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Methodology for the Evaluation of Reproductive Management in Pig Farms

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Abstract: To identify areas of opportunity in the reproductive management of pig farms, a questionnaire was developed consisting of 36 reagents, 18 directed to the male management area and 18 to the female. In a second stage, the questionnaire was validated by applying it to 15 cooperating farms. To corroborate the information of the questionnaire, the inspection of the reproductive management was carried out. Each reagent was assigned values of 0: does not exert a negative effect on the reproductive process, 1: slight effect, 2: intermediate effect and 3: negative effect. The average number of points per farm was 44.93; the area that obtained the worst percentage of points in the reproductive management was the boars with 54.93%. No correlation was found between the percentages of reagents classified as deficiencies with the number of females ($p > 0.05$), a negative correlation was found with the fertility percentage ($p < 0.05$) and total born ($p < 0.05$). No correlation was found between general points and area points with the number of females and the fertility percentage ($p > 0.05$), but there was a negative correlation with the total number of piglets born ($p < 0.05$). No effect of the type of operator was found for the general points ($p > 0.05$). There was also no effect of the region for general points in both male and the female areas ($p > 0.05$). It is concluded that the instrument identifies weak points (WP) of reproductive management.

Key words: Management, pigs, reproduction, small producers.

1. Introduction

Swine production can be classified according to the number of animals and the degree of technology used. In relation to the number of animals, the farms are divided into type A with more than 400 breeding sows, type B-1 with more than 200, type B-2 up to 199 and type C which is having pigs on a family with 15 or less sows [1]. Depending on the level of technology, they are classified as industrially technified, semi-technified and non-technified or smallholders farms. The B-1, B-2 units match the semi-technified farms, while the C farms are small-scale farms [2].

These last three make up the non-industrial pig farm (NIPF) including small or medium producers and have common aspects that make it differ from industrial production, since they do not employ technology, do not have sufficient land, are close to human populations and do not have the best genetic material and quality of raw materials for food [3].

Although this type of farms represent more than half of the farm population in Mexico, contribute with local production and benefit low-income populations, their production characteristics tend to originate weak points (WP) or areas of opportunity [4]; these WP focus on health problems, poor product quality, lack of added value, high production costs, low profitability and poor reproductive efficiency [5]; from the reproductive point of view, these WP are expressed with low fertility percentage at birth (FR), small litters, piglets with low weight, a low milk production, low weight at weaning and above all, a loss of body condition in their first lactation, which affects the subsequent gestations [6].

In the reproductive process, elements such as the female, the male, the environment and the operators

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are involved. Basic aspects of management of the boar such as the training age, the semen collection frequency or mating, the process of collection and management of semen [7] and aspects of the female, as heat detection, mating or insemination and quality of these, are some of the aspects that affect the reproductive performance and have an impact on the productive parameters of the farm [8]. The little knowledge on the part of the NIPF producers about the reproductive management of boars and females results in low production rates. For example, in a study where NIPFs were evaluated [9], average fertility was obtained with a minimum range of 75%; females had at least two deliveries per year with a minimum of 10 total births and eight piglets born alive per female. Piglets weaned by litter amounted to 9.2 on average, with a minimum of eight lactations ranging from 18 d to 45 d. These are lower level variables than those reported in industrial farms [10]

Due to the ignorance of the characteristics of the reproductive process in NIPF in rural and suburban areas, it is difficult to identify the WP of areas of opportunity to suggest remedial measures, which makes it necessary to implement a methodology for the evaluation of the reproductive performance in these farms and provide better veterinary support.

2. Materials and Methods

In the first stage, information related to the reproductive process in pigs was compiled, with the purpose of developing an evaluation instrument designed to rate aspects of boar and sow management. Three experts in the field were consulted to confirm that the data to be captured represented factors related to reproductive management. The instrument is composed of a total of 36 reagents, 18 directed to the management of the boar and 18 to the one of the female. For the boar, 12 reagents were associated with general management (BGM), one with direct mating (BDM) and five with artificial insemination (BAI), while for the sow, 15 were associated with general management (SGM), one with direct mating (SDM) and two to artificial insemination (SAI).

