Annals of
Reviews and Research

Juniper Publishers
key to the Researchers

Research Article
Volume 9 Issue 4 - July 2023
DOI: 10.19080/ARR.2023.09.555766

Ann Rev Resear

Evaluation of Boar's Semen Production and Characteristics for Artificial Insemination

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Submission: July 02, 2023; **Published:** July 12, 2023

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Abstract

The objective of this work was to evaluate the production and characteristics of boar semen from different genetic lines used for artificial insemination, for which 19 boars were used: LM100 (n=4); LM200 (n=2); LM300 (n=2); LTP27 (n=4); LTH1 (n=2); LTB1 (n=3) and LTB37 (n=2) for two and a half years; the variables evaluated were Ejaculate Volume, Motility %, Temperature, Sperm Concentration, Collection frequency, Season of the year, Age and Number of doses. The general averages of the results obtained were: semen volume 263.64 ± 3.59, Motility 89.99 ± 0.20, Ejaculate temperature 37.12 ± 0.03, Dose x ejaculate 19.43 ± 0.36, Winter season, semen volume 263.69 ± 3.59, Spring Motility 90.81 ± 0.43, Autumn temperature of the Ejaculate 37.12 ± 2.74, Spring number of doses (300 x 109) ; 19.43 ± .35, in relation to the Genetic Lines in which there was a significant difference with respect to the evaluated variables were in Volume it was LTP-27 with 328.74 ± 7.97 mL (P <0.05), in % Motility it was LTH-1, 91.81 ± 0.52 (P<0.05), in Ejaculate Temperature The LTB-1 with 37.70 ± .09 (P>0.05), in dose was the LTP-27, 23.15 ± 0.64 (P<0.05), the behavior by season of the year and your variables.

The general mean of ejaculate volume in winter was 271.02 ± 8.40 (P<0.05); The % motility in spring was 90.81 ± 0.43 P<0.05, in temperature it was 37.21 ± 37.21 (P<0.05), the average longest collection days in spring was 10.12 ± 0.34 (P<0.05); when comparing the Volume of the ejaculate by maternal genetic line (LM100,200,300) and Terminal (LTP27, LTH1, LTB1 and LTB37) it was 238.75 ± 3.58 Vs. 279.96 ± 5.31 (P<0.05), Motility % 91.23 ± 0.26 Vs. 89.18 ± 0.27 (P<0.05), sperm concentration 22.71 ± 0.545 Vs. 22.19 ± 0.42 (P>0.05), Ejaculate temperature 36.91 ± 0.03 Vs. 37.25±0.03 (P<0.05), Sperm per ejaculate 5.3 x 109 ± 1.3 x 109 Vs. 6.1 x 109±1.4 x109 (P<0.05), Number of doses 11.16 ± 0.27 Vs. 16.55±0.31 (P<0.05), Sperm per dose 370.82 ± 5.11 Vs. 331.78 ± 3.15 x 109 (P<0.05) , Dose (300 x 109), 17.79 ± 0.45 Vs. 20.35 ± 0.47 (P<0.05) Maternal Vs. Terminal line respectively in the variables described above. When evaluating the age of the stallions, the results were: Ejaculate volume 263.64 ± 3.58 (P<0.05), % Motility 89.99 ± 1.98 (P<0.05), Concentrated sperm 22.40 ± 0.33 (P>0.05), Temperature 37.119 ± 0.02 (P<0.05), Sperm per ejaculate 5.8 x 109 ± 1.0 x 109 (P<0.05), Number of doses 14.42 ± .239 P>0.05, Sperm per dose 347.24 ± 2.86 (P<0.05), Dose 300 x 109 19.34 ± .342 P<0.05 with a mean age of 26.5 months for the maternal line. It is concluded that the Terminal genetic lines have better performance in the parameters, when compared against the maternal lines when the production and characteristics of the semen of the boars used for artificial insemination were evaluated. Likewise, age and season of the year are determining factors.

