

Evaluation of milk production performance of dairy buffaloes raised in various herds of the Philippine Carabao Center

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ABSTRACT: Milk production performance of dairy buffaloes from 9 herds was evaluated. There were a total of 1,858 305D milk production records containing 13,219 milk test records from 1997 to 2006 available for evaluation. Records were analyzed with general linear model to determine the effect of season, parity and age at calving on standard 305D milk yield. Parity, season of calving and age at calving affected milk yield significantly. Average 305D milk production increased significantly from 864 kg in 1997 to 1244 kg in 2006. Genetic evaluation of milk production traits was also done using the same data set. The model for analysis is a multi-trait full animal model. Only the first three lactations are included in the analysis. The first lactation is divided into three stages namely, 100D, 200D, 300D each being considered as three separate traits. The resulting values from the three traits are combined into one to get the first lactation estimated breeding values (EBV). The genetic correlations between traits were all positive ranging from 0.78 to 0.94 between 100D and 303D of the lactation and between the 2nd and third lactation respectively. Estimates of heritabilities used in the analysis were 0.36, 0.39, 0.30, 0.32, and 0.33, for 100D, 200D, 300D, 2nd lactation and 3rd lactation respectively. The average EBVs of cows were plotted against birth year. The trend was positive with 4 kg and 8.4 kg increase per birth year for the 1st and both the 2nd and 3rd lactation respectively. This positive trend is consistent and may be responsible for the increase in milk production performance of cows. Apparently, selection of replacement animals based on milk production performance of dams and use of imported semen from proven bulls was effective before EBV information on sires and dams are available in the Philippines. The use of EBVs in selection would increase the rate of genetic improvement in dairy buffalo population in the Philippines.

Key words: Buffaloes, Carabao, Milk production, BLUP.

INTRODUCTION: Water buffaloes (*Bubalus bubalis*) typically are found in Asia, the India, Pakistan, Egypt South America and Europe. The species can be categorized into two types, the swamp and riverine. The Asiatic swamp type is more commonly seen in Asia as draft animal. In the Philippines, it is characterized by slow growth rate and low milk production potential. In order that the swamp buffaloes is transformed from a traditional draft animal to an efficient producer of milk and meat, upgrading of the population with

riverine blood is essential. Hence, the Philippine Carabao Center (PCC) has established several herds of riverine buffaloes as source of frozen semen and breeding animals to make available for buffalo farmers in order to increase the number of buffaloes with riverine blood. Milk production performance and genetic analysis was done using the records of these animals.

MATERIAL AND METHODS: Pedigree and milk production records of 757 riverine cows from 9 PCC herds of the PCC totaling 1,871 individual lactations and 13,219 milk test day records from the years 1997 to 2006 were available. Lactation records that are less than 30 days in length were edited out leaving a total of 1,858 records for analysis. The data was analyzed in a general linear model:

$$Y_{ijkm} = H_i + Y_j + S_k + Pm + D_n + e_{ijkm}$$

Where: Y_{ijkm} = 305D milk yield; H_i = fixed effect of herds (8 levels) included in the analysis; Y_j = fixed effect of calving year of cows (1997 to 2006); S_k = fixed effect of season of calving (4 levels); S_k = fixed effect of parity number of cows; D_n = days in milk as covariate; e_{ijkm} = random errors.

Using only the lactation records of the daughters of the original cows that calved starting in the year 2000 up to 2006; the effect of age at calving on milk yield was analyzed. There were 347 individual lactation records available. Age at calving was divided into 37 2-month intervals (24 mos.–100 mos.). Average milk production of cows in each 2-month interval was plotted against age at calving. A regression line was fitted to the plot. The same data set was used in genetic evaluation of milk production traits. The development of the customized program for running the genetic evaluation was developed in collaboration with the Agri-Business Research Institute (ABRI) and the Animal Genetics and Breeding Unit (AGBU) of the University of New England. The animal model is multi-trait between lactations that evaluate only the first three lactations. The first lactation is subdivided into three 100D intervals: 1-100D, 101 – 200D and 201 – 305D. The full 305D 2nd and 3rd lactation records are considered correlated traits. There are five Estimated Breeding Value (EBV) outputs corresponding to 1 – 100D, 101 – 200D, 201 – 305D of the 1st L and the full 305D 2nd and 3rd lactations respectively.

RESULTS AND CONCLUSION: The analysis of factors that affect milk production performance was done. Seasons in this model are defined as four 3-months intervals. Cows calving in season 3 (Table 1) had significantly higher milk yield than cows calving in season 1 and 2. Cows calving at season 3 would reach peak production when rainy season is about to end and the colder temperatures start to set in hence, it is favorable for production.