In the second stage, direct contact was made with pig farmers who had requested advice from the Department of Medicine and Animal Husbandry of the National Autonomous University of Mexico for the verification of the evaluation instrument. From this contact, NIPF located in seven states in the central part of Mexico (Mexico city, state of Mexico, Guerrero, Hidalgo, Morelos, Puebla, Tlaxcala) were selected that met the following requirements: a maximum number of 400 breeding sows; a complete production cycle; technical advice to the farm at least once a week by a veterinary; production records; a responsible stock worker of male and female breeders and that would agree to the inspection and verification by project personnel.

Although all the farms had the advice of a veterinarian, some reproductive management practices were carried out by the stock worker, such as estrus detection, monitoring during the birth and the diagnosis of pregnancy. The veterinarian was responsible for preparing the semen. In all the farms the concentration of the seminal dose ranged between 2,500 and 3,000 million sperm per dose prepared in plastic bags with a content of 80-100 mL. In all farms was used a short duration diluents but from different supplier.

Based on these requirements, 15 farms were visited between the months of January to March 2017, to perform the verification of the instrument. The farms located in the states of Puebla, Hidalgo and Tlaxcala were considered as rural type farms in region 1, with a temperate dry climate; those of the states of Mexico and Mexico city were considered as region 2 of a sub-urban nature and with temperate climate with rains in summer; the states of Morelos and Guerrero were considered as region 3 of rural category, with a dry tropic climate.

The operation of the instrument was always carried out by the same two previously assigned persons, who

were formerly trained in its application. A physical inspection complemented the evaluation to corroborate the information obtained in the instrument, reviewing the reproductive management of the animals and capturing the production variables: FR and average of the total piglets born per litter (TB) of the last six months, as a reflection of the efficiency in reproductive management.

Following the methodology proposed by Hayes *et al.* [5], four values were assigned for each of the reagents of the instrument: 0 = does not exert a negative effect on the reproductive process, 1 = has a slight effect on reproductive efficiency, 2 = represents a regular effect on reproductive efficiency and 3 = represents a strong effect on reproductive efficiency. The best value obtained by a farm both generally and by area could have been zero (100% adequate responses). The maximum number of points to obtain per area was 54, giving a total of 108 points per farm, establishing that the greater the number of points, the worse the reproductive management. The details of the instrument are presented in Table 1.

The third phase consisted in the analysis of the information obtained from the evaluation instrument and the physical inspection. Initially, the general characteristics of each farm visited were determined, such as: location of the farm, proximity of the farm to houses, number of breeding females, pig housing and personnel. A database was developed, which allowed obtaining a total of points both in general and by areas. From this, the number of points and the percentage of points per farm and per area (male and female) were obtained. Subsequently, the frequency of values that were rated as adequate (value 0) and those that were considered deficiencies (values 1, 2 and 3) was determined for each reagent and the percentage of reagents considered as WP was obtained.

To determine the effect of the points obtained by the instrument on the main reproductive variables, a Pearson correlation coefficient was obtained [11], between the number of females, the percentage of fertility-previously transformed by means of obtaining the square root of the sine-arc- and the average of total born piglets with the points of each farm and area. The comparison of means was made using a *t*-test for the number of points obtained by the farms with family operators or hired workers; finally, to evaluate the effect of the region on the number of points that the instrument generates, a Wilcoxon test was performed [12]. All analyzes were carried out using the JMP 8.0 statistical package [13].

3. Results

The general characteristics of the farms where the evaluation methodology was applied are presented in Table 2, where it is observed that the farm with the least number of females had 21 and the largest 400. Five farms were managed exclusively by the owner's family and 10 farms are in housing areas. All the males were housed in pens and in only two farms the sows were confined full time in individual stalls. All farms had hybrid females and males of commercial genetic lines.

The information collected from the 15 farms allowed to obtain the number of points and the percentage of points in a general manner and by area, recalling that the greater number of points is considered a worse reproductive management. The average of points per farm was 44.93. In addition, it was observed that the area that obtained the worst percentage of points in the reproductive management was that of the males with 54.93% (Table 3).

The percentage of points obtained in general and by area for each of the farms in which the instrument was applied is presented in Table 4 and Table 5 represents the percentage of reagents classified as WP (1, 2, 3), where it is observed that in the male area, of 18 reagents that make up the area of the boars, 12 have a percentage of WP above 50% in the farms evaluated.

Table 6 presents the same information regarding the reagents of the female area; in this case, this area presents a percentage of reagents classified as WP minor,

Table 1 Elements assessed in the evaluation instrument.

