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Technical Efficiency of Artificial Insemination in Dairy Cattle Companies in Camagüey, Cuba

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ABSTRACT

The technical efficiency behavior of artificial insemination in dairy cattle companies in the province of Camaguey, Cuba, was assessed. The breeding data (January 2009-December 2005) from the livestock Vice Presidency of the Ministry of Agriculture in the province were used in the study. The technical efficiency of insemination was calculated from the total number of inseminated females that tested positive to pregnancy diagnostic in every month and company. Range graphic and frequency analyses were performed, and the series components were determined by the multiplicative method. Autocorrelation analysis and seasonal decomposition were made, considering ± 10% as seasonability criterion. The technical efficiency values observed for artificial insemination ranged between 40 and 64%, with a mean of 51.49%. The most commonly observed frequencies were between 48 and 56%, with a stable behavior, and seasonal indexes between 90.21 (May), to 108.91 (September). The decrease in the mean values of technical efficiency in artificial insemination was characterized by the lack of seasonal behavior. It indicated the need to evaluate other factors related to the technical work, as well as other organizational aspects of breeding linked to measures implemented by management in 2008.

Key words: *seasonability, dairy cattle, artificial insemination, time series*

INTRODUCTION

The success of artificial insemination (AI) is usually expressed by the percent of females that do not receive a service again (no-return rate) within a defined period after the first artificial insemination. In most countries it accounts for 65-70% for 24, 60 or 90 days (Bols *et al*., 2010).

Morton *et al*. (2004) considered that the efficiency of the first service is the right indicator to prevent errors in management policies. It includes the terms conception rate, pregnancy rate, and final gestation rate or percent, within specific time periods (21; 42; 60 and 90 days) following the voluntary waiting period.

In Cuba, the technical efficiency of artificial insemination (final gestation rate) is the indicator used to evaluate the performance of the insemination technician, based on the gestations achieved from the total inseminations made. First service efficiency is not considered in herd breeding efficiency analyses, according to results from a survey applied by Bertot *et al*. (2008) to bovine breeding experts in the province of Camagüey, Cuba.

Horrach *et al.* (2012) reported a stable behavior for the final gestation rate, with mean values of 53.87 % in all the herds under AI, between 1982 and 2007, in Camaguey. However, during a gestation diagnostic, the females were observed to have a decreasing tendency.

Considering all the organizational changes taking place in Cuban agriculture since 2008 (changes in land and livestock possession, by decrees 259 and 300 issued by the Ministry of Agriculture), the goal of this work was to evaluate the behavior of artificial insemination efficiency from 2009 to 2015, in dairy companies located in Camaguey, Cuba.

MATERIALS AND METHODS

Production data collected at the livestock Vice-presidency of the Ministry of Agriculture (between January 2009 and December 2015), from seven companies, were used in the study.

The technical efficiency of artificial insemination was calculated from the total number of inseminated females (gestating) during the monthly gestation diagnostic in every company. It was made as follows:

ET = (total of gestating females during the diagnostic/total of inseminated females)*100

Technical efficiency of artificial insemination underwent graphic and range frequency analyses. Series components were determined (cycle-tendency, seasonability and residuals), using the multiplicative method. Autocorrelation analysis and seasonal decomposition were also performed, with ± 10 % as seasonability criterion. All the analyses were performed with Statgraphics Centurion XVI Version 16.1.18. (Statpoint, Inc. 1982-2012).

RESULTS AND DISCUSSION

The technical efficiency values observed for artificial insemination ranged between 40 and 64%, with a means of 51.49% standard deviation = 4.34%), with a difference of 24%, similar to reports by Risco and Archibald (2005), who claimed that the conception levels may vary up to 25%, depending on the inseminators. The most commonly observed frequencies were between 48 and 56%, with a stable behavior, and seasonal indexes between 90.21 (May) and 108.91 (September). The most usually observed frequencies ranged between 48 and 56% (see table), lower than reports by Horrach *et al*. (2012) in Camaguey. They showed the impact of organizational changes that took place since 2008 (changes in land and livestock possession, by decrees 259 and 300 issued by the Ministry of Agriculture).