Keywords: Artificial Insemination; Boar´s Semen; ANOVA; Morphoanomalies; Spermatozoa; Spermatozoon Membrane

Abbreviations: PAI: Porcine Artificial Insemination; AI: Artificial insemination

Introduction

Porcine artificial insemination (PAI.) is a first-generation reproductive biotechnology that consists of depositing semen in the genital tract of the female by means of instruments Decuadro [1]. Swine artificial insemination plays an important role for genetic improvement in animals, considering the use of information to improve genetic composition according to important economic characteristics Dion [2]. This integration is through the use of statistical models and computational methodologies as well as proven reproductive technologies to select and disseminate genetic improvement to large populations Decuadro [3]. During the last 10 years the use of Artificial insemination (AI) has increased enormously. Martínez [4]; Raath [5]. It is estimated that currently, of the 76 million sows in the world, more than 90% are inseminated. The countries of the European community lead the list of the use of A.I. with 95.7% of inseminated sows, with France, Finland, and Spain being the main ones. In the Pacific region and Asia, 69% of the sows are inseminated while in Latin America the percentage of use is 60%, particularly in Mexico they are at 85% AI Salazar [6]. The P.A.I. are a joint series of semen collection, treatment and conservation techniques as well as insemination per se Gosálvez [7]. Their effectiveness can be estimated through the percentage of fertility and births as well as the size of the litter Pallas [8]. These characteristics have made the pig sector react, producing a progressive evaluation in the use of the technique, being increasingly productive and effective, guaranteed with important biosecurity measures the sanitary quality of the doses and together with the increase in similar doses Córdoba [9]. The boars used for P.A.I. are selected through the BLUP (Best linear unbased prediction), the best unbiased linear prediction Batista [10], which considers all the information from all the relatives of an individual to calculate an estimated breeding value Becerril and Rocha [11]. With what allows to compare individuals or populations. To currently know the biotechnological developments that have made it possible to mark genes in the DNA associated with quantitative characteristics associated with growth, back fat and carcass characteristics in pigs.

Information that is taken into account in addition to the selection criteria that has allowed the development of the selection assisted by genetic markers. With which the precision and intensity of selection is increased and therefore the genetic progress, Stephano [12] through A.I. since obtaining good results in AI in pigs depends on the level of ability to develop the techniques collection, dilution, conservation, advantages it presents Jonson [13]: reduction in the number of boars on the farm, use of boars of high genetic quality allowing a general improvement of the herd, maximum exploitation of management in groups or lots, obtaining % fertility equal to or greater than those obtained in natural mating, facilitate handling by reducing time and work / mating, better control of semen quality and better sanitary control that allows obtaining reciprocal protection of male and female reproductives, avoiding contamination of females by the intermediate of infected males or preventing the contamination of the males during intercourse in the case of infected females Stephano [12]; Becerril and Rocha [11]. However, the real cause of the current increase in P.A.I. in the world is polyvalent: better knowledge of the physiology and management of sows and semen, better equipment, better extenders and a greater demand from consumers regarding the quality of the pork produced. However, the fact that the advantages of the P.A.I. Pallas [8]; Córdoba [9], far outweigh the drawbacks, does not mean that the use of this biotechnology is easy; In this sense, we have to remember that the era of the use of P.A.I., in certain countries, has initially failed due to its incorrect application or the existence of problems or management deficiencies that cannot be solved by the simple use of A.I. (Flowers and Esbenshade [14]; PIC [15]. Therefore, the objectives of this work were to evaluate the production and characteristics of the semen of the different genetic lines of the boars used for A. I. in a private company, as well as to know the ejaculate properties such as volume, motility, semen temperature, sperm concentration, collection frequency Kubus [16], boar age and season of the year.

Materials and Methods

The work was carried out in the artificial insemination center of the Super Gen pig genetic improvement nucleus farm located in Quecholac Puebla. Geographically, the municipality of Quecholac is located in the central eastern part of the state of Puebla (INEGI, 1998). Its geographical coordinates are the parallels 18º 49' 18" and 19º 00' 18" north latitude and the meridians 97º 34' 42" and 97º 44' 54" west longitude. Its borders are to the north with Felipe Ángeles and San Juan Atenco, to the southeast with Palmar de Bravo, to the east with Ciudad Serdán (Chalchicomula de Sesma) and to the west with Acatzingo and Tecamachalco (INEGI, 1992). It has an area of 163.29 km2 that places it in 83rd place with respect to the other municipalities in the state. Localities that constitute it: Palmarito Tochapa, San Simón de Bravo, Tuzoapan, La Compañía, Guadalupe Enríquez, Santa Catarina Villanueva, Francisco I. Madero INEGI [17]. With an average altitude of 2,080 meters above sea level. Subhumid temperate climate with summer rains, soils that exist: Xerosol, cambisol, litosol, regosol, feozem. The federal highway Mexico-Córdoba crosses the municipality from east to south. A state highway heading south leaves the municipal seat and connects with the highway to Tehuacan-Tecamachalco INEGI [18].