Reagent	Male area
BGM1	Does the farm have boars? a) yes; b) purchases doses; c) both; d) no.
BGM2	Meets the male-female ratio (artificial insemination 1:100; breeding 1:20) a) yes; b) no.
BGM3	How often do they buy boars? a) every year; b) every two years; c) less than 3.5 years; d) more than four years.
BGM4	Productive life of boar, years: a) less than 3.5; b) less than two; c) less than one; d) more than four.
BGM5	Are there teaser boars? a) yes; b) they are the ones collected; c) they are occasionally used as teaser boars; d) no.
BGM6	How often are they bought? a) in less than 3.5 years; b) less than two years; c) less than one year; d) more than four years.
BGM7	Boars productive life in years: a) less than 3.5; b) less than two; c) less than one; d) more than four.
BGM8	If the answer was they do not have boars, do they hire them? a) no; b) yes.
BGM9	They are used for? a) natural breeding; b) artificial insemination; c) natural breeding and artificial insemination; d) only as teaser.
BGM10	Are semen doses evaluated? a) all; b) only some; c) occasionally; d) never.
BGM11	Are semen doses sold? a) never; b) occasionally; c) frequently; d) constantly.
BGM12	Are seminal doses bought? a) yes; b) no.
BDM1	How many times per week does each boar mate? a) two; b) one; c) three; d) more than three.
BAI1	Semen collections per boar, per week: a) one; b) two; c) three; d) more than three.
BAI2	Is there a procedure to prepare seminal doses? Yes (seminal dose, diluents ratio: semen, diluents temperature: semen). Yes (seminal dose, diluents ratio: semen, no diluent temperature: semen). No (seminal dose, no diluent ratio: semen, diluent temperature: semen). None.
BAI3	Are the doses stored at a suitable temperature? a) yes; b) some doses; c) temperature is occasionally not kept; d) no.
BAI4	How long are the seminal doses stored? a) 24 h; b) 48 h; c) 72 h; d) more than 72 h.
BAI5	Before using a seminal dose, is motility checked? a) yes; b) yes but only some doses; c) occasionally; d) no.
Reagent	**Female area**
SGM1	Are females bought or female replacements used? a) replacement is done internally with breeding sows; b) replacements are bought; c) replacements are done with fattening females; d) all options are used.
SGM2	What is the main reason for replacing? a) age; b) reproductive problems; c) locomotive problems; d) disease.
SGM3	For pregnancy diagnosis, is any equipment used? a) renco; b) doppler; c) echography; d) none.
SGM4	How often is replacement done? a) monthly; b) yearly; c) every six months; d) over a year.
SGM5	Females reproductive life? a) up to six labors; b) more than seven labors.
SGM6	Weight at first service? a) 100-1,200 kg; b) 120-140 kg; c)150-200 kg; d) less than 100 kg.
SGM7	Is heat detection practiced? a) yes, twice daily; b) once per day; c) occasionally; d) no.
SGM8	Heat detection methods. a) Use of a male/5 min, heat signs, + lordosis. b) No male, only the observation of heat signs, + lordosis. c) No male, no detection of heat signs, only + lordosis. d) No male, no detection of heat signs, no + lordosis, only restlessness.
SGM9	Time of service or artificial insemination? a) 12 h; b) 24 h; c) immediately; d) other.
SGM10	Number of services or inseminations per female? a) 2; b) 3; c) 1; d) all the female will allow.
SGM11	Is one of the following heat revision methods applied? a) male, 18-24 d after mating; b) no male, 18-24 d after mating; c) pressure to back by the stockperson; d) visual.
SGM12	How many times is the diagnose performed? a) 2; b) 3; c) 1; d) 0
SGM13	Time of pregnancy diagnose is done? a) 21-42 d; b) after 21-42 d.
SGM14	Is a hormone product used to synchronize estrus? a) no; b) some sows with problems; c) some sows in general; d) for all the females.
SGM15	Is any hormonal product used to induce farrowing? a) no; b) only in specific cases; c) occasionally; d) always.
SDM1	Is natural breeding and artificial insemination used? a) only artificial insemination; b) artificial insemination followed for natural breeding; c) natural breeding followed for artificial insemination; d) only natural breeding.
SAI1	What is used to inseminate a female in heat? a) a dose from the same male; b) from different males; c) heterospermic doses; d) does not know.
SAI2	Which artificial insemination technique is employed? a) post-cervical; b) cervical; c) deep intrauterine; d) combinations.

