

## Productive and reproductive performance of F1 Holstein x Brahman cows in colombian warm climate

### ARTÍCULO DE INVESTIGACIÓN

Pablo A. Motta-Delgado<sup>1, 2, 3</sup>, Jaime A. Oliveros-Lugo<sup>3, 4</sup>, Laura L. Ico-Correa<sup>4</sup>,  
Nadia C. López-Holguin<sup>4</sup>, Lizeth J. Rodriguez-Ortiz<sup>4</sup>, Carlos A. Murcia-Rivas<sup>4</sup>,  
Milton E. Peñaloza-Galeano<sup>2, 3, 4</sup>

<sup>1</sup> *GIMCCA Group. Misión Verde Amazonia: Corporation for sustainable development and mitigation of climate change, Florencia, Caquetá, Colombia.*

<sup>2</sup> *Association of Professionals in Veterinary Medicine and Animal Science from Amazonia (AMEVEZA). Florencia, Caquetá, Colombia.*

<sup>3</sup> *BYDA Group. Universidad de la Amazonia, Florencia, Caquetá, Colombia.*

<sup>4</sup> *Medicine Veterinary and Animal Science Program, Universidad de la Amazonia, Florencia, Caquetá, Colombia.*

[pmottamvz@gmail.com](mailto:pmottamvz@gmail.com)

(**Recibido:** 23 de Febrero de 2015 **Aprobado:** 9 de Noviembre de 2015)

**DOI: 10.17151/vetzo.2015.9.1.2**

**ABSTRACT:** Milk production in the intertropical region has been based on the crossbreeding of *Bos taurus taurus* with *Bos taurus indicus* breeds, generating products of high hybrid vigor as the F1 mix breed with high productive-reproductive potential and resistance to the environment. The dairy productive performance and the reproductive performance of F1 Holstein x Brahman cows in a herd raised in warm climate in the municipality of Cartago, Valle del Cauca, Colombia were evaluated. Records for age at first calving (AFC, n=23), Calving Interval (CI, n=60), milk production per lactation (n=71) and lactation persistency (LP, n=67) in crossbreeding of Holstein bull with Brahman cows were evaluated; the cows were milked twice a day with calf support and supplementation per milking lot. The AFC was 31.3±4.12 months; the average of CI was 423.46±111.26 days; milk production average per lactation was 3052±785 kg, with a range between 540 and 3471 kg. The average LP was 54.22±17.59%, with persistency higher than 60% until the third lactation and lower than 40% after the seventh lactation. In conclusion the productive and reproductive performance in F1 Holstein x Brahman cows is optimum and superior compared to the Colombian double purpose cattle national parameters. F1 Holstein x Brahman cows are long lived reaching ages of 139 months (11.5 years) with eight (8) lactations, milk production per lactation higher than 3000 kg and persistency close to 40%. Nevertheless, this genetic potential is only shown under good nutritional management.

**Key words:** crossbreeding, lactation, hybrid vigor, persistency, sustainable development.

## Desempeño productivo y reproductivo de vacas F1 Holstein x Brahman en clima cálido colombiano

**RESUMEN:** La producción lechera en la región intertropical se ha basado en el mestizaje de razas *Bos taurus taurus* con *Bos taurus indicus*, generando productos de alto vigor híbrido como el mestizo F1 con elevado potencial productivo, reproductivo y resistencia al ambiente. Se evaluó el desempeño productivo lechero y reproductivo de vacas F1 Holstein x Brahman en un hato de clima cálido en el municipio de Cartago Valle del Cauca, Colombia. Se evaluaron registros para edad al primer parto (EPP, n=23), intervalo entre partos (IEP, n=60), producción por lactancia (n=71) y persistencia de la lactancia (PL, n=67) en cruzamiento de toro Holstein con vacas Brahman; las vacas fueron ordeñadas dos veces al día con apoyo de ternero y suplementación por lote de ordeño. La EPP fue de  $31,3 \pm 4,12$  meses; el IEP fue de  $423,46 \pm 111,26$  días; la producción de leche promedio por lactancia fue de  $3052 \pm 785$  kg, con rango entre 2450 a 3471 kg. La persistencia de la lactancia promedio fue de  $54,22 \pm 17,59\%$ , con persistencia superior a 60% hasta la tercera lactancia y menor de 40% después de la séptima lactancia. En conclusión, el desempeño productivo y reproductivo en vacas F1 Holstein x Brahman es óptimo y superior comparado con los parámetros de ganado doble propósito en Colombia. Las vacas F1 Holstein x Brahman son longevas, llegando a edades de 139 meses (11,5 años) con ocho (8) lactancias, producción de leche superior a 3000 kg/lactancia y persistencia cercana al 40%, sin embargo este potencial genético sólo será expresado bajo buen manejo nutricional.

