Journal of Animal Production, *3*0 (1), 49-53, 2018

Association of Disease Outbreak and Reproduction in Cattle Herds

Alfredo Alejandro Leal Labrada, José Alberto Bertot Valdés**, Maydier Horrach Junco**, Roberto Vázquez Montes de Oca**, Magaly Garay Durba***

***Agricultural Company, Ministry of Agriculture, Camagüey, Cuba**

****University of Camagüey, Cuba**

jose.bertot@reduc.edu.cu

ABSTRACT

In order to determine the effects of infectious and parasitic diseases during the reproductive stage of artificially inseminated dairy cattle herds in the municipality of Camagüey, province of Camagüey, Cuba, the monthly data of death causes and number of cases (2010-2014) were collected at the company Triángulo 3. Significant correlations were found between the categories of the reproductive stage and the number of cases, seen as stimulus intensity (none = 0; one case = 1; about 2-4 cases = 2; five or more cases = 3). Probit regression revealed that the higher the stimulus the fewer cows awaiting diagnostic, and the greater the number of empty cows. Hence, these cases had a negative impact on the dairy herd´s reproductive behavior. This study recommends Probit regression as a tool for analysis of health issues associated with variables that define the reproductive status of the herd.

Key words: *health status, dairy cattle, reproduction, Probit regression*

INTRODUCTION

Bertot *et al.* (2005) reported the existence of high parasitic infestations, nutritional problems and metabolic disorders (energy and protein metabolism, immune deficit, hypocalcemia, and hypophosphoremia), in dairy cattle herds with high anestrus levels, in Camagüey. These aspects are usually overlooked during analysis of reproductive behavior due to the critical role of nutrition, particularly variations in grass availability, which conditions spontaneous emergence of seasonal calving patterns (Loyola, 2010; Soto *et al.*, 2010).

Fernández, Bertot and Vázquez (2012) reported that the major causes of cow rejections made by companies were reproductive issues, malnutrition, and sales. Also significant were infectious diseases, but their effect on herd reproduction has not been evaluated. Accordingly, the aim of this paper was to analyze the link between the reproductive status of the herd and the number of disease outbreaks.

MATERIALS AND METHODS

Location and duration

This study was made at the cattle raising company Triángulo 3, in the municipality of Camagüey (78º, 10´ W, 22º,29´ N), in the province of Camagüey, adjacent to Sierra de Cubitas and Esmeralda municipalities to the north; Jimaguayú and Minas, to the east; Florida, to the west; and Vertientes, to the south.

The company comprises 14 basic production cooperative units (UBPC), and its purpose is livestock production, including dairy, meat, and leather.

Animals

The female population for reproduction in the period was 11 958 (8 787 cows and 3 171 heifers, on average), distributed in all the productive areas, and under artificial insemination practices. All the animals are Holstein x Zebu, feeding on natural pastures and forages.

Estrus control was made through early morning observation, using the teaser bull procedure. Artificial insemination services were conducted according to the am - pm regulation, based on the national standards established by the Ministry of Agriculture.

Data description

The data related to death causes and number of disease outbreaks in cows were collected from the offices at the Institute of Veterinary Medicine (IMV) in Camagüey.

The entire female population was part of the artificial insemination program, with controlled individual records made by the insemination personnel. The data were used as the primary source of information to compile the monthly reports in all the UBPCs, which provided the extra data in the municipality.

During the period, a number of 108 outbreaks were reported, including infectious diseases (65) and parasitic diseases (43). All the outbreaks classified as moderate; the number of animals affected varied between 150 and 350, with more than 3% recurrence.

Description of the reproductive status of the herd

Reproduction was controlled through the general model used in Cuba, the cows in each herd were pooled in different reproductive categories. The reproductive status of the herd was monitored monthly, based on the reproductive categories below:

Total gestating cows. Total cows in the herd with confirmed gestation

Post calving cows. Post calving cows (60 days) with no artificial insemination service so far.

Cows awaiting gestation diagnostic. Cows that received AI in the last three months.

Empty cows. Post calving cows (more than 60 days) without artificial insemination service.