BGM = boar general management; BDM = boar direct mating; BAI = boar artificial insemination; SGM = sow general management; SDM = sow direct mating; SAI = sow artificial insemination.

Table 2 General description of the evaluated farms.

Farm	Region	Near housing area	Number of females	Female housing	Male housing	Type of personnel
1	1	No	189	Pen	Pen	Stockperson
2	1	Yes	142	Pen	Pen	Stockperson
3	1	Yes	237	Pen	Pen	Stockperson
4	2	Yes	21	Pen	Pen	Family
5	2	Yes	46	Pen	Pen	Family
6	2	No	196	Pen	Pen	Stockperson
7	3	Yes	140	Stall	Pen	Stockperson
8	1	Yes	27	Pen	Pen	Family
9	3	Yes	279	Pen	Pen	Stockperson
10	3	No	342	Pen	Pen	Stockperson
11	3	No	177	Pen	Pen	Stockperson
12	1	No	400	Pen	Pen	Stockperson
13	2	Yes	183	Stall	Pen	Family
14	3	Yes	150	Pen	Pen	Stockperson
15	2	Yes	37	Pen	Pen	Family

Table 3 Total, average and percentage of points in general and by area of all farms evaluated.

Total	General points	Points from the male area	Points from the female area
Total points	108	54	54
Average per farm	44.93 ± 11.9	29.66 ± 5.82	15.26 ± 7.80
Percentage	41.60 ± 11.0	54.93 ± 10.79	28.27 ± 14.45

Table 4 Points and percentage (%) of points obtained in general and by area in each farm.

Farm	Points in general	%	Male points	%	Female points	%
1	44	50.0	27	40.74	17	31.48
2	39	55.3	30	36.10	9	16.67
3	53	64.81	35	49.07	18	33.33
4	34	44.44	24	31.48	10	18.52
5	71	75.93	41	65.74	30	55.56
6	46	64.81	35	42.59	11	20.37
7	51	66.67	36	47.42	15	27.78
8	44	61.11	30	43.52	14	25.93
9	43	57.41	31	39.81	12	22.22
10	28	40.74	22	25.93	6	11.11
11	36	35.19	19	33.33	17	31.48
12	41	57.85	28	37.94	13	24.07
13	42	53.70	29	38.89	13	24.07
14	34	46.30	25	31.48	9	16.67
15	68	64.81	33	62.96	35	64.81

because in 13 of the 18 reagents the percentages are below 50%.

The number of reagents classified as deficiencies both by area and in general and the percentage of these, as well as the percentages of FR and TB in each of the farms are presented in Table 7.

When correlating the percentage of reagents classified as WP with the number of females, no effect was found ($p > 0.05$). However, a negative correlation was found with FR and TB ($p < 0.05$). No correlations were found between the points obtained in general and by area with the number of females, FR ($p > 0.05$), but negative correlation with TB ($p < 0.05$) was found.

Table 5 Frequency of responses per reagent and percentage of deficiencies in the male area.

General management of boar per reagent					
Reagent	Suitable	Values considered as deficiencies			Percentage of deficiencies per reagent
	0	1	2	3	
1	100.0	0.0	0.0	0.0	0.0
2	60.0	0.0	0.0	40.0	40.0
3	20.0	0.0	0.0	80.0	80.0
4	33.3	0.0	0.0	66.7	66.7
5	60.0	0.0	0.0	40.0	40.0
6	73.3	0.0	0.0	26.7	26.7
7	13.3	0.0	0.0	86.7	86.7
8	100.0	0.0	0.0	0.0	0.0
9	40.0	26.7	13.3	20.0	60.0
10	26.7	0.0	0.0	73.3	73.3
11	13.3	0.0	0.0	86.7	86.7
12	20.0	0.0	0.0	80.0	80.0
13	26.7	20.0	6.7	46.7	73.3
14	20.0	0.0	0.0	80.0	80.0
15	20.0	0.0	0.0	80.0	80.0
16	80.0	0.0	0.0	20.0	20.0
17	40.0	0.0	26.7	33.3	60.0
18	6.7	0.0	0.0	93.3	93.3

Table 6 Frequency of responses per reagent and percentage of deficiencies in the female area.