Animals

Nineteen stallions from different genetic lines were used: LM-300 (n=2), LM-200 (N=2), LM-100 (n=4), LTP27 (n=4), LTH1 (n=2), LTB1 (n=2), LTB137 (n=2). The diluent used for this research was MR-A (long duration), for a period of 2.5 years, and the productive characteristics of the boars' semen were determined.

Experimental design

An experimental design of repeated observations was used, the data was analyzed through a simple ANOVA and a Tukey test for multiple comparisons, in the statistical program SPSS v. 13 (2005).

Statistical Model

$$Yijk = M + tj + Si\,(j) + Pk + (TP)\,jk + Eijk$$

Where:

Yijk= Measurement in Subject i, of treatment j, in period K

M= General Mean

Tj=Effect of treatment j; j =1.....t

If (j) effect of subject i, where treatment j .

Inter-subject error i = 1......s

Pk= Effect of period k; k= 1........p

(Tp) jk = Effect of the interaction of Tx j and period k

Eijk= Inter-subject error (in fact, it supposes no interaction (Pxs)

Inside the Ti).

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Procedure

Semen collection

Semen is obtained using a riding dummy and double gloves, cleaning the sides of the stallion and the preputial diverticulum, then pressing the penis to stimulate the ejaculate Loula [19]. It is collected in a tempered thermos, which has filter paper to avoid tapioca or smegma. Once the semen has been collected, it is weighed to determine the total volume. A mercury thermometer is introduced into the semen to know the temperature of the ejaculate Ubeda et al. [20]. The semen used was from the 2nd spermatic or rich fraction (fraction that comes from the epididymis and that contains 70% of the spermatozoa in the ejaculate, representing 30-50% of the total volume Donald [21].

Motility

A slide is heated to a temperature of 37 °C, then a drop of semen is taken with a Pasteur pipette (Kubus, 2000), the drop of semen is placed on the slide and covered with a coverslip, the percentage of motility is evaluated. Progressive analysis of the spermatozoa in the light microscope, with the 10X weak dry objective and the 40X strong dry objective Flowers [14]; Loula [19].

Concentration

Using a graduated pipette to 1 cubic centimeter, a 1:100 dilution is made in a formulated saline solution, one centimeter of pure semen is added, making up to 100cc Burker [22]. A drop of semen is taken and deposited in the reticulum of the Burker chamber. Dead spermatozoa are counted in 40 frames with the 40X strong dry objective Decuadro [1]. The counted spermatozoa without morphoanomalies are added Burker [23]. Knowing its concentration, we calculate the number of doses that can be obtained from that ejaculate at a concentration of 3 x 109 to obtain good quality semen Kubus [16]; Technical Department of Minitube Mexico [24]; Flowers [25]; Roozeboom [26].

Dose calculation

Number of doses (N) = (A) x 10,000 x 1,000 x (V)

$3x10^9$

Simplified formula.

$$N=\frac{(A)x(V)}{300}$$

Bürker chamber concentration

i. 40 little squares =A

ii. A x 100 =mm3

iii. A x 100000 x 100=CC

iv. A x 10^7 spz/CC

(V) = Volume of the ejaculate in CC.

(A) = Sperm (SPZ). Counted in 40 squares.

(C) = Number of spermatozoa.

(C) = In mm3 = (A) x 10,000 = SPZ /mm3.

(C) = In CC = (A) x 10,000 x 1,000 = SPZ / CC.

(C) Total = (A) x 10,000 x 1,000 x (V) = Total SPZ in the Ejaculate.

Dilution

The MR-A extender is heated in a thermoplate or in a water bath, the temperature is equalized to that of the semen collected, the mixture of semen and extender is homogenized, and motility is observed again Fragoso [27]; Escobedo [28].

Packing

It is carried out in a plastic (cochette bag) which contains identification of the stallion, genetic line to which it belongs, expiration date, and 100 ml of semen Flowers [25]; Kubus [16].