Additionally, these variables were used:

Gestating cows at pregnancy diagnostic. Cows found pregnant during the pregnancy diagnostic made in the month, corresponding to inseminations performed three months earlier.

Estrus females (during estrus). Estrus females detected in all cycles.

Technical efficiency of artificial insemination. The reproductive index used in production to evaluate the technical work of the insemination technician. The percent of pregnant cow proportion at the time of diagnostic of all inseminated cows.

Analysis of the association between reproductive variables and the number of outbreaks

Bivariate cross was made for combinations between the number of outbreaks and the pregnant cows, post calving cows, and empty cows, through cross-correlation functions of time series, up to 12-month delays. However, no significant association was observed to any delay.

Later, the SPSS optimal interval choice was made to classify the number of outbreaks in the following categories: 0 (none), 2 (between 2 and 4 outbreaks), and 3 (more than 4 outbreaks). Hence, a more adequate data proportion was made, and each outbreak category was regarded as a stimulus, from 0 (minimum) to 3 (maximum).

Spearman correlation was made between the intensity (stimulus) and the reproductive status categories (gestating, post calving cow, awaiting inseminated animals, and empty animals).

It was intended to measure the relationship between the number of outbreaks and case proportion (categories of the reproductive status of the herd) of the total cows for reproduction, which responded to the stimulus or intensity scale during the Probit analysis. Every statistical analysis was made using the IBM ®Stastistics 23 (2015).

RESULTS AND DISCUSSION

To define the expected order of preference of the variable for organization and control reproduction in dairy cattle systems to match the real observations, according to the chronology of the physiological events that end in births, Bertot *et al.* (2009) made bivariate crosses of all series combinations series through cross-correlation function of time series, based on up to 24-month delays. They achieved significant correlations for all the variable combinations between 0 and 15 months, in terms of births. It confirmed the precedence order established to control reproduction in practice.

Figueroa (2010) reported differences of eight and five months among the observed and expected relations during the first estrus. The empty and inseminated cows were within the expected range. However, the gestating cows showed unexpected behaviors.

These results indicated the need to evaluate productive variables with a time preceding approach, considering the manner in which different reproductive events took place, though they have not been linked to health issues.

The Spearman correlation analysis within the quantity of outbreaks with the categories of reproduction, showed the existence of significant correlations with the pregnant cows (Rho= -0.342; $P < 0.01$), the inseminated cows awaiting diagnostic (Rho= -0.551; $P < 0.01$), post calving cows (Rho= -0.375; $P < 0.01$), and the empty (Rho=-0.263; $P < 0.05$).

Probit regression was important to measure the correlation between the number of outbreaks and the proportions of inseminated cows (Table 1), and empty cows (Table 2), in relation to the total number of cows in reproduction.

The response rate to the stimulus intensity (number of outbreaks) in the awaiting and empty cows is shown in Fig. 1. When the number of outbreaks was zero, the natural response rate was 35% for the inseminated cows, and 28% for the empty cows, which indicated that the behavior of such categories was dependent on other factors.

As long as the stimulus increased, the inseminated cows decreased, and the number of empty cows increased. The effect of outbreaks was not significant for total gestating cows, post calving cows, gestating at diagnostic, and technical efficiency.

The previous results proved the negative impact of the number of outbreaks on the reproductive status of the herd, and, therefore, on their reproductive efficiency due to the negative effects on fertility.

In the conditions evaluated, management of pregnant cows was particularly deficient, considering the future performance of cows. According to Santos *et al.* (2013), the transition period between non-lactating pregnant cows and non-pregnant lactating cows was the period with the highest risk of sacrifice and death for a dairy cow.

It is important not to forget that some diseases with direct effects on reproduction, like Trichomoniasis, have distinctive epidemiological traits, as stated by Ondrak (2016), including venereal transmission, transient infection in the cows, and a predilection for chronic prepuce infection in infected bulls.

Some management practices are highly risky to herds, such as changes in policies of land ownership, which favor natural mating and coexistence of studs in AI systems that may contribute to transmission of diseases and an increase in the number of empty cows.

