of culling of boars in four pig commercial farms in Yucatan, Mexico were studied. The get-in and get-out dates of the boars corresponded to the period of March 1994 to June 2007. Stayability was defined as the number of days between the first service of the boar (approximately 8 months) until its culling or end of the study. Information on 169 boars of which 147 were culled and 22 were in service at the end of the study was investigated. Stayability curves of the boars were obtained by survival analysis. The risk of culling of the boars between farms was determined by the Cox proportional-hazards regression method. Stayability curves between farms were statistically different ($P<0.05$). The longest stayability belonged to boars of farm A and the shortest to boars of farm B. The hazard risks were 6.26, 2.16 and 1.93 times greater for the boars from farms B, C and D, in comparison with boars from farm A. The main causes of culling were: old age and loss of sexual appetite (22.5 and 12.4%).

Key words: Longevity; culling; boars; tropics; Mexico.

RESUMEN

Se investigó el tiempo de permanencia de los verracos y las causas de desecho en cuatro granjas comerciales de Yucatán, México. Los datos de fecha de entrada y salida de los verracos correspondieron al periodo de marzo 1994 a junio 2007. El tiempo de permanencia en la granja se definió como el número de días entre el primer servicio del semental (aproximadamente 8 meses) hasta su remoción de la piara o fin del estudio. Se utilizó la información de 169 sementales de los cuales, 147 fueron desechados y 22 estaban activos al final del estudio. Las curvas de permanencia de los verracos se obtuvieron mediante análisis de sobrevivencia. La magnitud del riesgo de desecho de los verracos, entre granjas, se determinó mediante el método de regresión de riesgo proporcional de Cox. Las curvas de permanencia entre granjas fueron diferentes ($P<0.05$). El mayor tiempo de permanencia correspondió a los verracos de la granja A y el menor a los verracos de la granja B. Los riesgos de desecho fueron 6.26, 2.16 y 1.93 veces mayores para los verracos de las granjas B, C y D, respectivamente, en comparación con verracos de la granja A. Las principales causas de desechos en las granjas fueron: la edad y falta de líbido (22.5 y 12.4%).

Palabras clave: Vida útil; desecho; verracos; trópico; México.

INTRODUCTION

Genetic improvement of pig production nowadays is based on the purchase of "high quality" boars from companies specialized in animal breeding for those traits of economic importance for the industry. The purchase costs of a boar constitute one of the most important decisions of the available budget and ideally the boars should stay in the herd until the inversion is paid-off. Optimal culling rates need to be determined for commercial and breeding herds, expecting greater culling rates in the latter, due to the genetic programs of improvement. In practice, boars are kept in the herd for two to three years old, when most of them pay back their initial cost (Vinent-Duany *et al*., 2007). The incentives for a longer stayability of the boar in the herd include: a greater number of semen doses produced, fewer number of unproductive days, acquired immunity, greater recuperation value and less cost of replacement (D'Allaire, *et al*., 1987; Lucia, *et*

al., 2000). The main disadvantage is the increase in the interval generation, which reduces the rate of genetic improvement per year.

Stayability of a boar is an example of survival or time event data, time typically being the number of days a boar stays in the herd and the event it's the removal from the herd (for example culling or dead). This type or data are always positives, they do not show normal distribution and can be censored (Allison, 1997). Censored data occur when the event of interest is not observed during the period of study; for example, those boars alive at the end of the study. Censored data should not be dropped from the statistical analysis, as is normally done (Holder *et al*., 1995; Yazdi *et al*., 2000), because they provide information about the productive life of an animal. Survival analysis is the recommended method for the study of data on boar stayability in a herd (Brandt *et al*., 1999; Yazdi *et al*., 2000). Stayability of a boar could be determined for many genetic and management factors. Differences in the productive life of a boar could be due to type of management in the farm, type of housing, breed differences and diseases present in the region. Porcine circovirus type 2, porcine respiratory and reproductive syndrome and respiratory diseases are very common in Yucatan.

