

## Lactation persistency in buffalo herds in Granma province, Cuba. Preliminary results

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A study was developed in Granma province, Cuba for analyzing 1484 monthly records of daily milk production of 500 lactations corresponding to 150 buffaloes of Buffalypso breed between 1997 and 2005. The statistical package SAS (2007), version 9.1.13 was used with the application of a mixed model including six herds, nine calving years (1997-2000) and two calving seasons as fixed effects and as random, each animal dwelling in each herd. Accumulated milk yield was calculated up to 100 (M100) and 200 d (M200). From there, the relationships between these periods  $PI = (M200 - M100) / L100 * 100$  and  $P2 = (M200 - M100) / M200 * 100$  were evaluated. Means were 81.62 and 43.60 %, respectively. The factors herd, year and calving season affected the persistency measurements 1 and 2. The correlations between persistency and production traits were medium and negative. These results are preliminary, since only Granma data were considered. However, the calculated measurement of persistency by the method I showed the best results and showed high variability (57 %). Further studies are necessary on this trait with higher number of observations for allowing the adoption of practical decisions and its possible inclusion in selection programs.

Key words: *persistency, buffaloes, milk yield, environmental factors*

Lactation persistency can be defined as the ability of the animal of maintaining high milk flow during the lactation period (Asker *et al.* 1959). This aspect has been studied in dairy cattle, since it is one of the main traits defining the lactation curve (El Faro 1996), besides being correlated with the initial production.

In view of the economic value of this trait (Dekkers *et al.* 1998) and its favorable correlation with health (Jakobsen *et al.* 2002) and fertility of the female (Muir *et al.* 2004), some countries act in function of evaluating lactation persistency in cows for estimating the breeding values (Mark *et al.* 2005).

In the literature four methods for measuring the persistency are mentioned: 1) milk yield ratios in different lactation phases; 2) variation of milk yield the milk test day throughout lactation; 3) parameters of mathematical models and 4) breeding values obtained through random coefficients of the random regression models (Gengler 1996 and Cobuci *et al.* 2003).

In buffalo cattle, Tonhati *et al.* (2001) stated that milk yield is not thoroughly known indicating the need of studying the production persistency in this species. In Cuba the persistency of milk yield has been studied (Mitat 2008) and the importance of continuing studies on this trait have been pointed out. The objective of this research was to evaluate the lactation persistency by three methods and to learn the non-genetic factors affecting it in buffalo herds in Granma province.

### Materials and Methods

For the investigation, 1484 records of milk production in the control day (PCD) of 500 lactations from the first to the sixth, corresponding to 150 buffaloes of Buffalypso breed, were used. Animals came from six dairy units, belonging to two enterprises

of Granma province. Calving occurred between 1997 and 2005.

From the tenth calving day, buffaloes were incorporated to hand milking which was made once daily, in the morning hours with the support of the buffalo calf. To this, one fourth of the udder was left for its feeding which was rotated during lactation.

Individual measuring of milk yield was carried out every 28 or 32 d. In the control day, milking was realized thoroughly, so that milk calculated from that datum was considered as total female production without considering that taken by the buffalo calf.

The main feeding system was based on natural pastures among which predominated *Dichamantium caricosum*, with the use of king grass (*Pennisetum purpureum*) as biomass bank and sugar cane (*Saccharum officinarum*) as forage. Also, mineral supplements, available in the corrals, were supplied and to which animals had only access at night. Grazing was carried out continuously at daylight hours. This area was divided in paddocks with electric fences to facilitate animal management and best pasture utilization.

For the calculation of persistency, lactation was adjusted to 200 d in each animal and divided in two periods of 100 d each. From these conditions their relationships were evaluated.