**Palabras clave:** cruzamiento, lactancia, vigor híbrido, persistencia, desarrollo sustentable.

---

### Introduction

The livestock production in tropical ecosystems has been a continuous challenge technical by the difficult environmental, sanitary conditions and low rusticity of specialized breeds. Specialized so-called racial groups are from *Bos taurus taurus* and usually have been imported from Europe or the United States (Campos et al., 2007). The import of Holstein cattle genetic material for Latin America was an increase in milk production, allowing the immediate needs of producers. However, the productive and reproductive performance of animals not always reached expected levels, due to the influence of environmental factors such as climatic, nutritional conditions and management (Cerón-Muñoz et al., 2004; Vergara et al., 2009; Peña-García et al., 2011; Vélez-Terranova, 2011; Herrera et al., 2014), because according to Bohmanova et al. (2005), the continued selection to higher milk production without considering the heat tolerance, results in a decrease in productivity. Therefore, the success of animal production is to

counteract those stress factors that definitely affect negatively on the welfare of animals (Cordova-Izquierdo et al., 2005).

According to Cordova-Izquierdo (2005), the breeding of animals of high production from temperate environments (such as the Holstein breed), with animals resistant to conditions of warm climate of the tropical environment (such as the Brahman breed), are some of the alternatives for the production of animals resistant to heat stress in the tropics. According to Freitas (2003), the multiplication of crossbred animals happen so intense due to good productivity and reproductive efficiency, being the crossbreeding F1 *B. t. taurus* x *B. t. indicus* the more adaptable than animals of pure breed (Magaña et al., 2009).

In view of the growing national trend for milk production based on models of double purpose (DP) with the use of top crosses of high production obtained from the both crossing of taurine breeds such as the Holstein with breeds Zebu as Brahman, it is necessary to highlight the performance of productive and reproductive of this type of crossing in DP systems in warm climate. The present study aimed to evaluate productive dairy and reproductive performance of F1 cross cows between Bull Holstein in Brahman cow product in a herd from Cartago municipality in the Cauca Valley, Colombia.

---

## Materials and Methods

The work was carried out in a cattle company from Cartago municipality in the Cauca Valley state, Colombia, located at 4°41'43" N and 75°54'43" W. The farm is at 900 m S.N.M., with mean annual precipitation of 1800 mm, mean temperature of 25 °C, and relative humidity of 60%, being classified according Holdridge life zone as Tropical Dry Forest (TDF) (Beltrán-González & Abreo, 2013; Motta-Delgado et al., 2013).

The company is dedicated to the bovine production of double purpose based on the crossbreed of Zebu races with Holstein breed, which is performed twice milking with calf support to stimulate the milk ejection. Cows grazing in grassland of *Cynodon nlemfuensis* and *Panicum maximum* cv Mombasa, and were supplemented in modules with a diet of silage grain corn wet, concentrate 40% of crude protein, urea, and ammonium sulphate, balanced taking into account: average production, weight average, days in lactation and body condition of the milking herd.

The physical records inscribed on individual cards of F1 crossbred cows (Holstein bull x Brahman cow) since 2002 until 2011 year, for to determine the age at first calving (AFC, n=23), Calving Intervals (CI, n=60), milk production until the seventh lactation (n=71) and Lactation Persistency (LP, n=67) were analyzed. According to Motta-Delgado et al. (2012) the lactations were normalized to 305 days based on the standardization for incomplete lactations of the Holstein breed and corrected to 4% of fat, was also determined the lactation persistency (reason

between the production of the 280 day reached maximum production peak which is around day 60 and multiplied by 100).

BIOSTAT V. 5.0 statistical software was used for data analysis, using descriptive statistics from probability distribution with the test of normal distribution, correlations and regression ( $r^2$ ) between the number of lactation and milk yield per lactation, age at first calving and milk yield in the first lactation, and the number of lactation and calving interval respectively.