Culling of boars is a step in the management of the pig herd that it is often no taken care by the producer. The knowledge of the annual boar culling rate and the reasons of culling could be beneficial in identifying possible diseases and management problems. Some authors have documented the patterns of culling in sows (D'Allaire *et al*., 1987; Dagorn and Aumaitre, 1979). However, the literature on boar culling rate is scare (D'Allaire and Leman, 1990). To the authors knowledge this is the first report in Mexico. Among the main causes of boar culling are cited: the age, lesions, diseases, overweight etc. (Vinent-Duany *et al*., 2007). The objectives of this study were to estimate the stayability of boars and their culling causes in four pig farms of Yucatan, Mexico.

MATERIAL AND METHODS

Location and climate

The study was carried out using the information from four pig farms of the state of Yucatan, localized in southeastern Mexico between coordinates 19°31' y 21°35' north latitude and 90°24' west altitude of Greenwich meridian. The climate of the region is tropical subhumid with rain in summer. The range of temperature is between 7 to 42°C (mean 26.5°C). Relative humidity varies from 65 to 100% with an average of 78%. Annual rainfall varies from 415 a 1290 mm depending of the area, and the predominant winds coming from the north and south (INEGI, 2004).

Farms description

Farms were located in a high pig density area (0.5 farms per km^2) and were considered representative of the central region of the state of Yucatan. A and B were two-site farms whereas C and D were complete cycle farms. Animals in farms A, C and D were kept in pens and cages, whereas in farm B they were kept in individual cages. Feeding in farm A was based on requirement of the genetic line, and in farms B, C and D boars were fed the breeders type of diet for sows used in those farms. In farms A, B, and C reproduction of the herd was based only on artificial insemination (AI), whereas in farm D natural mating and IA was used. Only farm A had biosecurity measures and quarantined the animals.

Boar management

In general, when boars arrived to the farms they were given a two-month period of acclimatization to get adapted to the management and sanitary status of the farm. In the farms reproduction of sows was carried out through natural mating, artificial insemination or both. Boars were fed using a commercial feed for each of the productive stages. Boars of approximately 200 kg received 2.6 kg/day of feed with 3000 Kcal EM/kg, 16% crude protein and 0.8% lysine and those with 300 kg of weight were given 3.2 kg/day of the same feed.

Culling reasons

The boar culling reasons were divided into 10 groups: Problems included low fertility or infertility, poor libido, inbreeding, poor productive performance, locomotor problems, old age, death, diseases, sold and unknown.

Data analysis

The data of four farms of the central region of Yucatan, Mexico recorded from March 1994 to June 2007 were used. Available information for each animal included the date at first service and the date of culling. Stayability was defined as the number of days between the first service of the boar (8 months in average) until its removal from the herd or the end of the study.

Information on 169 boars was used, of which 147 were culled and 22 were still active at the end of the study. The data of the boars that ended the study were considered censored; whereas the data for the culled boars were non-censored.

Stayability curves of the boars per farm were obtained by survival analysis, using the life table or actuarial method of the LIFETEST procedure (SAS, 1999). The magnitude of the risk of boar culling between farms was determined through the Cox proportional hazard regression. The stayability of each boar was characterized using the hazard function that represents the instantaneous culling rate of each boar that remains in the farm at a given time (Allison, 1997).

The hazard function describes the concept of the risk of an event at a given t time interval, conditional to the fact that the animal has survived (still stay) in the farm until time t. In this study, the hazard function was the conditional probability that a boar being culled between a given day and the next, divided by the probability that the animal not being culled longer than day t (Noordhuizen *et al*., 2001). The Cox proportional hazards model was:

$$h(t) = h_0 e^{\beta_i X_i}$$

Where: h (t) was the risk at a given time interval, h_0 the base risk (the risk obtained if there were no risk factors in the model), and βi the regression coefficient for the i-th farm. The hazard ratio (HR) for the situation when the risk factor X is present versus the situation when the risk factor X is absent is given by (Noordhuizen *et al*., 2001):

$$HR = \frac{h(t, x=1)}{h(t, x=0)} = e^{\beta_i X_i}$$

Stayability was modeled using the Cox proportional hazard regression methods in order to identify the effect of farm as a culling factor, through the PHREG procedure (SAS, 1999). The confidence limits of the HR for the final model were based on the Wald test.