Two persistency measurements were analyzed:

$P1 (2:1) = ((L200 - L100) / L100) * 100$  (Johansson and Hansson 1940)

$P2 (2: Total) = ((L200 - L100) / L200) * 100$  (Johansson and Hansson 1940)

Where:

L100 = Partial production from day 1 to 100

L200 = Total production from day 1 to 200

The mixed model used (PROC MIXED of SAS

2007) was:

$$y_{ijklm} = \mu + \alpha_i + \beta_j + \gamma_k + a(\alpha)_i + \alpha_i * \beta_j + \alpha_i * \gamma_k + \beta_j * \gamma_k + \alpha_i * \beta_j * \gamma_k + e_{ijklm}$$

Where:

y = value for each one of the observations of the persistency indicators evaluated

μ = Mean of the population

α<sub>i</sub> = Fixed effect of herd (i = 1, 2, ..., 6)

β<sub>j</sub> = Fixed effect of the calving year (i = 1, 2, ..., 9)

γ<sub>k</sub> = Fixed effect of calving season (i = 1, 2)

a(α)<sub>i</sub> = Random effect of the ear tag of each animal dwelling within each herd i

e<sub>ijklm</sub> = Residual error, normal and independently distributed (0, σ<sub>e</sub><sup>2</sup>).

In the model described there were no interactions between main effects, due to the inequality and, in some cases, to the low number of observations for their correct representation (table 1).

11 provinces, with more than 12 000 lactations obtained a persistency value of 56.67 %.

Other authors reported higher persistency indices than those attained here. De Andrade *et al.* (2010) in dairy Murrah buffaloes, reared with natural pasture in the Northern state of Rio Grande, Brazil, registered 92.7 % as persistency mean, regarding total milk production. The methods used for its calculation were based on the relationships between milk yield and its variation throughout the lactation.

The coefficients of variation were high and different between methods, due to the phases in which lactation was divided (100 and 200 d) with which the persistency measurements were calculated.

P2 mean is considered low and could be due to the progressive reduction of lactation (CENCOP 2007), therefore, it is possible that a lower amount of animals surpassed the 200d with acceptable productions.

Table 1. Number of observations by effect

Effects	Observations	Effects	Observations		
Dairy unit	1	169	Calving year	1997	13
	2	96		1998	13
	3	37		1999	17
	4	32		2000	19
	5	23		2001	39
	6	14		2002	48
Calving season	1	272		2003	53
	2	99		2004	63
				2005	106

The phenotypic correlations were determined between the three persistency measurements and four productive indicators: milk yield at 100 and 200 d (M100 and M200), total yield (Mtot) and lactation length (Llen). These were obtained through the procedure CORR of Pearson of SAS (SAS 2007).

**Results and Discussion**

Results from the general means, standard deviation and coefficient of variation are set out in table 2. The value of P1 was similar to that 73.96 % reported by Mitat (2008) in female buffaloes of the genotype in the Western region of the country. Suárez *et al.* (2011) in a study with records of 135 dairy units, 26 enterprises and

The significant effect of the herd, year and calving season was evidenced for the measurements 1 and 2 (table 3). Similar results to these were reached by Suárez *et al.* (2011) in buffaloes of similar genotype, located in herds of different provinces of the country. De Andrade *et al.* (2010) and Abdelsabour (2010) in Brazil and Egypt respectively reported a similar performance.

It was verified that the herd effect had an impact on two persistency measurements (table 4) and that the highest values corresponded to the herd 3. This variability between the different herds was mainly due to the fact that in the buffalo population of Granma no selection directed to milk production has been practiced and, thus, there are animals of variable performance.

