

# Estimation of Breeding Values by WOMBAT Method for Selection of Sires in Crossbred Cattle

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## Abstract

The records of 1003 crossbred cattle sired by 68 bulls were analyzed to estimate breeding values of sires using Wombat sire evaluation method. The average breeding value for age at first calving in crossbred bulls was found to be 1198.26 days by Wombat method. The estimated overall average breeding value of sires by Wombat method for first lactation milk yield was found to be 2766.27 kg. The average breeding value of sires by Wombat method for first lactation period in crossbred bulls was found to be 324.58 days. The average breeding value of sires by Wombat method for first dry period in crossbred bulls was found to be 106.00 days. The average breeding value of sires by Wombat method for first calving interval in crossbred bulls was found to be 430.95 days. The average breeding value of sires by Wombat method for first service period in crossbred bulls was found to be 166.28 days. Average breeding value by Wombat method for life time milk yield in crossbred bulls was found to be 10305.59 kg. The estimated overall average breeding value of sires by Wombat method for life time lactation length was found to be 1102.99days.

The estimated breeding values of sire's estimates for first lactation and life time traits showed small genetic variation as estimated by Wombat method. The simple correlations among all first lactation and life time traits estimated by the wombat method of sire evaluation were ranged from (-0.108 to 0.935) very low to very high.

However, the rank of sires for different sire evaluation methods revealed that 4-5% of top sires almost had similar rank for all the traits.

## Introduction

For bringing about overall genetic improvement in production, reproduction and growth traits of dairy cattle; the selection in females has limited scope due to insufficient number of replacement stock. On the contrary, intensive selection can be practiced in case of males, as a few males are required for breeding purpose. The selection of the superior sires with maximum accuracy is also of utmost importance for any breed improvement programme. Robertson and Rendel [1] opined that as much as 61 per cent of genetic gain in dairy cattle results from selection of sires through bulls to breed cows and bulls to breed bulls' path. Therefore, more emphasize has been given to sire evaluation. Hence, an early and accurate appraisal of sires breeding values is essential for prime importance of long term genetic progress in the population. Thus, the knowledge of genetic properties of traits is the pre-requisite in establishing the selection programme or mating system. Simultaneous attention to reproductive traits in addition to milk production is expected to bring about overall improvement in the index value of a sire, so multi trait criteria of sire evaluation using advance statistical technique like Derivative Free Restricted Maximum Likelihood method would be expected to enhance the accuracy of selection of the sire [2], further Miszal et al., [3] developed mixed model programme (BLUP-90, Dairy Pack) and WOMBAT 1.0 software in animal breeding for genetic evaluation, estimation of breeding value and variance for single and multiple traits [2].

## Materials and Methods

Data for the present investigation were collected from history sheet of crossbred cattle at instructional dairy farm of G. B. Pant University of Agriculture and Technology, Pantnagar. The data pertained to 1198 crossbred cattle from 68 sires were distributed over a period of 48 years from 1966 to 2010. Cows with abnormal and incomplete records were excluded from the study. Only the sires having records on at least 5 daughters were included in the present study. The records of only those animals with known pedigree and normal lactation were considered. The lactation records of less than 150 days were considered as abnormal and were not included in the analysis. The total duration of the present study was divided into 10 equal periods of five years each. Each year was divided into three seasons namely winter (November- February), summer (March- June) and Rainy (July- October). In order to classify the data for different genetic group periods and seasons of calving were considered for all the traits. The traits considered in the present study were age at first calving, first service period, first lactation period, first dry period, first calving interval, first lactation milk yield, lifetime milk yield and life time lactation yield. Records on various first lactation and

lifetime traits of crossbred cattle being in non-orthogonal nature were analyzed by Least Squares Analysis (LSA) technique of fitting constants for the estimation of genetic parameters as well as to examine the simultaneous effects of different genetic and non-genetic factors affecting any traits.

### Statistical analysis

As the data in the present study were non-orthogonal in nature with unequal subclass numbers, they were subjected to least squares analysis of variance without interactions using different models to examine the effect of genetic as well as non-genetic factors on various first lactation traits as per standard procedures of Harvey [4]. The model was based on the assumption that different components fitting in the model were linear, independent and additive. While sire was treated as random effect, the other genetic and non-genetic factors (genetic group, season and period) were taken as fixed effects in the model. Breeding value of sires for first lactation and life time traits were estimated by WOMBAT 1.0 software as proposed by Meyer [2].