Temperature

It affects the quality of the semen since it is particularly sensitive to thermal changes, so it is vital to keep it between 18 °C, to avoid fluctuations in temperature. The temperature of the semen is gradually reduced for 2 or 3 hours for its conservation Kubus [16]; Goss, 2003). The decrease in temperature below 14 °C causes alterations in the spermatozoon membrane, affecting its fertilizing power Decuadro [1]; Pursel and Johnson [29]. Temperatures above 20°C do not lower sperm metabolism or stop bacterial growth, which greatly reduces the useful life of semen Conejo [30]; Johnson [13]; Bertrand [31].

Transport and conservation of semen

The semen is transported through insulating material such as Styrofoam boxes that prevent temperature variation of the semen. Flowers [25]; Roozeboom [26]. Doses are stored at 18ºC.

Variables to Evaluate

a) Volume of the ejaculate.

b) Motility.

c) Semen temperature.

d) Sperm concentration.

e) Collection frequency.

f) Number of doses

g) Season of the year.

h) Age of the boar.

i) Genetic line of the stallion.

Results and Discussion

The results are described following the variables evaluated:

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Ejaculate volume

In Table 1 The results of each Boar are presented, noting that the highest volume corresponds to the LTP-27 genetic line, and the lowest volume is presented by the LTB-37 line. As the results obtained in this work can be observed, the volume produced by the different genetic lines and the collection rhythms, it is observed that the best genetic line was LTP-27 with a total ejaculate of 328.74 ml. In a study carried out by García Ruvalcaba et al., (1996), they obtained an average of 310.5 ml of ejaculate, with an interval of 5 days between collections. Being this lower than the present study, this is possibly due to the fact that in this work the semen collection was 8.59 days on average. In another investigation carried out in (1998) by Salazar, he found a volume of 207 ml with a collection interval of 3 days, being less than what was found in this study, differing with 121.74 ml in 5.59 more days. Donald [32], obtained 291 ml of ejaculate with an average of 6 days between collections. Which means that the longer the time between collections, the greater the volume of ejaculate (Table 2).

Table 1: Characteristics of Semen by Genetics. Descriptive N Mean Dev. Standard Error Standard Minimum Maximum Meaning.

Descriptive		N	Mean	Standard deviation	Standard error	Minimum	Maximum	Signif
Volume	LTP27	187	328.74	109.01	7.97	71	528	*
	LTH1	118	227.33	55.9	5.15	105	500	
	LM100	137	221.72	63.88	5.46	113	429	
	LM200	91	274.04	37.64	3.95	161	348	
	LM300	53	221.72	54.76	7.52	90	350	
	LTB1	81	295.46	109.82	12.2	70	535	
	LTB37	40	177.35	96.89	15.32	36	505	
Total		707	263.64	95.34	3.59	36	535	
Motility	LTP27	187	88.28	5.03	0.37	70	100	*
	LTH1	118	91.82	5.65	0.52	70	100	
	LM100	137	91.77	4.42	0.38	70	100	
	LM200	91	91.18	3.45	0.36	80	100	
	LM300	53	89.81	5.37	0.74	70	100	
	LTB1	81	87.16	5.64	0.63	60	95	
	LTB37	40	89.75	5.3	0.84	80	100	
Total		707	89.99	5.25	0.2	60	100	
Temperature	LTP27	187	37.06	0.62	0.05	36	38	**
	LTH1	118	37.37	0.79	0.07	35	39	
	LM100	137	36.85	0.73	0.06	35	39	
	LM200	91	36.91	0.49	0.05	36	38	
	LM300	53	37.13	0.52	0.07	36	38	
	LTB1	81	37.7	0.77	0.09	36	39	
	LTB37	40	36.83	0.75	0.12	36	39	
Total		707	37.12	0.73	0.03	35	39	
Doses 1X109	LTP27	187	23.15	8.73	0.64	7.2	46.91	**
	LTH1	118	19.36	9.55	0.88	6.7	69.72	
	LM100	137	19.52	11.1	0.95	8	93.6	
	LM200	91	17.11	5.15	0.54	7.41	35	
	LM300	53	15.64	5.97	0.82	0.9	33.5	
	LTB1	81	19.48	10.97	1.22	2.8	44.46	
	LTB37	40	12.18	7.89	1.25	1.36	35.35	
Total		707	19.43	9.51	0.36	0.9	93.6	
* =p< 0.05 NS **= p> 0.05								

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Table 2: Parameters according to the Season of the Year. Season of the Year Vol Mot Temp No. of doses Interval of rec.