Fig. 1 shows the sequence for technical efficiency during the period assessed. A normal behavior was observed for time series, with significant partial autocorrelation in the first delay (Fig. 2).

In Camaguey (Bertot, 2007) reported the existence of seasonal behavior in terms of technical efficiency, with the highest values in June and July, and declining by December, between 1982-2005, in the same companies. Later, Horrach (2012) corroborated that behavior during analysis that included herds in the AI plan, in Camaguey, between 1982 and 2007.

The technical efficiency of artificial insemination had a stable behavior between 2009 and 2015 (Fig. 3), with seasonal indexes that fluctuated from 90.21 (May), to 108.91 (September) (Fig. 4). It indicated a 9.71% decline, and a 8.91% increase above the average, respectively, along the period.

These results suggested the low influence of seasonability and pasture availability on the technical efficiency of artificial insemination. However, other studies made in Camaguey demonstrated their effects on female distribution within several breeding categories during the year (Bertot, 2007), and the concentration of calvings (Soto et al., 2014).

Analysis of the annual subseries may help appreciate a decrease in the mean values of efficiency (Fig. 5), which confirmed the effects of the measures taken in 2008; according to the literature on time series, an external event may affect the subsequent observations, as with the application of new policies or decisions (Pupo, González, Neninger and Gómez, 2004).

The key role of the insemination technician is to consider every single detail as relevant, having a close relationship within the expected results, according to their purposes. The technician must be ethical, capable, skillful and highly motivated to complete the job (Alonso, 2003; De Jarnette, 2003).

The results achieved suggested the need to assess the action of other factors associated to technical work and organizational facets of breeding. Motivation is an important element (Bane and Hultnas, 2008); it may be in the form of satisfying financial incentive based on the results achieved.

CONCLUSIONS

The decrease of the mean values of technical efficiency of artificial insemination between 2009-2015, in dairy cattle companies in Camaguey, was characterized by the lack of seasonal behavior. It indicated the need to evaluate other factors related with technical work, as well as organizational aspects of breeding linked to measures implemented in 2008.

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Table. Range frequencies for technical efficiency of artificial insemination

Class	Limits		Mean point	Frequency
	Lower	Higher		
	Less or equal	40.0		0
1	40.0	44.0	42.0	4
2	44.0	48.0	46.0	18
3	48.0	52.0	50.0	19
4	52.0	56.0	54.0	33
5	56.0	60.0	58.0	8
6	60.0	64.0	62.0	2
	Greater than	64.0		0