### Results and Discussion

In the present study, the breeding values of sires were estimated on the basis of breeding value of their progeny by four different sire evaluation methods and presented in Table 1. The average breeding value for age at first calving in crossbred bulls was found to be 1198.26 days by Wombat method. There were 35 sires whose breeding values observed above the average breeding value and 33 sires with breeding values below the average breeding value. The lowest breeding values observed for age at first calving was 1105.26 days for sire no.5 and highest breeding value was 1330.60 days for sire no. 71. The difference between highest and lowest breeding value was 225.34 days.

The estimated overall average breeding value of sires by Wombat method for first lactation milk yield was found to be 2766.27 kg. There were 25 sires whose breeding value observed above the average breeding value and 43 sires with breeding value below the average breeding value. The lowest breeding value observed for first lactation milk yield was 2309.49 kg for sire no.64 and highest breeding value was 3167.45 kg for sire no.14. The difference between highest and lowest breeding values was 768.01 kg.

The average breeding value of sires by Wombat method for first lactation period in crossbred bulls was found to be 324.58 days. There were 34 sires whose breeding values observed above the average

breeding value and 34 sires with breeding values below the average breeding value. The lowest breeding values observed for first lactation period was 302.97 days for sire no.01 and highest breeding value was 352.24 days for sire no.21. The difference between highest and lowest breeding value was 49.27 days.

The average breeding value of sires by Wombat method for first dry period in crossbred bulls was found to be 106.00 days. There were 30 sires whose breeding values observed above the average breeding value and 38 sires with breeding values below the average breeding value. The lowest breeding values observed for first dry period was 83.26 days for sire no.34 and highest breeding value was 144.47 days for sire no.27. The difference between highest and lowest breeding value was 61.21 days.

The average breeding value of sires by Wombat method for first calving interval in crossbred bulls was found to be 430.95 days. There were 33 sires whose breeding values observed above the average breeding value and 35 sires with breeding values below the average breeding value. The lowest breeding values observed for first dry period was 395.98 days for sire no.34 and highest breeding value was 465.21 days for sire no.41. The difference between highest and lowest breeding value was 69.23 days.

The average breeding value of sires by Wombat method for first service period in crossbred bulls was found to be 166.28 days. There were 29 sires whose breeding values observed above the average breeding value and 39 sires with breeding values below the average breeding value. The lowest breeding values observed for first dry period was 130.47 days for sire no.34 and highest breeding value was 197.29 days for sire no.31. The difference between highest and lowest breeding value was 66.82 days.

The average breeding value by Wombat method for life time milk yield in crossbred bulls was found to be 10305.59 kg. There were 26 sires whose breeding values observed above the average breeding value and 42 sires with breeding values below the average breeding value. The lowest breeding values observed for life time milk yield was 8919.68 for sire no.11 and highest breeding value was 13167.33 kg for sire no.14. The difference between highest and lowest breeding value was 4247.65 kg.

The estimated overall average breeding value of sires by Wombat method for life time lactation length was found to be 1102.99 days. There were 34 sires whose breeding value observed above the average breeding value and 34 sires with breeding value below the average

**Table 1:** Average breeding value estimates for different first lactation and life time traits by Wombat method.

Traits	Average breeding value	Minimum breeding value (below average)	Maximum breeding value (above average)	Number of sires (over average breeding value)	Number of sires (below average breeding value)	Range of Breeding Value
AFC	1198.26	1105.26	1330.6	35	33	225.34
FLMY	2766.27	2403.44	3167.45	25	43	768.01
FLP	324.59	302.97	352.24	34	34	49.27
FDP	106.00	83.26	144.47	30	38	61.21
FCI	430.95	395.98	465.21	33	35	69.23
FSP	166.28	130.47	197.29	29	39	66.82
LTMY	10305.59	8919.68	13167.33	26	42	4247.65
LTL	1102.99	832.32	1360.94	34	34	528.62

**Table 2:** Product moment correlations among first lactation and life time traits estimate by Wombat sire evaluation methods.

	AFC	FCI	FDP	FLMY	FLP	FSP	LTLL	LTMY
AFC	1	0.063	-0.088	0.106	0.194	0.063	-0.099	0.276
FCI		1	-0.108	0.157	0.651	0.935	0.119	0.008
FDP			1	0.009	-0.06	-0.105	-0.009	0.112
FLMY				1	0.56	0.109	0.004	0.325
FLP					1	0.554	0.035	0.167
FSP						1	0.107	0.109
LTLL							1	-0.026
LTMY								1

(0.01 Level of significance).

breeding value. The lowest breeding value observed for life time lactation length 832.32days for sire no.64 and highest breeding value was 1360.94days for sire no. 97. The difference between highest and lowest breeding values was 528.62days.