Culling frequencies were calculated as the proportion of animals culled for a given reason between the total number of animals culled (n=147).

RESULTS

Information on the number of censored and non-censored boars and the average stayability in the farms are shown in Table 1. The highest stayability corresponded to boars in farm A and the least to boars in farm B.

Table 1. Boars culled, censored and average stayability in four pig farms of Yucatan, Mexico.

Farm	Total	Culled	Censored	Stayability (days)
A	43	26	17	1310 ± 102
B	38	38	0	492 ± 49
C	47	42	5	942 ± 94
D	41	41	0	1019 ± 98
Total	169	147	22	----------

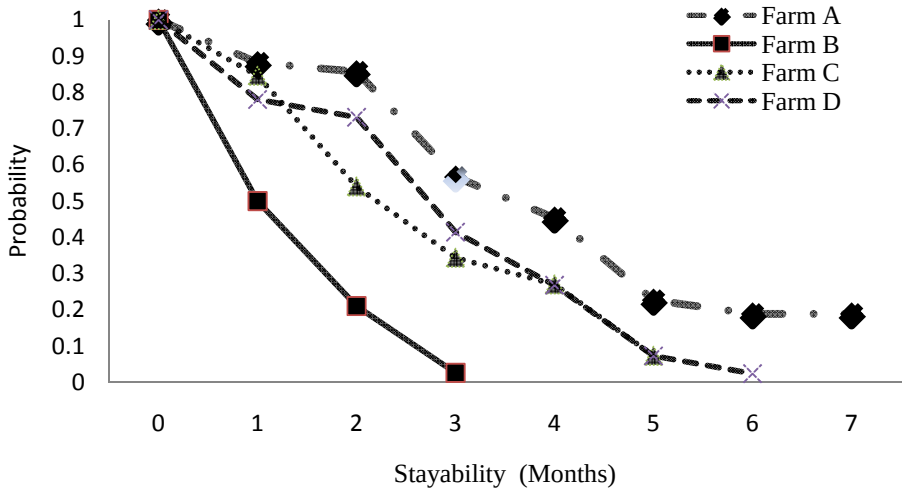

Figure 1. Stayability of boars in four farms in Yucatan, Mexico

The stayability curves of the boars for the farms are shown in Figure 1. The stayability curves were statistically different (P<0.05). The probability of a boar remaining in the farm was highest in farm A compared with the other farms. The risk of boar being culled was 6.26, 2.16 and 1.93 times greater for farms B, C and D respectively; in comparison with boars from farm A (Table 2).

The main causes of culling in the four farms were: old age and poor of libido (22.49 and 12.43%), whereas the lowest culling percentages corresponded to poor production and infertility (Figure 2).

Table 2. Hazard ratios from the Cox proportional hazards regression for culled boars in four pig farms in Yucatan, Mexico.

Farms	Parameters	SE	HR	CI (95%)
A	0	0	1	---------
B	1.835	0.274	6.26	3.66, 10.72
C	0.771	0.252	2.16	1.32, 3.55
D	0.658	0.252	1.93	1.18, 3.17