Mean = 51.49 Standard deviation= 4.34

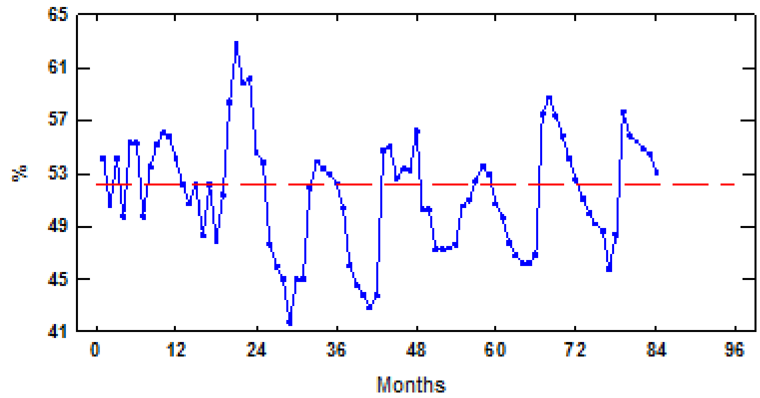


Fig. 1 Time series graph for technical efficiency of artificial insemination

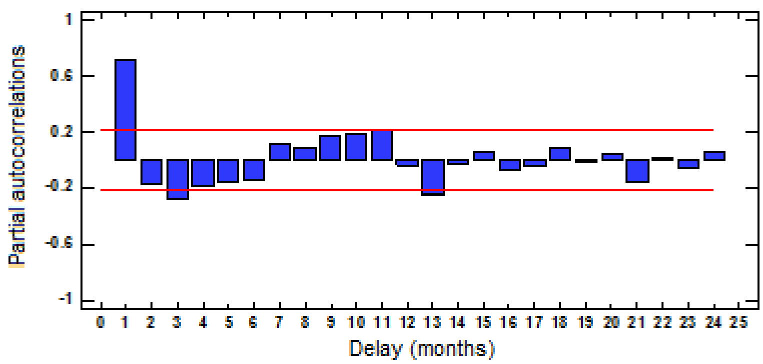


Fig. 2. Estimated partial autocorrelations for technical efficiency of artificial insemination

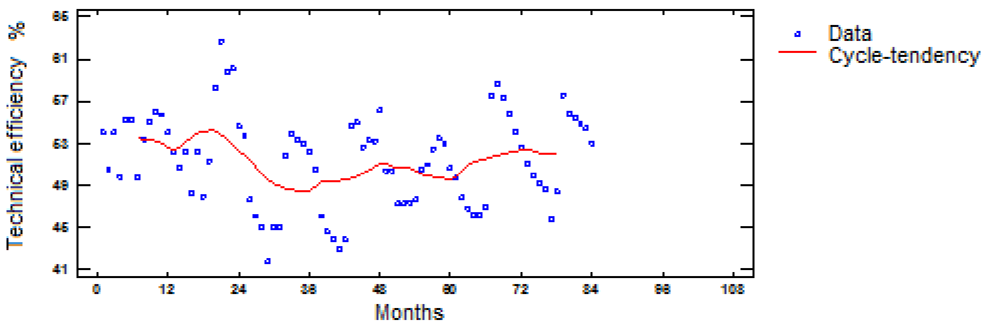


Fig. 3. Cycle-tendency observed for technical efficiency of artificial insemination

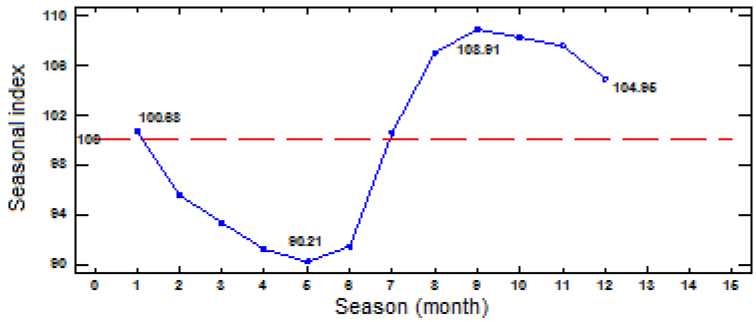
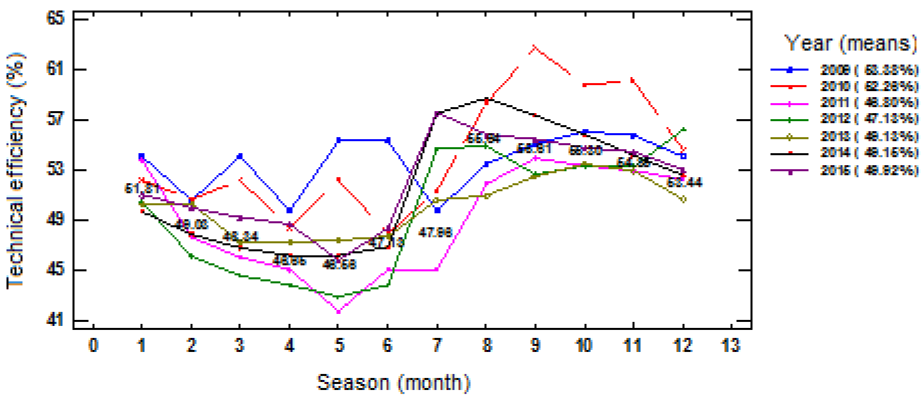


Fig. 1. Seasonability indexes for technical efficiency of artificial insemination



The figures from each month represent the monthly means

Fig. 5. Annual subseries for technical efficiency of artificial insemination