Considering the wide variety of factors that influenced the reproductive behavior of herds, it would be very hard to isolate the effects of all outbreaks of infectious and parasitic diseases. Van Knegsel *et al.* (2014) hypothesized on a link between adapting to lactation, cow health and fertility, cow lifespan, and sustainability of the dairy production chain. In turn, Horrach *et al.* (2012) implied the need to assess the action of other factors associated to technical work and the organizational aspects of reproduction.

Similar results have not been published in Cuba. Nevertheless, the existing data can support the stated hypothesis thanks to the relation observed between the outbreaks of infectious and parasitic diseases and the reproductive status of the herd. The elevated number of outbreaks reduced the quantity of inseminated cows, thus increasing the number of empty animals (heifers and cows) that did not receive AI service for several reasons.

The above arguments call for readily implementation of a global and comprehensive approach of reproductive management with organizational, environmental, and social issues, including animal husbandry and health, tackled by several authors (Rodríguez-Martínez *et al.*, 2008; Thatcher, Staples and Santos, 2013; Horrach *et al.*, 2017) , which might contribute to improvements in the reproductive state of herds and AI efficiency.

CONCLUSIONS

Significant correlations were achieved between the categories of the reproductive status and the number of outbreaks classified as intensity of the stimulus. Probit regression showed that fewer cows were awaiting diagnostic as the stimulus increased; the number of empty cows was also increased. The outbreaks had a negative impact on the reproductive status of the dairy herds. Probit regression is suggested as a tool for analysis of health-related issues with the variables that define the reproductive status of the herd.

REFERENCES

BERTOT, J. A.; DE LA ROSA, A.; ÁLVAREZ, J. L.; AVILÉS, R., GUEVARA, R.; RAMÍREZ, J. A. *et al.* (2005). Evaluación de las causas de anestro en rebaños bovinos lecheros. *prod. anim., 17* (1), 83-89.

BERTOT, J. A.; VÁZQUEZ, R.; DE ARMAS, R.; GARAY, MAGALY; AVILÉS, R.; LOYOLA, C. *et al.* (2009). Relaciones de dependencia temporal entre las variables de organización y control de la reproducción en sistemas lecheros. *Rev. prod. anim., 20 (1),* 89-93.

FERNÁNDEZ, R.; BERTOT, J. A.; VÁZQUEZ, R. (2012). Estacionalidad e impactos de las causas que producen el desecho de hembras bovinas en rebaños lecheros de Camagüey. *Rev. prod. anim., 24* (1), 14-18.

FIGUEROA, J. L.; BERTOT, J. A. y VÁZQUEZ, R. (2010). Evaluación de la recogida de hembras en estro en la empresa pecuaria Triángulo 4 de la provincia de Camagüey. *Rev. prod. anim., 22* (1), 20-25.

HORRACH, M. N.; BERTOT, J. A.; VÁZQUEZ, R.; MAGALY GARAY; AVILÉS, R. *et al*. (2012). Comportamiento estacional de variables relacionadas con la eficiencia de la inseminación artificial en rebaños vacunos lecheros en la provincia de Camagüey. *Rev. prod. anim., 24* (2), 43-46.

HORRACH, M. N.; BERTOT, J. A.; VÁZQUEZ, R.; GARAY, MAGALY; AVILÉS, R. y LOYOLA, C. (2017). Eficiencia técnica de la inseminación artificial en empresas lecheras vacunas de la provincia de Camagüey, Cuba. *Rev. prod. anim.*, *29* (1), 45-49.

LOYOLA, C. J. (2010). *Efectos del periodo de ocurrencia y la intensificación de laparición al inicio de la época lluviosa, sobre la eficiencia bioeconómica de vaquerías comerciales*. Tesis de doctorado, Universidad de Camagüey Ignacio Agramonte y Loynaz, Cuba.

ONDRAK, J. D. (2016). *Tritrichomonas foetus* Prevention and Control in Cattle. *Vet Clin. Food Anim*., *23* (1), 10-16.

RODRÍGUEZ-MARTÍNEZ, H.; HULTGREN, J.; BAGE, R.; BERGQVIST, A.-S.; SVENSSON, C.; BERGSTEN, C. *et al.* (2008). *Reproductive Performance in High-producing Dairy Cows: Can We Sustain it Under Current Practice?* Retrieved on May 10, 2014, from http://dc130.4shared.com/doc/4aMb_ZN-/preview.html.