---

## Results and Discussion

Physical records where the dates of birth of individuals were consigned and the date of first calving, finding only 23 complete records, it were analyzed so the age at first calving (AFC) for F1 Holstein x Brahman cows was 31.3 months with a variation of 4.12 months.

Motta-Delgado et al. (2012), evaluated the previous parameter in cows F1 Gyr x Holstein in a herd from Cartago municipality in Cauca Valley state, Colombia, found that AFC in this type of crossing is  $35.4 \pm 5.49$  months, similarly, Freitas et al. (2008), reported an AFC of  $34.5 \pm 5$  months, these results are superior to those found in this study. Likewise, AFC of 31.3 months is an very good parameter for double-purpose cattle in Colombia and is nearly to optimum value ( $30 \pm 2$  months) for dual purpose cattle according to Román et al. (2009), also Marulanda (Vergara et al., 2009) reported that the ideal age at first calving must coincide with the maturity of heifer for support a lactation.

Table 1 show that the general average of calving interval (CI) for F1 crosses between Holstein with Brahman is  $423.46 \pm 111.26$  days. The lower CI arose between second (CI2) at fourth calving (CI3), as well as the eighth birth (CI7). However, studies have shown that the increase in milk production is directly related to the increase of the CI (Girolando, 2009; Leblanc, 2010; Walsh et al., 2011; Motta-Delgado et al., 2012; Veerkamp et al., 2009), coinciding with the data of table 2, where minor CI are presented in the lactations with lower milk yields. Average higher CI is 509.00 days on the CI6, coinciding with increased of 3471 kg of milk yield. Grajales et al. (2006), found that the first CI in Holstein x Brahman cows was of  $425 \pm 77$  days, being softly upper than this work, and according to Vergara et al. (2009), it is a good parameter for double purpose cattle because is lower than 469.2 days.

**Table 1.** Calving interval of F1 Holstein x Brahman in Colombian warm climate.

Parameter	n	Average (days)	SD (days)
CI1	15	422.13	100.82
CI2	10	383.00	43.06
CI3	9	370.78	51.42
CI4	9	445.33	210.91
CI5	8	450.25	136.67
CI6	5	509.00	200.34
CI7	4	383.75	35.59
<b>TOTAL</b>	<b>60</b>	<b>2964.24</b>	<b>778.83</b>
<b>AVERAGE</b>	<b>8.57</b>	<b>423.46</b>	<b>111.26</b>

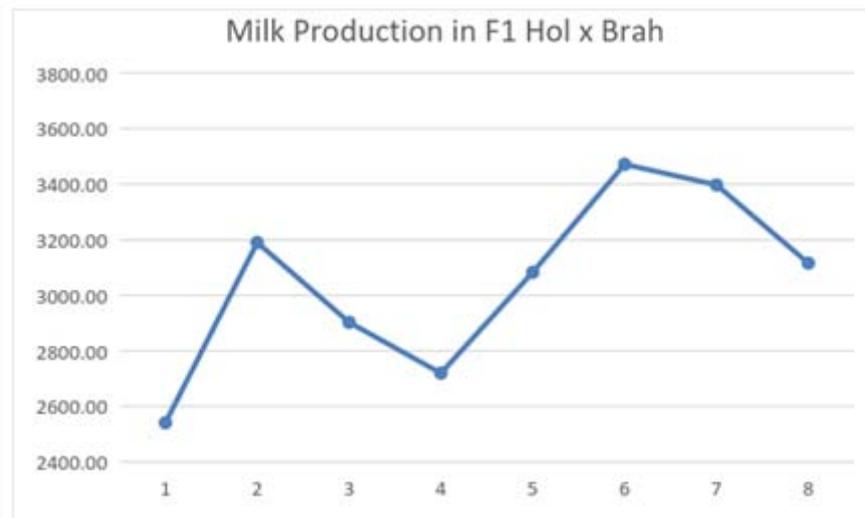
n: Number of observations; DS: Standart desviation.

**Table 2.** Milk per lactation production and lifetime of F1 Holstein x Brahman in Colombian hot climate.

Nursing	n	Average (kg)	SD (days)
1	17	2540.78	913.72
2	13	3190.13	1261.72
3	10	2902.68	706.80
4	9	2719.37	655.35
5	9	3083.05	622.61
6	7	3471.53	1019.81
7	4	3397.42	946.17
8	2	3115.60	156.60
<b>Total</b>	<b>71</b>	<b>24420.55</b>	<b>6282.22</b>
<b>Average</b>	<b>8.88</b>	<b>3052.57</b>	<b>785.28</b>

n: Number of observations; DS: Standart desviation.