Season of year		Vol	Mot	Temp	Num. Of doses	Interval Of rec.
Winter	Mean	271.02	90.15	37.08	13.14	8.75
	Number	169	169	169	169	169
	Standard deviation	109.21	5.68	0.75	5.24	3.77
	Minimum	36	70	35	4	0
	Maximum	514	100	39	26	19
	Standard error of mean	8.4	0.44	0.06	0.4	0.29
	Significance	**				
Spring	Mean	266.19	90.81	37.13	16.1	10.12
	Number	162	162	162	162	162
	Standard deviation	96.53	5.44	0.59	7	4.27
	Minimum	100	70	36	3	0
	Maximum	528	100	39	31	21
	Standard error of mean	7.58	0.43	0.05	0.55	0.34
	Significance	*				
Summer	Mean	255.9	90.65	37.03	14.85	10.11
	Number	170	170	170	170	170
	Standard deviation	85.83	4.3	0.67	6.83	4.16
	Minimum	71	80	35	1	1
	Maximum	505	100	39	34	22
	Standard error of mean	6.58	0.33	0.05	0.52	0.32
	Significance	*				
Autumn	Mean	261.96	88.67	37.21	13.78	8.59
	Number	206	206	206	206	206
	Standard deviation	89.64	5.23	0.84	5.95	4.1
	Minimum	104	60	35	3	0
	Maximum	535	100	39	36	21
	Standard error of mean	6.25	0.36	0.06	0.41	0.29
	Significance	*				
* =p< 0.05 NS **= p> 0.05						

Motility

In relation to sperm motility between genetic lines, it was observed that LTH-1 had a (91.82%) and LM-100 (91.77%) being the highest, as can be seen in Table 1, the genetic line that had the lowest motility was LTB. -1 with (87.16%) ($p<0.05$) compared to those with the highest motility. Salazar [6] obtained 87.07% Motility in their samples studied, which means that in this study the performance in this variable was better when compared with the results obtained by before Salazar, this may be due to the Hybrid Vigor of the genetic lines studied.

Semen temperature

The temperature of the semen influences according to the genetic line, determining that the highest temperature of the ejaculate recorded for LTB-1 with (37.7 ºC) and the lowest for LTB-37 with (36.83 ºC) see Table 1, we determined this according to animal temperament and genetic line.

Dose 1 x 10^9

The number of doses obtained by the different genetic lines was analyzed, where it was observed that the best genetic line is LTP-27, with 23.15 on average, compared to the one that gave the lowest number of doses produced, LTB-37, with 12.18 on average Table 1. According to the number of doses produced, they coincide with the results obtained by Salazar [6]; Stephano [12], where they report 24.27 doses and 20 doses respectively, these

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results are attributed to the similarity in terms of the elaboration process of the seminal doses and in terms of the concentration in the dilution.

Volume by Station

Taking into account the season of the year, it was observed that the largest volume is produced in winter, with 255 ml. And the season with the lowest volume is in summer, the cause being the high temperature. As can be observed the results obtained in the present work where the volume produced by the different genetic lines, agree with those observed by Cameron, in (1992) found 367 ml in winter and in summer 274 ml. Also, Salazar [12] demonstrated; that in winter an ejaculate of 207 ml is obtained and in summer 188 ml.

Motility by Season

It demonstrates the motility percentages found according to the season of the year, observing that there is a greater motility in all the genetic lines during the spring, it is also observed that there is a lower percentage of motility during the autumn. As can be seen, the results obtained where the motility produced by all the genetic lines agree with what was observed by Salazar [12] who found 87.07% motility in spring, also obtaining 82.31% in autumn.

Collection Interval Days by Station

Demonstrates the days of collection of stallions, during the seasons of the year, noting that there are a greater number of days in spring and summer, also noting that during autumn and winter there is the lowest range that exists in spermatic ejaculations by stallions. In the same way Nazare Torres observed in [33] who found similar results to the intervals of days between ejaculates obtaining the same similarity of the doses produced by the different genetic lines, autumn - 7 days (19 days) and spring - 5 days (20 doses).

