Repeatability of Productive and Reproductive Traits on a Dairy Buffalo (*Bubalus bubalis*) Farm in Ciego de Ávila Province, Cuba

Odalis Carrera Sáname, Ángel Ceró Rizo**, Roberto Vázquez Montes de Oca**, Guillermo Guevara Viera****

*** Ministry of Agriculture, Ciego de Ávila, Cuba**

**** Faculty of Agricultural Sciences, University of Camagüey, Cuba**

***** Faculty of Agricultural Sciences, University of Cuenca, Azuay, Ecuador**

angel.cero@reduc.edu.cu

ABSTRACT

To estimate the repeatability values of productive and reproductive traits, 257 observations were made to 34 river buffalo cows on a dairy buffalo (*Bubalus bubalis*) farm, at Ruta Invasora Cattle Company, in Ciego de Ávila, Cuba. The buffalo herds were naturally bred, and were manually milked between 4:00 and 6:00 am; the animals grazed on native and introduced grass all the year. One stud was used per of 30-40 cows. The reproduction data were collected from individual control charts, which included the calving number, weight at weaning (WW), weight at breeding start (WBS), calving-calving interval (CCI), and milk production (MP). SPSS, version 23, for Windows was used to estimate the repeatability of the variables studied (weight at weaning, weight at breeding start, calving interval, and milk production), according to the variance components by the general linear model for inter and intra cow variance components. The repeatability values achieved were 0.41 ± 0.03 for WW; 0.50 ± 0.04 for IWM; 0.01 ± 0.03 for CCI; and 0.65 ± 0.06 for MP. High repeatability values for milk production occurred thanks to the absence of previous genetic selection.

Key words: *repeatability, buffalo species, productive and reproductive traits*

INTRODUCTION

Buffalo breeding is carried out as an alternative to milk and beef production on tropical and subtropical regions of the western hemisphere, due to their high rusticity, long productive life, high natality, low mortality, efficient use of native grass, and adaptation to different environmental conditions (Fraga, 2015).

Fundora (2015) noted that the nutrition of buffaloes in the tropic is based on pastures and forages, in the same way overall poor management has a negative influence on the productive and reproductive results.

Today, the repeatability values for weight at weaning (WW), weight at breeding start (BW), calving interval (CI), and milk production (MP) in the province are unknown, which makes it impossible to conduct a selection program of buffalo cows and determine their real production potential.

General objective

The aim of this paper was to estimate the repeatability values of buffalo cows for the traits weight at weaning (WW), weight at breeding start (BW), calving interval (CI), and milk production (MP).

MATERIALS AND METHODS

The Ruta Invasora Livestock Company in Ciego de Ávila, Cuba, was part of the experiment, in which 257 observations were made to 34 river buffalo cows on a dairy farm.

The buffalo herds were naturally bred, on manual milking between 4:00 and 6:00 am; the animals grazed on native and introduced grass all the year. One stud was used every 30-40 cows.

The local climate is characterized by variable temperature and precipitation values (1 200 mm) a year. The annual temperature average is 25 ºC, with a top value of 32 ºC and a minimum of 18.6 ºC. The lowest temperatures were reported in January (15.1 ºC) and the highest were measured in August (34 ºC). Relative humidity averaged 71.5%, with monthly top values of 77% in August, and minimum values in December (60%). Humic, calciform, and very saline brown soils with carbonates are prevalent in the area.

The reproduction data were collected from individual control charts, which included the calving number per cow, weight at weaning (WW),

weight at breeding start (WBS), calving interval (CI), and milk production (MP).

The BW comprised the records of 34 cows from a dairy herd of river buffaloes, including 113 young buffaloes born from the same herd. The records of 257 calvings from the 34 females were used for WW, CI, and MP.

SPSS, 23 (2015), for Windows, was used to estimate repeatability, according to the variance components by the general linear model. The variance components achieved between and within cows were used to calculate repeatability and standard error, according to Falconer (2001) and Becker (1986), respectively.

RESULTS AND DISCUSSION

Inter and intra cow variance components

The analysis of variance table was used to estimate inter and intra cow repeatability. It can be used to break down total variance from observations (inter and intra cow). Table 1 shows the estimation of variance components and the pondered mean of each lactating buffalo cow (7.5), using the Becker correction (1986).