Lifetime production for F1 Brahman x Holstein cows (138.78 months or 11.56 years) is 24,420.55±6,282.22 kg of milk yield during eight lactating, with an average of production per lactation of 3052.57±785.28 kg milk in 305 days. It is possible to observe a reduction in milk yield between the third and fourth lactation, despite being higher than the milk yield of the first lactation, but it increases since the fourth until to reach the production peak in the sixth lactation, and after to begin a descent from the seventh lactation as is shown in [Figure 1](#).



**Figure 1.** Evolution of the production of milk per lactation in F1 Holsteins Brahman x in Colombian hot climate.

The figure 1 show two trends of increase in production, between both, first and second lactation and the fourth to sixth lactation, showing irregular and atypical behavior in relation to F1 Gyr x Holstein cows and Holstein Friesian cows and, who presented an increase from the first to eighth and first to fifth lactation respectively (Motta-Delgado et al., 2012; Ferris et al., 2014). According to Hoque & Hodges (1980), the total lifetime milk in Holstein cows was 20,165 kg in 3.3 lactations and 43 months of length of productive life, however the lifetime milk in Holstein is lower than F1 HxB, but milk yield higher.

In addition, taking into account the milk yield accumulated at the eighth lactation, F1 Holstein x Brahman cows produce 3883.55 kg less than F1 Gyr x Holstein cows evaluated by Motta-Delgado et al. (2012), but while F1 Holstein x Brahman cows reach eight (8) lactations in 140 months, the F1 Gyr x Holstein at this age only reached seven (7) lactations, which equates the milk yield of these two types of crosses at the same age.

The lactation persistency is located in a range of 38.39 at 69.28%, with an average population of the 54.22% and variation of 17.59%, where the first six lactations are over 50% natural persistency, starting from the seventh lactation persistency fall below the 40%; from the first to the fourth lactation persistency is located above the population average. Lactation persistency greater than 60% are presented during the first three lactations, from which, started a slight decline to sixth lactation. This indicates that F1 Holstein x Brahman cows present a stable and sustained production over the first six lactations.

Persistency of lactation is typically defined as the rate of decline in production after peak milk production has been reached. High lactation persistency is associated with a slow rate of decline in production, whereas low lactation persistency is associated with a rapid rate of decline (Cole & Null, 2009).

Motta-Delgado et al. (2012), found that cows F1 Gyr x Holstein greater persistence in milk production are between the first and second lactation, coinciding with the data of the present study, however these authors also found that up to the eighth lactation persistence in production are higher than 50%, contrary to the results found in this investigation for the seventh and eighth lactation.

For Shahrabak (1997), lactation persistence is a feature of economic importance and also of great importance in milk yield. Cows with greater persistence ingested less feed to produce the same amount of milk produced by a cow lower persistence, being thus more easily fed in accordance with your requirements, because it's lactation curve is directly related to its ability to ingestion of food.

The correlation and regression results are shown in table 4. This results indicate that variables as age at first calving with milk yield at first lactation are an elevate correlation and a moderate regression, being that to increase the age at first calving also increase the milk yield in the first lactation, also, that to greater number of lactation, the milk yield per lactation is higher. The number of lactation with the calving interval variables is not representative, nor the calving interval with milk yield per lactation variables.

Table 3. Lactation persistency of F1 Holstein x Brahman in Colombian hot climate.

Parameter	n	Average (%)	SD (%)
PL1	17	64.38	24.07
PL2	12	69.28	29.77
PL3	9	61.56	20.18
PL4	9	54.74	17.96
PL5	8	53.70	22.47
PL6	6	53.05	20.92
PL7	3	38.39	3.83
PL8	3	39.50	1.51
<b>TOTAL</b>	<b>67</b>	<b>433.75</b>	<b>140.71</b>
<b>AVERAGE</b>	<b>8.34</b>	<b>54.22</b>	<b>17.59</b>

n: Number of observations; DS: Standart desviation; PL: Persistency of lactation.

Table 4. Correlation and regression results for productive and reproductive variables in F1 Holstein x Brahman cows.