SE= standard error, HR= Hazard ratio of culling, CI= confidence interval

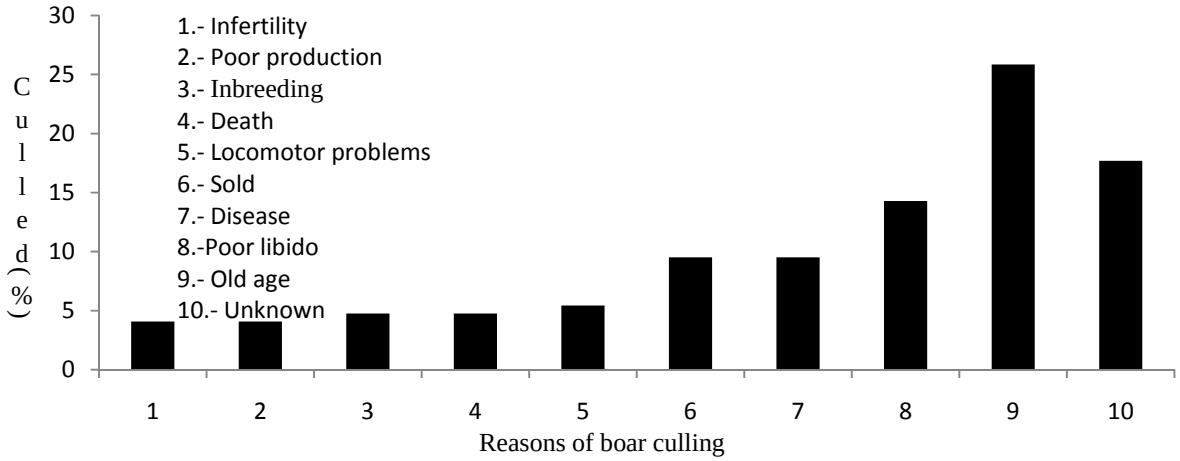

Figure 2. Main reasons of boar culling in four commercial farms in Yucatan, Mexico

DISCUSION

The average stayability of the culled boars in the four farms here studied (30.4 months) was greater than the 20 months value notified by D'Allaire and Leman (1990) and Le Denmat *et al*. (1980); who also found differences between farms. Arganosa *et al*. (1981) studying seven commercial farms found a boar average stayability of 14.7 months with an interval of 0.3 to 38.5 months. Differences between farms are probably due to management and health status of the herds. The expected stayability according to Vinent-Duany *et al*. (2007) should be 2.5 to 3 years; however, boar stayability was lower in some of the farms. Therefore attention to boar management should be emphasized in order to recover the money invested on them.

Figure 1 shows that stayability was greater for boars in farm A compared with the other farms. The grater stayability of animals from farm A was probably due to a better management and good health or to the production objectives of the farm. As mentioned before farm A was the only one that had biosecurity measures and quarantined the boars before being used. The lowest stayability curve for farm B could be associated with the arrival of old boars or more disease susceptible animals, which is a cause of early culling. With the high cost of feed ingredients for the Mexican pig industry, slowing the rate of boar and sow culling could help to improve the rentability of a farm.

D'Allaire and Leman (1990) mentioned that the main cause of culling was overweight and old age (47.1%) followed by reproductive (18.4%) and locomotor (11.8%) problems, which is similar to the ranking culling reasons found in this study, although the frequencies were lower. The main causes of culling were: old age (25.9%) followed by poor or lack of libido (14.3%). The ranking and proportions of cases could vary between farms, a finding suggesting that

environmental or management may be responsible for the differences in culling. A management causes that could increase the frequency of old boars being culled, is the introduction of many replacement gilts into a herd, which will necessitates the introduction of young boars and the culling of older or large boars that are not necessarily aged. This aspect of culling is peculiar to commercial herds. In order to improve the boar stayability in the herd, better management, good environment and chiefly good nutrition should be taken into consideration.

The proportion of boars culled for reproductive problems (infertility and poor libido, 18.4%) was equal to the proportion (18.4%) reported by D'Állaire and Leman (1990) in Minnesota USA. These authors also mention that boar culling for reproductive problems is higher in experimental centers or farms where artificial insemination is used. In two studies conducted in commercial breeding herds in France, reproductive problems represented 20% and 32% of all culled animals, and were considered one of the two major causes of removal (Le Denmat and Runavot 1980; Le Demant *et al*., 1980).

An effective culling program for boars and sows should be part of the herd management because culling policies influence economic profitability in many ways. Culling policies for sows should also be evaluated, since sow culling rate is correlated with boar culling rate (DÁllaire and Leman, 1990).

CONCLUSIONS

Boar stayability varied from 1.4 to 3.6 years, therefore some farms might not be recuperating the inversion made on the boar. The results of this study indicates that there were differences in stayability of the boar in the farms; therefore environmental and management are important factors that the producer should consider in order to prolonged the stayability of the boar.

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