Given the difficulties to estimate genetic parameters in Cuban buffalo populations, caused by the absence of animal genealogies, repeatability was estimated in the four characters included in the study. This genetic parameter not only shows the upper limit of heredity, but also the magnitude of differences among the productive levels of animals with a permanent origin.

The repeatability calculated for the traits in Table 1 corroborates the existence of a low correlation between the means of a single animal; therefore, a larger record is required to estimate further productions concerning the permanent differences among buffalo cows in the herd.

This is attributed to differences between buffalo cows in relation to the maternal environment acquired by the young animals during the first months of life, which has a residual influence on post weaning weights. Weight repeatability at birth was not included in this paper due to the homogeneity of this indicator.

Weight at weaning (r)

The value of repeatability for weight at weaning (Table 2) was 0.41, very similar to the ones reported by Suárez and Ramos (2011), with 0.45. Weight at weaning was higher than the values reported by Tonhati, Giannoni, Polastre, and Ferreira (1988), who found 0.20 repeatability in a Murrah herd, in Brazil.

The standard error of repeatability of weight at weaning (WW) was 0.03, which accounts for only a tenth of the repeatability value.

The standard error for repeatability of weight at weaning (WW) was similar to the values reported in Murrah buffalo females in Brazil (0.04), by Tonhati, Giannoni, Polastre, and Ferreira (1988), and Méndez and Fraga (2009), for Buffalypso (0.03) in the province of Granma, Cuba.

These differences may be given by the utilization of a dairy breed, the ownership type, nutrition, and management conditions, as well as the controls performed to herds under different conditions than in Ciego de Ávila, Cuba.

Weight at breeding incorporation (r)

The value of repeatability for this trait (Table 2) was 0.50 ± 0.04, very similar to the reports made by Tonhati, Giannoni, Polastre, and Ferreira (1988) for Murrah in Brazil (0.38-0.50), with 0.03 standard error.

Calving interval (r)

The estimated repeatability for this indicator (Table 2) was 0.01 ± 0.03, very similar to the study conducted at the Agricultural University of Havana, Mayabeque, Cuba, by Suárez and Ramos (2011), who reported values of 0.08 ± 0.06, and by Amorim and Fraga (2010), who reported 0.06 in Murrah, in Brazil. It was also found in buffalo cows in Egypt (Afzal, Anwar, and Mirza, 2007), with 0.14.

The estimated repeatability value for CI suggests that the selection based on the previous results was conservative, since only 11% of the phenotypical differences between buffalo cows depend on permanent factors. Possibly, the reproductive and nutritional management, and the sanitary conditions have a significant influence on this trait.

Milk production (r)

The repeatability value determined was 0.65 ± 0.06 for milk production (Table 2), much higher than the value range reported in the provinces of Havana and Granma, Cuba, by Mitat, Menéndez, González, and Ramos (2007), with 0.10-0.26; and by Méndez and Fraga (2009), with 0.21-0.35 in Buffalypso.

Moreover, Rosati and Van Vleck (2002), achieved 0.41 in Murrah buffaloes in Italy, whereas Hurtado, Cerón, Aspilcueta, Sesana,

Galvao, and Tonhatí (2011), and Cerón, Gómez, Ramírez, Cifuentes, and Gutiérrez (2012) found 0.38 and 0.41 for repeatability in milk production, in Brazilian and Colombian buffalo cows, respectively.

For milk production, the results of repeatability were higher than the ones reported by Tonhati, Mendoza, Sesana, and Alburquerque (2006), with 0.38-0.50.

Repeatability, like heredity, is not a biological constant, and it may vary from population to population, or from time to time, because it is influenced by genetic differences between individuals, and by environmental differences, due to permanent and temporary effects (Suárez, Pérez, and González, 2001).

When repeatability is high (as observed in milk production), the special environmental variance is low, and measurements provide little accuracy. However, accuracy gain drops quickly as the number of measurements increases, and more than two measurements are seldom needed (Falconer, 2001).

These results should be interpreted as total genetic differences among the animals of the population studied, which may be further used for personal benefit.

CONCLUSIONS

The value of repeatability was very low for the calving interval, and high for weight at weaning, weight at breeding start, and milk production, which in this particular case may be caused by the high number of controlled lactations by each buffalo cow without previous genetic selection.

REFERENCES

AMORIM, A. y FRAGA, L. (2010). *Capacitar y producir en un ambiente seguro*. Ponencia presentada en el Tercer Congreso Producción Animal Tropical, 15 al 19 de noviembre, Palacio de las Convenciones, La Habana, Cuba.