Semen temperature by season.

The semen temperature of the different lines was analyzed during the seasons of the year and it was observed that the season where the temperature is higher is during the autumn months, there is also a lower semen temperature of the genetic lines during the summer.

Seminal Doses Produced by Season

The number of doses produced from the different genetic lines during the seasons of the year is analyzed, observing that in spring there is a higher production of doses as well as low production of doses during the autumn months. According to the results obtained, it was the record of the doses produced by the different

genetic lines during the season of the year as shown by the reports of Stephano [12]; Salazar [6], 21 days in spring - autumn and 19 days and 19.7 days spring -16 days autumn.

Ejaculate Volume by Maternal and Terminal Genetic Lines

As we can see the results obtained in this work, where the volume produced by the different genetic lines was taken into account, we demonstrate that the best genetic line is the terminal one, obtaining a greater ejaculate. In a study carried out by Stephano [12]: he obtained a similar result of 265.25. ml., in another investigation carried out (1998) by Salazar found results of 207 ml. We attribute the similar results to the method of semen collection.

Motility between Lines

It represents the variables that the motility suffers between the genetic, maternal and terminal lines where it is observed that the maternal line has the highest motility with 91.23%. According to the results obtained based on the motility percentage, they coincide with those observed by Donal (1998), where he observed 90.75% motility in the semen.

Sperm concentration by lines

Analyzing the number of counted concentrated spermatozoa, we determined the amount of doses produced per ejaculate, between genetic lines, observing that maternal line boars have a higher sperm concentration, it is also observed that there is a lower sperm concentration in terminal line stallions. In a study carried out by Stephano [12], a result of 24.19 counted spermatozoa was obtained. Being this similar to the present study, this is possibly due to the way of interpreting the sperm count in the Burker chamber.

Semen Temperature between Lines

Semen temperature was analyzed between maternal and terminal lines. Where it was determined that the highest recorded ejaculate temperature is in the terminal line, this could be observed according to the genetic temperament of the boars, and there is also a lower semen temperature of the terminal line stallions. Flowers [25] observed in the same way, where he obtained results similar to those obtained at 37.00º C.

Sperm per ejaculate between genetic lines

According to the results obtained in the number of spermatozoa per ejaculate, we can define that the terminal line has a greater production of sperm. As can be seen, the results agree with those obtained by Donal, (1995), where it was obtained 60, 259, 346, and 382. For ejaculate attributed to the similarity in terms of the semen collection process.

Number of doses

The number of doses obtained between the maternal and terminal lines is analyzed, where it was observed that the best genetic line is the terminal producing a greater number of doses,

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also showing a lower number of doses produced by the maternal ones. As can be seen the results obtained by Batista [10], obtained 18 doses per ejaculate. Another study by Donald [32] obtained 17.53 doses.

Sperm per dose

We demonstrate the number of spermatozoa contained in each dose produced by genetic line where we found that the maternal stallions have a higher concentration of sperm in each dose, it is also observed that the terminal line has a lower number of spermatozoa concentrated per dose. As we can analyze the results obtained, they agree with those observed by Salazar [6] & Stephano [12], where they obtained 387.34 and 321.45 respectively, the similar results obtained are attributed to the way of processing the semen and the demand for doses within the farm.

Dose 3 x 10^9

The number of doses obtained per ejaculate between the maternal and terminal lines is analyzed, where it is observed that the best genetic line is the terminal, producing a greater number of doses, also demonstrating that the maternal line produces fewer doses. According to the results obtained in the number of doses produced, they coincide with the results obtained by Nazare Torres [33], obtained 20 doses. In other investigations carried out by Stephano [12] & Salazar [6], 21ds. And 19.7 days. Similar results are attributed according to the standard preparation used for the elaboration of doses in terms of sperm content.

Volume by age

According to the results obtained in terms of volume produced by the different genetic lines. We determined that a higher semen production is reached during the age of 30-41 months, where an X= 263.64 ml is obtained of volume. In a study carried out by Stephano [12], it was observed boars between 24-38 months of age where a volume X of 265.25 ml is obtained. The similarity of the results is attributed to different factors such as: Semen evaluation, age, breed, type of accommodation, season of the year, free or controlled environment, health, nutrition and collection rhythms.