Table 2. Number of observations (N), general means (Mean), standard error (SE) and coefficient of variation (CV) of the two persistency measurements and of milk yield

Persistency measurements	N	Mean	SE ±	CV %
P 1 (2:1), %	371	82.47	0.33	57.0
P 2 (2: total), %	371	43.60	0.15	19.0
M100, kg	371	391.76	6.68	32.84
M200 kg	371	692.30	10.20	28.36

Table 3. Results from the variance analysis of the fixed effects using the mixed model for the persistency measurements evaluated

Trait	Effect	Numerator DF	Denominator DF	F	Sig.
P1	Herd	5	226	10.00	***
	Calving year	8	226	9.28	***
	Calving season	1	226	16.54	***
P2	Herd	5	226	5.99	***
	Calving year	8	226	4.49	***
	Calving season	1	226	15.59	***

\*\*\*P &lt; 0.001

Also, other genetic factors could have influenced (different genotypes by uncontrolled crossing and lack of selection) and non-genetic (climate, management, feeding). Studies realized by Suárez *et al.* (2011) in 135 herds of eleven Cuban provinces also indicated the herd factor as one of those affecting most the persistency measurements.

The calving season (table 5) had significant effect on two persistency measurements (1 and 2). Similar seasonal effects on lactation persistency were also reported by Chaudhary *et al.* (2000) and Paula de Sousa *et al.* (2011) in dairy Murrah buffaloes.

Buffaloes calving out of season (99 calvings) had higher values regarding those calving in the seasonal periods (272 calvings). This was to be expected, because of greater feed availability in this stage (July-October). Das *et al.* (2007) in a study carried out with female swamp buffaloes in India registered this same behavior, although the calculation of both persistency measurements was by different methods than that applied in this investigation. The above cited authors stated that this performance could be due to the fact that in the period out of season (February to July) there is lower

number of calved buffaloes and, thus, there is a better attention to the management.

The persistency measurements of milk yield in buffaloes throughout the different years (figure 1) show variation ( $60.1 \pm 11.2$  to  $123 \pm 9.4$  %) and ( $37.8 \pm 2.1$  to  $52.6 \pm 1.9$  %) for P1 and P2 persistency, respectively. These significant differences between the different years of study can be attributed to changes in the environmental conditions, especially in the climatic, as well as to different management conditions or calving frequency, according to the season. Various authors (Mitat 2008 and Paula de Sousa *et al.* 2011) reported this effect as significant in the lactation persistency attributing it, in general, to the management.

In table 6 are shown the correlations between the three persistency measurements with three production traits: lactation length (Llen) and milk yield at 100 (M100) and 200 d (M200).

The correlation found in this study between the persistency measurements (1 and 2) with the milk indicators (M100, M200 and Mtot) were medium and negative. A similar result was found by Gengler *et al.* (1995) in Holstein cows of Belgium and Mitat (2008)

Table 4. Least quadratic means of P1 and P2, according to the herd

Herds	P1 %		P2 %	
	$\bar{X}$	$\pm$ SE	$\bar{X}$	$\pm$ SE
1	86.4 <sup>a</sup>	3.5	44.1 <sup>ab</sup>	0.7
2	91.6 <sup>a</sup>	4.7	45.8 <sup>b</sup>	0.9
3	123.6 <sup>b</sup>	7.2	52.7 <sup>c</sup>	1.4
4	83.8 <sup>a</sup>	7.5	44.4 <sup>ab</sup>	1.4
5	81.5 <sup>a</sup>	9.3	41.4 <sup>a</sup>	1.7
6	97.9 <sup>a</sup>	11.4	48.0 <sup>b</sup>	2.1

Means with different letters by column differ significantly at P < 0.05 (Duncan 1955)

Table 5. Least quadratic means of P1 and P2 according to the calving season

Calving season	P1 %		P2 %	
	$\bar{X}$	$\pm$ SE	$\bar{X}$	$\pm$ SE
1 (in season: July-October)	84.8 <sup>a</sup>	4.4	44.3 <sup>a</sup>	0.8
1 (out of season: November-June)	103.5 <sup>b</sup>	5.0	47.9 <sup>b</sup>	1.0

Means with different letters by column differ significantly at P < 0.05 (Duncan 1955)