AFZAL, M.; ANWAR, M. y MIRZA, M. A. (2007). Some Factors Affecting Milk Yield and Lactation Length in Nili Ravi Buffaloes. *Pakistan Veterinary Journal*, *27* (3), 113-117.

BECKER, D. (1986). *Manual de Genética Cuantitativa*. Washington. E U.: Publicado por Academia Enterprises Pullman.

CERÓN, M.; GÓMEZ, F.; RAMÍREZ, T.; CIFUENTES, T y GUTIÉRREZ, S (2012). Parámetros genéticos para producción de leche, grasa y proteína en búfalas de Colombia. *Livestock Research for Rural Development*, *24* (2), 34-42.

FRAGA, L. (2015). Principales investigaciones genéticas desarrolladas en el Instituto de Ciencia Animal desde su fundación. *Revista de Ciencias Agrícolas*, *49* (2), 127-130.

FUNDORA, O. (2015). Comportamiento de búfalos de agua (*Bubalus bubalis*) de la raza Buffalypso en sistemas de alimentación basados en pastoreo: quince años de investigaciones en el Instituto de Ciencia Animal. *Revista Cubana de Ciencia Agrícola*, *49* (2), 161-165.

FALCONER, D (2001). *Introducción a la genética cuantitativa*. Londres, Inglaterra: Editorial Longmn.

HURTADO-LUGO, N.; CERÓN-MUÑOZ, M.; ASPILCUETA-BORQUIS, R.; SESANA, R.; DE ALBUQUERQUE, L. G. y TONHATI, H. (2011). Buffalo Milk Production in Brazil and Colombia: Genotype by Environment Interaction. *Livestock Research for Rural Development*, *23* (7), 12-16.

MÉNDEZ, M. y FRAGA, L. M. (2009). Factores no genéticos en la producción lechera de las búfalas Bubalus bubalis en la provincia Granma, Cuba. *Revista Cubana de Ciencia Agrícola*, *43* (3), 239-244.

MITAT, A.; MENÉNDEZ, A.; GONZÁLEZ, D. y RAMOS, F. (2007). *Comportamiento productivo del primer rebaño Buffalypso introducido en Cuba*. II Congreso de Producción Animal Tropical, Instituto de Ciencia Animal, La Habana, Cuba.

ROSATI, A. y VAN VLECK, L. D. (2002). Estimation of Genetic Parameters for Milk, Fat, Protein and Mozzarella Cheese Production for the Italian River buffalo *Bubalus bubalis* Population. *Livestock Production Science*, *74* (2), 185-190.

SUÁREZ, M.; PÉREZ, T. y GONZÁLEZ, M. (2001). *Manual de Mejora Animal*. La Habana, Cuba: Editorial Félix Varela.

SUÁREZ, A. y RAMOS, F. (2011). Caracterización del comportamiento productivo y reproductivo en Búfalas Buffalypso en Cuba. *Zootecnia Tropical*, *29* (4), 485-494.

SPSS (2015). *Software estadístico para Windows* (Versión 23).

TONHATI, H.; GIANNONI, M. A.; POLASTRE, R. y FERREIRA, M. (1988). *Repetibilidade e fatores ambientais que afetam algunas caracteristicas productivas nos bubalinos*. Reuniao Anual Da Sociedade Brasileira de Zootecnia, 25 de marzo, Rio do Janeiro.

TONHATI, H.; MENDOZA, G.; SESANA, R. y ALBURQUERQUE, S. A. (2006). *Programa de mejoramiento del búfalo lechero en Brasil*. III Simposio Búfalos de las Américas, Medellín, Colombia.

.

Received: 9-10-2018
Accepted: 9-16-2018

Table 1. Inter and intra-cow variance components used to calculate repeatability

Characteristics	Inter-cow	Intra-cow
Weight at weaning (kg)	472.104	672.020
Weight at breeding start (kg)	98.772	98.523
Calving interval (days)	1.315	164.489
Milk production (kg)	5 059.949	2 658.064

Table 2. Repeatability values achieved in the four traits evaluated

Traits	r ± SE
Weight at weaning	0.41 ± 0.03
Weight at breeding start	0.50 ± 0.04
Calving interval	0.01 ± 0.03
Milk production	0.65 ± 0.06