General management of the female per reagent					
Reagent	Suitable	Values considered as deficiencies			Percentage of deficiencies per reagent
	0	1	2	3	
1	20.0	0.0	0.0	80.0	80.0
2	13.3	73.3	13.3	0.0	86.7
3	6.7	6.7	6.7	80.0	93.3
4	53.3	0.0	0.0	46.7	46.7
5	53.3	0.0	0.0	46.7	46.7
6	66.7	0.0	13.3	20.0	33.3
7	86.7	0.0	0.0	13.3	13.3
8	86.7	0.0	0.0	13.3	13.3
9	60.0	26.7	13.3	0.0	40.0
10	60.0	33.3	0.0	6.7	40.0
11	86.7	6.7	0.0	6.7	13.4
12	40.0	13.3	46.7	0.0	60.0
13	93.3	0.0	6.7	0.0	6.7
14	86.7	0.0	0.0	13.3	13.3
15	86.7	0.0	0.0	13.3	13.3
16	73.3	0.0	0.0	26.7	26.7
17	40.0	0.0	0.0	60.0	60.0
18	80.0	6.7	0.0	13.3	20.0

Table 7 Number of reagents considered as deficiencies in general and by areas, percentage of reagents considered as deficiencies (%), fertility percentage at birth (FR) and average of the total piglets born per litter (TB), per farm.

Farm	Male	Female	General	%	FR	TB
1	10	8	18	50.0	80.2	9.66
2	10	5	15	41.6	92.0	12.05
3	13	8	23	63.8	74.7	10.10
4	8	4	12	33.3	100.0	11.40
5	14	13	27	75.0	66.6	7.40
6	12	6	18	50.0	75.3	12.40
7	12	6	18	50.0	84.1	9.00
8	10	8	18	50.0	85.0	11.66
9	12	7	19	52.7	80.9	11.80
10	9	5	14	38.8	86.1	13.63
11	7	8	15	41.6	79.2	12.66
12	10	6	16	44.4	75.1	13.09
13	10	6	16	44.4	93.0	12.80
14	9	5	14	38.8	71.6	11.57
15	11	13	14	66.6	82.2	11.37

No effect of the type of operator was found for the general points, or for the points of the male and female areas ($p > 0.05$). No effect of the region was found for general points and for points of the male and female areas ($p > 0.05$).

4. Discussion

The instrument designed for the evaluation of the farm was applied with no trouble in farms with different characteristics, number of animals and diverse environmental conditions. Family operators and hired stock workers equally answered the questionnaire and were present during farm visit. In all the farms, the application of the questionnaire and the confirmation of the information took a day of work, starting at 8 a.m. and ending at 6:00 p.m., which agrees with other reports where similar instruments were applied [6, 14].

Considering the percentage of negative points obtained, it was determined that the reproductive management carried out in NIPF in the central zone of Mexico is deficient in a general way, since all the farms generated those negative points, the lowest percentage being 31.19%. The evaluated farms obtained a total of 674 negative points (41.60%). From this total, 229 negative points (14.13%) belong to the females, while 445 negative points (27.47%) to the males, making it clear that the management of the boar is the area that presents the most deficiencies during the reproductive process, therefore, the productive performance of the boar in NIPF is compromised.

Contrary to the results obtained in this study, Lañada *et al.* [15], refer that in the Philippines, in a small-scale production, the productive performance of females is the most damaged due to two main aspects: the high number of non-productive days and the mortality that occurs during preweaning. In the same way, Wang *et al.* [16] mention that there are several management practices that affect the productive efficiency of animals and the performance of brood stock is significantly influenced by several factors that include nutrition, management of future breeders during the growth phase, management of the gilt and training of the boar, which coincides with that reported by Martinez [3].

In the case of the boar, only two reagents were considered adequate on all farms (BGM1 and BGM8). In all cases, this type of farms has boars and do not rent males as reported by Losada *et al.* [9]; this allows expecting a decrease of sanitary risks in the farms. Regarding the replacement of males (BGM6) this is

correct in 73.3% of the farms while the storage of semen doses is carried out adequately in 80% of the farms. Regarding the WP, it is striking that over 80% of the farms came out with them in the reagents BGM3, BGM7, BGM11, BDM1, BAI1 and BAI5; these indicate that most of the farms have old boars; sell part of their prepared doses or buy outside doses despite having boars; collect from the males or use them for natural mating in an excessive way; the seminal doses are not checked before their application.