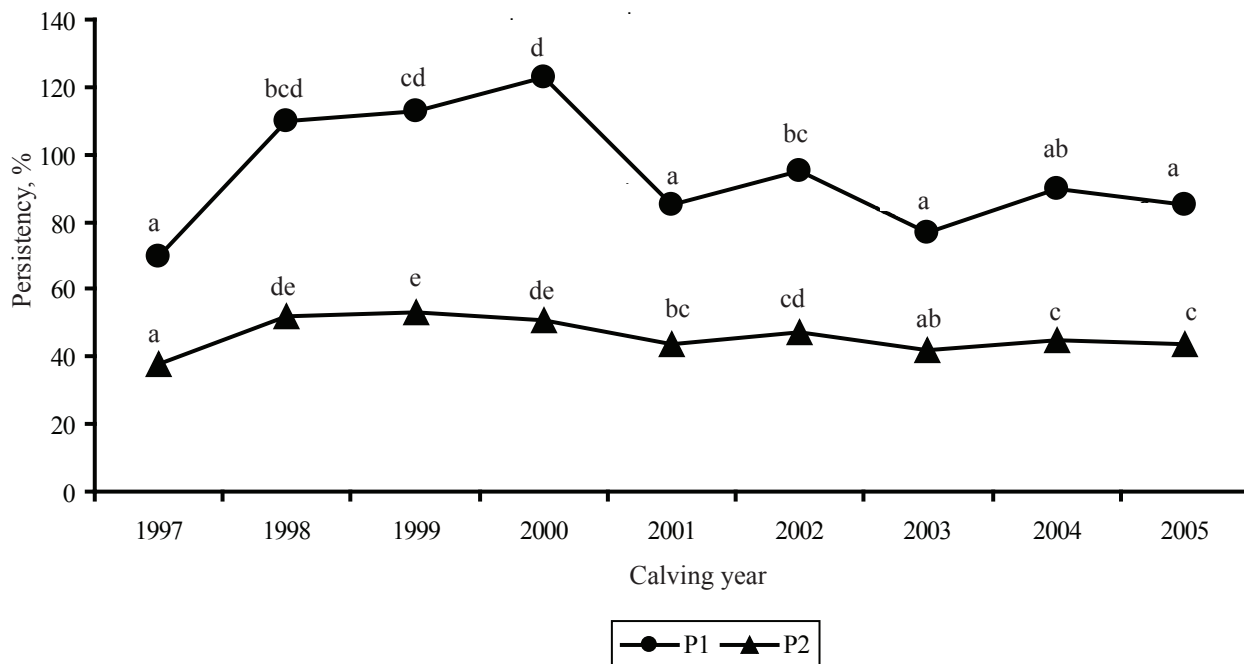


Figure 1. Variation of the least square means of P1 and P2, according to the calving year

Table 6. Phenotypic correlations between the persistency measurements and four milk yield traits

	Per 2	M100	M200	L len	Ltot
Per 1	0.87***	-0.50***	-0.08	-0.48***	-0.37***
Per 2		-0.43***	-0.06	-0.38***	-0.29***
M100			0.89***	0.34***	0.83***
M200				0.15***	0.76***
Llen					0.73***

Llen = lactation length

M100, M200 = Milk yield at 100 and 200 d of lactation

Ltot= Total milk yield

\*\*\* P < 0.001

in female buffaloes of similar genotype in Western units of Cuba. Methods 1 and 2 are very similar indicating that it is not to be expected that on extending lactations there will be greater persistency. According to Cobuci *et al.* (2003) the measuring method of persistency based on the sum of milk yield in different lactation periods presents positive correlations regarding total production. However, that considering the deviations in milk production during lactation showed signs of negative correlation.

The explanation for these contradictory results is that, in the first method, the production level exerts high influence on persistency, while in the second the production variation is the one affecting it.

Results of this investigation are preliminary, since there were only data from Granma province. Nonetheless, the persistency measurement of milk yield calculated by method 1 showed best results. It presented high variability (57%) in which significantly influenced the herd, year and calving season factors. Facing this reality, other studies on this trait are necessary with greater number of observations that will allow taking

practical decisions for the inclusion of this trait in selection programs.

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