Motility during age

It represents the variables that the motility of the different genetic lines suffers during different ages, where it is observed that there is a greater motility between 89.99% at 17-28 months of age. Likewise, there is a minimum motility variance during the other months of age. In the same way I observe Salazar [6], 90.54% of motility between 15-27 months of age. We attribute the similar results to the process of assessing semen quality.

Concentration of waits by age

The number of concentrated spermatozoa counted inside the burker chamber of the boars during different ages is analyzed, observing that there is a higher concentration of spermatozoa during 9-33 months of age where a concentration X=22.40 is found. In an investigation carried out by Stephano [12], found a sperm concentration X= 24.19.

Semen temperature

The temperature of the semen of the different maternal and terminal genetic lines was analyzed during different ages and observing that there is a higher temperature of the semen between 7-25 months of age of the boars where a temperature X = 37.11 is found. In a study carried out by Flowers [25], he found an ejaculate temperature of 37.00º C, at an age of boars between 9-24 months.

Sperm by ejaculate and age between genetic lines

As we can observe the results obtained in this work where the age of the stallions was taken into account, spermatozoa contained within the total volume of semen, it was observed that there is a greater quantity of spermatozoa during the 9-40 month of age, where there is a total sperm production in the ejaculate of 58,000, 000, 000. As can be seen, the results agree with those obtained by Donal (1995), where he obtained 60259346382, at an age of the stallions of 11-43 months, the similarity of the results is attributed to the semen collection process and age of the boars.

Number of doses by age

The number of doses produced at different ages of the different genetic lines is analyzed, where it is observed that the highest number of doses produced is during the 14-41 month period, obtaining an average of 14.42 doses. As can be observed the results obtained in an investigation by Batista [10], where he obtained 18.0 doses, at 12-43 months of age of the boars, another study carried out by Donald [32], obtained 17.53 doses. With an age of stallions from 13-39 months. The similarity of the results is attributed to the age of the stallions, the way of elaboration of doses based on their contained sperm concentration.

Sperm by dose and different ages of stallions

As we can observe the results obtained in this investigation where the number of spermatozoa contained per dose and the age of the boars were taken into account, it is shown that there is a higher concentration of spermatozoa X= 347.24 during 9-40 months of age depending on the number of doses and time of use of the same. In a study carried out by Nazare Torres [33], obtained a sperm concentration per dose of 300.00, at an age of the boars between 11-42 months. Similar results can be attributed to the way semen quality is assessed and the age of the stallions used.

Dose 3 x 10^9 and age of the boars

The number of doses produced per ejaculate and age of the stallions are analyzed where it is observed that there is a higher production of 19.34 doses, at an age of 9-41 months. According to the results obtained in the number of doses produced and the

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age of the stallions, coincide with the results obtained by Nazare Torres [33], where obtained 20 doses, in boars with an age of 11-41 months. In other investigations carried out by Stephano [12] & Salazar [6], 21days and 19.7 days, in stallions aged 12-48 months and 10-45 months. Similar results are attributed according to the standard preparation used for the preparation of doses in terms of sperm content and age of the boars used [34-89].

Conclusions

a) Ejaculate volume, by season of the year, age of the boar, genetic line was for LTP-27 and the lowest volume was for LTB-37.

b) Motility, by season of the year, age of the boar, genetic line was for LTH-1 and the one with the lowest % was for LTB-1.

c) The highest temperature of the semen by season of the year, age of the boar, genetic line was for LTB-1 and the lowest belonged to LTB-37.

d) Sperm concentration by season of the year, age of the boar, genetic line was for LTH-1 and the lowest concentration was for LTB-37.

e) Collection frequency by season of the year, age of the boar, genetic line had no significant differences ($p \leq 0.05$).

f) Number of doses per season of the year, age of the boar, genetic line, no significant differences were found ($p \leq 0.05$).

Finally, it can be concluded that the longer the time between collections, the greater the volume of ejaculate, the better concentration, better motility, and the greater number of doses.

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How to cite this article: Méndez PN, Galicia DJA, Méndez PNN, Vázquez FF, Campos RM, et al. Evaluation of Boar's Semen Production and Characteristics for Artificial Insemination. Ann Rev Resear. 2023; 9(4): 555766. DOI:10.19080/ARR.2023.09.555766

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DOI:10.19080/ARR.2023.09.555766

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