The age of the boar is an important factor since it affects productive performance. Wang *et al.* [16] mention that the ideal age for the boar to have the first mating is at eight months. After this age, the boar reaches a stable performance from 24 months to 42 months after which the performance declines. The productive parameters related to seminal production are affected by age. The semen volume, the sperm concentration, the total sperm count, sperm motility and number of semen doses per ejaculate, fall drastically after 42 months, which causes a higher proportion of sperm with abnormalities and a lower fertility rate [17, 18].

In several of the farms evaluated there were deficiencies during the processing, evaluation and conservation of the semen, which leads to the understanding that the process of production of seminal doses includes some factors in which attention must be paid to achieve the success of the artificial insemination, without compromising the viability of the doses prepared. The dilution and temperature control of the recently collected ejaculates are the main factors that influence the viability of the sperm. The lack of supervision reduces the survival of the sperm, since it has been reported that ejaculates kept at fluctuating temperatures tend to decrease the quality of the semen, influencing the integrity of the membrane and the motility of the sperm, reducing the amount of sperm capable of fertilizing, which affects the number of piglets born [8, 18].

Finally, it was found that in this type of farms, in addition to storing the seminal doses for a prolonged period, the viability is not verified, not even evaluating, at least, the sperm motility. Broekhuijse *et al.* [19] mention that one of the parameters that is most related to the viability of a seminal dose is motility, contrary to the relationship between sperm motility and fertility where the relationship is minimal, since there is a diverse series of factors that can affect that parameter. In the farms where the questionnaire and visit farm was made, the management had location conditions and technical advice that allowed carrying out reproductive management practices close to those that are carried out in intensive farming on a large scale. These results coincide with those reported by Lemke *et al.* [14] who point out that in small-scale conditions reproductive practices are similar to intensive ones when they are close to communities.

As for the females, 11 reactants were rated as strengths in more than 50% of the farms evaluated, while SGM1, SGM2, SGM3, SDM1 and SAI1 had percentages of weaknesses in more than 60% of the farms. Therefore, the main problems that can be associated as weaknesses in this type of farms are the production of self-replacements, the excessive culling due to reproductive problems; the lack of use of a methodology for pregnancy diagnosis; the use of natural mating, or combination of natural with insemination; and the use of doses from different males to inseminate the same sow.

Regarding the former, an excessive use of replacement females causes the fluctuation of the inventory and of the average female age all of which is related to lower fertility rates and a decreased general productivity of the females [20]. The disposal of females, due to reproductive reasons, agrees with that reported by De Jong *et al.* [21] although many of those replacements do not correspond to reproductive problems, especially when the diagnosis of pregnancy is not carried out.

The use of combinations of natural mating and artificial insemination is considered a common

practice in small-scale pig production but it can be associated with variable results in terms of litter size [9].

The percentage of reagents classified as WP could not be linked to the size of the farm, which indicates that the instrument can be applied in farms of different sizes; however, this percentage of reagents classified as WP is negatively related to the variables that were used as criteria of reproductive efficiency such as FR and TB. The application of the instrument served to identify farms with lower reproductive parameters.

The WP in issues such as: heat detection, timing of insemination and insemination technique, are of great importance in the ovulation rate, female age at first farrowing, parity number [22]; the feeding program, which is a key determinant in the appearance of heat and in the ovulatory rate since any nutritional deficiency or excessive food intake, all have a negative effect on the productivity of the female. The type of facilities and the personnel also have an influence on the parameters mentioned [23].

5. Conclusions

As previously mentioned, some of the WP detected by the evaluation instrument are related to an inadequate heat detection, timing of insemination and quality of the applied dose, all being variables that affect the number of births. This confirms that the instrument was able relate the deficiency of reproductive management with this last-mentioned variable.

Not finding differences in the points obtained by region and type of operator suggests that they are aspects that do not interfere with the application of the instrument or have no effect on the reproductive management of the evaluated farms. However, some of the aspects mentioned above and related to the age of the females or the parity number and feeding variables that were not included in the instrument, may be important, so they should be included in future evaluations. In conclusion, it can be mentioned that the instrument has the capacity to identify deficiencies in the reproductive management of NIPF, especially in relation to the management of the boar.

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