Independent variable	Dependent variable	Correlation	Regresión (R <sup>2</sup> )
Age at first calving	Milk yield at first lactation	0.60	0.36
Number of lactation	Milk yield per lactation	0.65	0.42
Number of lactation	Calving interval	0.36	0.13
Calving interval	Milk yield per lactation	0.19	0.04

Hoque & Hodges (1980), found a positive and high correlation (0.82) between age at first calving with the productivity and longevity of Holstein cows, coinciding with the results of this work. Also Berry & Cromie (2009), found that for each month earlier at first calving the milk production drops, therefore, older the heifer at first calving increased the milk production, coinciding with this study.

---

## Conclusion

The productive and reproductive performance of F1 Holstein x Brahman cows in double purpose system in Colombian warm climate is very satisfactory, when compared with Colombia national parameters for double purpose cattle, presented a precocious reproductive behavior, because the age at first calving is less, as well as the Calving intervals in comparison to other F1 crossbred an double purpose cattle. Milk yield per lactation is high and optimum if are considered productive parameters average of cows of double purpose in Colombia. Lower calving intervals correspond to the lactations with lower milk yields, due to the increase in milk yield inhibits reproductive hormones and even more so when the cows are subject to periods of stress. F1 Brahman x Holstein cows are long-lived, reaching ages of 139 months (11,5 years) with eight (8) lactations, milk yield per lactation upper 3000 kg and lactation persistency nearly to 40%, however, this genetic potential only is showed under conditions of good nutritional management.

---

## Acknowledgements

Appreciation is expressed to Dr. Gabriel Alfonso García for his contributions in research, to Dumar Alonso Zapata for their patience and available during the work, to all workers of the ranch La Miranda and to Mr. Juan Marín by allowing work on his property.

---

## Bibliographic references

Beltrán, J.L.G.; Abreo, C.A. **Evaluación de la producción lechera en vacas F1 estimuladas con somatotropina recombinante bovina (r-bST) en Cartago Valle del Cauca.** Florencia, Caquetá: Universidad de la Amazonia, 2013. 52p. Trabajo de grado (Medicina Veterinaria y Zootecnia).

- Berry, D.P.; Cromie, A.R. Associations between age at first calving and subsequent performance in Irish spring calving Holstein-Friesian dairy cows. **Livestock Science**, v.123, n. 1, p. 44-54, 2009.
- Bohmanova, J.; Misztal, I.; Tsuruta, S. et al. National genetic evaluation of milk yield for heat tolerance of United States Holsteins. **Interbull Bulletin**, v. 33, p. 160-162, 2005.
- Campos, G.R.; Cubillos, C.; Rodas, A.G. Indicadores metabólicos en razas lecheras especializadas en condiciones tropicales en Colombia. **Acta Agronómica**, v. 56, n. 2, p. 85-92, 2007.
- Cerón-Muñoz, M.F.; Tonhati, H.; Costa, D. et al. Interação genótipo-ambiente em bovinos da raça Holandesa brasileiros e colombianos. **Arch. Zootec.**, v. 53, p. 239-248, 2004.
- Cole, J.B.; Null, J. Genetic evaluation of lactation persistency for five breeds of dairy cattle. **Journal of Dairy Science**, v. 92, n. 5, p. 2248-2258, 2009. doi:10.3168/jds.2008-1825.
- Córdova-Izquierdo, A.; Saltijeral-Oaxaca, J.; Rodríguez-Ariza, G. et al. Comportamiento reproductivo de razas bovinas de carne europeas en condiciones de trópico húmedo mexicano. **REDVET**, v. 6, n. 11, p. 1-5, 2005.
- Ferris, C.P.; Patterson, D.C.; Gordon, F.J. et al. Calving traits, milk production, body condition, fertility and survival of Holstein-Friesian and Norwegian red dairy cattle on commercial dairy farms over 5 lactations. **Journal of Dairy Science**, v. 97, n. 8, p. 5206-5218, 2014.
- Freitas, M.S. **Utilização de modelos de regressão aleatória na avaliação genética de animais da raça Girolando**. Viçosa, Brasil: Universidade Federal de Viçosa, 2003. 89p. Tesis (Doctorado en Zootecnia).
- Freitas, A.F.; Costa, C.N.; Menezes, C.R.A. et al. **Programa de melhoramento da raça Girolando-teste de progênie: sumario de touros 2008**. 1. ed. Juiz de Fora, Brasil: Embrapa Gado de Leite, 2008. 20p.
- Grajales, H.; Hernández, A.; Prieto, E. Age and weight at puberty and their relation with reproductive efficiency of cattle breed in the Colombian tropics. **Livestock Research for Rural Development**, v. 18, n. 139, 2015. Available in: <http://www.lrrd.org/lrrd18/10/graj18139.htm>.
- Herrera, J.A.; García, A.; Suárez, J. Prospective analysis o the feeding

basis in a tropical dairy farm with linear programming. **Pastos y Forrajes**, v. 37, n. 4, p. 435-441, 2014.