The estimated breeding values of sire’s estimates for first lactation and life time traits showed small genetic variation as estimated by Wombat method. Dubey et al., [5] reported BLUP as best sire evaluation method when compared with other procedures of sire evaluation. While Banik and Gandhi [6] found DFREML method most effective sire evaluation method as compare to other methods in Sahiwal Cattle. While Dalal and Dubey et al., [5,7], in crossbred cattle, Banik and Gandhi [6] in Sahiwal Cattle; Moges et al. [8], Singh and Singh [9], Singh et al., [10]. Dubey et al., [11], Bajetha and Singh [12], Bajetha et al., [13], Bajetha et al., [14], Lodhi et al., [15] Lodi et al., [16], Singh and Singh [17], Lodhi et al., [18] Abbas et al., [19] Singh and Singh [20] and Singh et al., [21] also reported large genetic variation between the estimated breeding values of sires estimated by different sire evaluation method in case of Sahiwal and cross bred cattle.

In general, EBV’s for sires did not showed any systematic trend of first lactation and life time traits. In the present investigation the estimated breeding values of sires showed large variation between EBV’S of sires which revealed more genetic variation in the herd.

**Table 3:** Sires of top 10 ranks on the basis of estimated breeding values of sires for first lactation life time traits by Wombat method.

	AFC	FLMY	FLP	FDP	FCI	FSP	LTMY	LTLL
Rank	Sire no	Sire no	Sire no	Sire no	Sire no	Sire no	Sire no	Sire no
1	71	14	1	27	41	33	14	12
2	8	97	2	41	33	41	71	43
3	27	22	4	59	31	31	88	45
4	43	65	5	33	59	59	43	30
5	6	40	6	26	74	74	30	14
6	14	21	7	31	22	5	100	71
7	37	78	8	64	5	18	66	96
8	10	66	10	96	18	22	99	88
9	29	102	11	12	2	2	5	100
10	15	8	12	8	21	71	4	19

Accuracy of the methods of sire evaluation was determined by comparing the simple Pearson’s (Product moment correlations) correlation of breeding values of sires estimated by wombat sire evaluation method for first lactation and life time traits. Product moment correlations between breeding values by wombat method are presented in Table 2. The simple correlations among all first lactation and life time traits estimated by the wombat method of sire evaluation were ranged from( -0.108 to 0.935) very low to very high.

These findings agreed with the reports of Dalal and Dubey et al., [5,7], in crossbred cattle, Banik and Gandhi [6] in Sahiwal Cattle; Moges et al. [8], Singh and Singh [9], Singh et al., [10]. Dubey et al., [11], Bajetha and Singh [12], Bajetha et al., [13], Bajetha et al., [14], Lodhi et al., [15] Lodi et al., [16], Singh and Singh [17], Lodhi et al., [18], Abbas et al., [19] Singh and Singh [20] and Singh et al., [21].

Top 10 sires ranked on the basis of estimated breeding values of sires for age at first calving, first lactation period, first dry period, first calving interval, first service period life time milk yield and life time lactation length by wombat method are presented in Table 3. Top 10 sires ranked on the basis of estimated breeding values of age at first calving revealed that sire no.71 ranked first. On the basis of estimated breeding values of first lactation milk yield sire number 14 ranked 1<sup>st</sup>. On the basis of estimated breeding values of first lactation period sire number 01 ranked 1<sup>st</sup>. The top 10 sires ranked on the basis of first dry period revealed the sire no.27 ranked 1<sup>st</sup>. On the basis of estimated breeding values for first calving interval sire number 41, ranked 1<sup>st</sup> and Sire number 33 and 31 ranked 2<sup>nd</sup> and 3<sup>rd</sup>. In the present study the top 10 sires ranked on the basis of first service period revealed that sires number 33 ranked 1<sup>st</sup> and sire number 41 ranked 2<sup>nd</sup>. On the basis of estimated breeding values for life time milk yield sire number 14, ranked 1<sup>st</sup>. While on the basis of estimated breeding values for life time lactation length sire number 12, ranked 1<sup>st</sup>.

However, the rank of sires for different sire evaluation methods revealed that 4-5% of top sires almost had similar rank for all the methods. Similar results were also reported by Dalal and Dubey et al., [5,7], in crossbred cattle, Banik and Gandhi [6] in Sahiwal Cattle; Moges et al. [8], Singh and Singh [9], Singh et al., [10], Dubey et al., [11], Bajetha and Singh [12], Bajetha et al., [13], Bajetha et al., [14], Lodhi et al., [15] Lodi et al., [16], Singh and Singh [17], Lodhi et al., [18] Abbas et al., [19] Singh and Singh [20] and Singh et al., [21] in crossbred cattle.

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