SANTOS, J.; BISINOTTO, R. S.; RIBEIRO, E. S.; MARTÍNEZ, N. y LIMA, F. S. (2013, noviembre). *Role of Animal Health on Reproduction of Dairy Cows*. Dairy Cattle Reproduction Conference Indianapolis, EE.UU.

SOTO, S.; GUEVARA, R.; SENRA, A.; GUEVARA, G.; OTERO, AIMY y CURBELO, L. (2010). Influencia de la distribución de parición anual y el aprovechamiento del pasto en los resultados alcanzados en vaquerías de la cuenca de Jimagüayú, Camagüey. I. Indicadores productivos y reproductivos. *Rev. prod. anim*., *22* (2), 10-14.

THATCHER, W. W.; STAPLES, C. R. y SANTOS, J. E.P. (2013, noviembre). *The Future of Reproductive Management*. Dairy Cattle Reproduction Conference Indianapolis, EE.UU.

VAN KNEGSEL, A.T.M.; HAMMON, H. M.; BERNABUCCI, U.; BERTONI, G.; BRUCKMAIER, R. M., ROSELINDE, M. A. *et al.* (2014). Metabolic Adaptation during Early Lactation: Key to Cow Health, Longevity and a Sustainable Dairy Production Chain. *CAB Reviews, 9* (2), 41-45.

Received: 7-12-2017
Accepted: 7-20-2017

Table 1. Probit regression results for inseminated cow´s proportion in relation to outbreaks

Parameter	Estimation	Standard error	Z	Sig.	Confidence interval 95 %	
					Inferior limit	Superior limit
Stimulus*	-.089	.006	-15.138	.000	-.100	-.077
Intersection	-.383	.059	-6.535	.000	-.441	-.324

*Number of outbreaks

Table 22. Probit regression results for empty cow´s proportion in relation to disease outbreaks.

Parameter	Estimation	Standard error	Z	Sig.	Confidence interval 95 %	
					Inferior limit	Superior limit
Stimulus*	.068	.012	5.473	.000	.044	.092
Intersection	-.533	.203	-2.628	.009	-.736	-.330

*Number of outbreaks

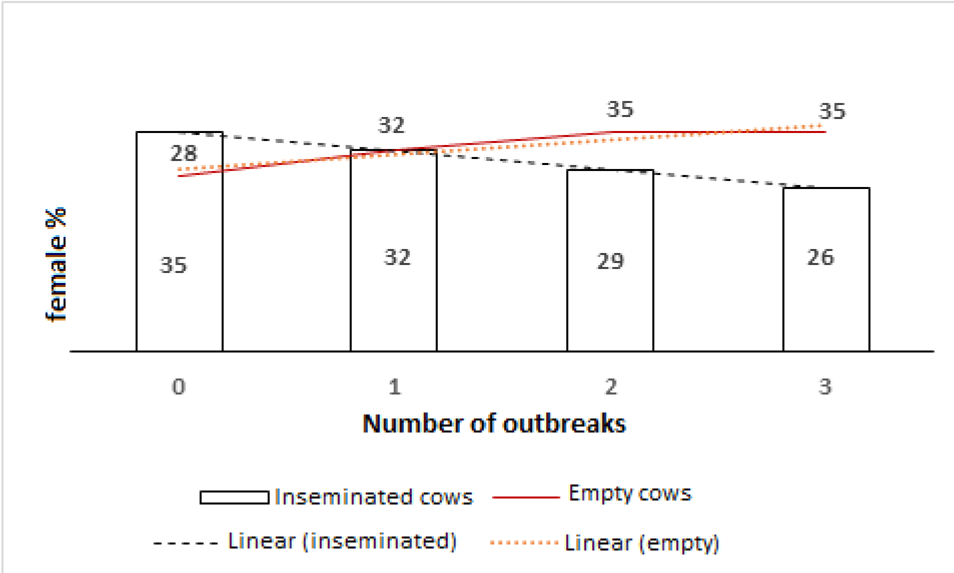

Fig. 1. Response to intensity of stimulus (number of outbreaks)