Hoque, M.; Hodges, J. Genetic and phenotypic parameters of lifetime production traits in Holstein cows. **J. Dairy Sci.**, v. 63, p. 1900-1910, 1980.

Leblanc, S. Assessing the association of the level of milk production with reproduction performance in dairy cattle. **Journal of Reproduction and Development**, v. 56, suppl. P, S1-S7. 2010.

Magaña, J.G.; Parra-Bracamonte, G.M.; Estrada-León, R.J. et al. Characterization of animal genetic resource in the desing of sustainable cattle production system in the tropics. **Tropical and Subtropical Agroecosystems**, v. 10, p. 85-94, 2009.

Motta-Delgado, P.A.; Rivera-Calderon, L.G.; Mariño, A.A. et al. Productive and reproductive performance of F1 Gyr x Holstein cows in Colombian warm climate. **Vet. Zootec.**, v. 6, n. 1, p. 17-23, 2012.

Motta-Delgado, P.A.; Murcia-Ordoñez, B.; Beltrán-González, J.L. et al. Productive and reproductive performance of F1 cows stimulated with recombinant bovine somatotropin (r-bST) in warm climate. **Vet. Zootec.**, v. 7, n. 2, p. 105-116, 2013.

Peña, I.G.; Corvisón, R.M.; Vidal, F.F. Genotype-Environment interaction in on-production dairy cattle during intercalving period in Camagüey-Jimaguayú, Cuba. **Rev. Prod. Anim.**, v. 23, n. 2, p. 141-145, 2011.

Román, P.H.; Ortega, R.; Hernández L. et al. **Producción de leche de ovino en el sistema de doble propósito**. Veracruz, México: SAGARPA-INIFA, 2009. 355p.

Shahrbabak, M.M. **Feasibility of random regression models for Iranian Holstein test day records**. Guelph, Canada: University of Guelph, 1997. Thesis (Ph.D). 138p.

Vélez-Terranova, O.M. **Análisis de las limitaciones nutricionales y de manejo en un sistema de producción lechera en el Valle del Cauca**. Palmira, Colombia: Universidad Nacional, 2011. Tesis (Maestría en Ciencias Agrarias con énfasis en Producción Animal). 165p.

Vergara, O.G.; Botero, L.A.; Martínez, C.B. Environmental factors that affect the age of first calving and calving interval in cows under double-purpose system. **Rev. MVZ Córdoba**, v. 14, n. 1, p. 1594-1601, 2009.

Veerkamp, R.F.; Windig, J.J.; Calus, M.P.L. et al. **Selection for high**

**production in dairy cattle.**In: Raw, W.M. (Ed.). Resource allocation theory applied to farm animal production. United Kingdom: CABI, 2009. p. 243-260.

Walsh, S.W.; Williams, E.J.; Evans, A.C.O. A review of the causes of poor fertility in high milk producing dairy cows. **Animal Reproduction Science**, v. 123, n. 3, p. 127-138, 2011.

---

Motta-Delgado, P.A.; Oliveros-Lugo, J.A.; Ico-Correa, L.L.; López-Holguin, N. C.; Rodriguez-Ortiz, L.J.; Murcia-Rivas, C.A.; Peñaloza-Galeano, M.E. Productive and reproductive performance of F1 Holstein x Brahman cows in Colombian warm climate. **Veterinaria y Zootecnia**, v.9, n.1, p.76-86, 2015. DOI: 10.17151/vetzo.2015.9.1.2. Disponible en: <[http://200.21.104.25/vetzootec/index.php?option=com\\_content&view=article&id=157](http://200.21.104.25/vetzootec/index.php?option=com_content&view=article&id=157)>

---

Esta obra está bajo una [Licencia de Creative Commons Reconocimiento CC BY](#)