Average milk production is lower for 1st parity cows (Table 2) but increases significantly up to 3rd pari-

Table 1. Effect of season of calving on milk yield of buffalo cows.

Season	LSMean, kg	SE
1 (Dec – Feb)	1016.2 ^b	27.36
2 (Mar – May)	1003.8 ^b	31.23
3 (June – Aug)	1068.7 ^a	28.24
4 (Sept – Nov)	1023.5 ^{ab}	26.00

Levels not connected by the same letter are Significantly different.

ty. This suggests that on the average, the age at which the cows are at maximum production is at 5-6 years assuming that they first drop a calf at 3 years. The average milk of cows at different age of calving was plotted. A line was fitted best described by a quadratic equation: $Y_{305D} = -107.6 + 34.6(\text{age}) - 0.224(\text{age})^2$. The average milk yields increases linearly with age up to about 48 mos. and starts to decline with increasing age reaching maximum production at about 72-80 mos. of age. The line suggests that routine replacement of cows should be considered at 7-8 years old. However, management decision of how old cows should be retained should also consider the cost of rearing heifers on one hand and faster turnover rate for a higher rate of genetic gain in the female population on the other hand.

The average milk production of cows per year is given in Table 3. There is a significant increase in average 305D milk production per year from 864.5 kg. to 1,244 kg. The difference is most noticeable between the years 1997-2000 involving only the original cows' production records and the years 2004-2006 wherein there is already large contribution from the daughters. The improvement seen per year can be attributed to improvement in overall herd and feeding management and improved genetics.

The heritability estimates used in the analysis were 0.36, 0.39, 0.30, 0.32 and 0.33 for 1-100D, 101-2—D, 201-305D, 2nd L and 3rd L production traits respectively. Genetic correlations were high between traits ranging from 0.78 – 0.94. The average cow EBVs are shown in Table 4. The first lactation EBV is derived from the combination of the three intervals of the first lactation. It is very apparent that there is a very large variation between the good and poor performing cows for all milk production traits. Values ranged from -556.3 to 618.9. It is expected that response to selection will be large with such a wide range. Because the data

set available in PCC is still relatively small, there is a need to re-estimate genetic parameters and non-genetic adjustment factors once the data set has grown. Nevertheless, it is better to have such information available on cows than not having any solid basis for selection especially if we are going to consider elite cows from several herds as dams to produce sires.

Table 2. Effect of parity on milk Yield of buffalo cows.

Parity	LSMean, kg	SE
1	956.9 ^b	21.58
2	1094.9 ^a	21.20
3	1069.7 ^a	24.49
4	1039.5 ^{ab}	29.29
5	1072.5 ^{ab}	36.23
6	981.5 ^{ab}	44.52
7	1050.9 ^{ab}	66.20
8	955.9 ^{ab}	114.56
9	640.0 ^{ab}	370.69

Table 3. Average 305D milk yield of buffalo cows per calving year.

Calving Year	305D milk yield, kg	SE
1997	864.8 ^d	42.0
1998	934.2 ^d	38.7
1999	916.5 ^d	41.1
2000	944.9 ^d	37.9
2001	978.4 ^{cd}	36.9
2002	983.2 ^{cd}	34.8
2003	1068.9 ^{bc}	30.3
2004	1121.4 ^{ab}	31.3
2005	1224.0 ^a	32.3
2006	1244.3 ^a	43.3

Levels not connected by the same letter are significantly different.

Table 4. Average EBVs of buffalo cows.

Parameter	1-100D	101-200D	201-305D	1 st L	2 nd L	3 rd L
Mean EBV	-13.5	-6.4	-14.4	-34.3	-63.4	-59.8
SD	56.4	54.4	43.6	150.6	175.9	170.8
Max	216.4	238.8	163.8	618.9	568.3	569.2
Min	-165.9	-167.2	-142	-468.8	-556.3	-553.2

The average EBVs were also plotted against calving or birth year of cows to determine the trend. There is a steady increase in average cow EBVs per birth year. There is a 4 kg increase in average EBV/yr for the first lactation and 8.4 kg increase/yr for the 2nd and 3rd lactation. The result support or is consistent with the observed increase in average milk yield of cows per year shown in Table 3 wherein we saw that the markedly significant increase in 2004 to 2006 when the daughters started to have a larger share in the production. The selection of replacement heifers and young bulls for breeding prior to the year 2006 were mostly based on dam's milk production performance. Nevertheless even with only such a basis there appeared to have an increase in genetic potential among the daughter relative to their dams. Now that information is available for both the sire and dam, the selection will be much better and it is expected that the rate of genetic gain will be much faster.

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