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# Estimation of Means and Trends in Economic Traits of Sahiwal

**Shive Kumar[1], R.K. Sharma[1], Aashaq Hussain Dar*[1], S.K. Singh[1], Sunil Kumar[2], Rajeev Ranjan Kumar[3], M.K. Singh[1] and Devesh Singh[1]**

*[1]Department of Livestock Production Management, College of Veterinary & Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand*

*[2]Department of AGB, College of Veterinary & Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, INDIA*

*[3]Department of Veterinary Parasitology, College of Veterinary & Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, INDIA*

*Corresponding author: AH Dar; Email: daraashiq09@gmail.com*

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**ABSTRACT**

The performance records of Sahiwal cattle maintained under ICAR funded All India Coordinated Research Project on Cattle (Data Recording Unit - DRU) pertaining from 2011-2015 were utilized to estimate means and trends in important economic traits. It was found that the overall average of age at first calving, first lactation milk yield, first lactation length, first peak yield, first dry period, first service period, first calving interval, wet average and herd average were 1360.12 ±34.13 days, 1531.23±56.88 kg, 288.55±19.41 days, 8.36±1.19 kg, 151.55±19.46 days, 143.57±11.63 days, 439.52±14.18 days, 5.49±0.47 kg and 3.62±0.15 kg respectively. The analysis further revealed that the rate of change/year (trend) in the traits were -40.58 days in age at first calving, 41.38 kg in first lactation milk yield, 2.67 days in first lactation length, 0.71 kg in first peak yield, 1.70 days in first dry period, 0.80 days first service period, 10.84 days in calving interval, 0.09 kg in wet average and 0.06 kg in herd average from 2011 to 2015. The study of trends indicated that there has been considerable reduction in the age at puberty and increase in first lactation milk yield, lactation length, peak yield, wet average and herd average. It may be concluded that improvement in the traits has been realized by breeding and management interventions namely: comfortable housing, balanced feeding, timely inseminations, use of quality semen from bulls with higher breeding worth and better husbandry practices.

**Keywords**: Economic traits, herd average, Sahiwal, trends, wet average

Dairy sector has enormous potential to provide livelihoods for rural poors leading to empowerment of women, underprivileged and downtrodden and hence alleviating poverty. Dairying plays a pivotal role in supplementing incomes of small and marginal farmers and acts as insurance during crop failures. It provides a regular source of daily income for meeting cash requirements of rural households. It also plays a significant role in ensuring nutritional security of rural populace. Sahiwal breed of cattle is considered as one of the best zebu milch breed in the tropics with higher disease resistance and heat tolerance properties (Ilatsia *et al.*, 2011). Many crosses/synthetics (such as Australian-Friesian-Sahiwal, Australian Milking Zebu, Frieswal, Jamaica Hope, Karan Swiss, Mafriwal, Mpwapwa and Taurindicus) have been developed from this breed for raising under tropical conditions. During last 4-5 decades almost all the indigenous breeds of cattle didn't receive required attention on account of focus on crossbreeding for quick fix solutions. Consequently number of animals under all indigenous cattle breeds dwindled sharply to alarming levels and their reproductive and productive performance remained static or deteriorated with time in the absence of any meaningful breeding programme. Keeping the above facts in view, ICAR launched All India Coordinated Research Project on Cattle - Sahiwal in 2009 and Pantnagar was included as one of the data recording unit. The data pertaining to Sahiwal cattle maintained at Instructional Dairy Farm of G.B.P.U.A. & T., Pantnagar

and local population under the project from 2011-2015 were utilized to estimate means and trends in important economic traits.

## MATERIALS AND METHODS

The data for the present study was obtained from the performance records of 267 Sahiwal cattle maintained at Instructional Dairy Farm of G.B.P.U.A. & T., Pantnagar and local Sahiwal population under the project beginning from 2011 to 2015. The data on age at first calving, first lactation milk yield, first lactation length, first peak yield, first dry period, first service period, calving interval, wet average and herd average were included in the study. The statistical analysis was done by estimating the means and standard deviations and regressing means over the years to determine the average rate of change per year (trends) for all the traits to study behavior pattern of means over the years.

## RESULTS AND DISCUSSION

### Averages

The means of economic traits under study were estimated and have been presented in Table 1.

### Age at first calving (AFC)

Table 1 shows that the mean values for age at first calving of Sahiwal cattle under the project were 1,362.3±32.34, 1,358.62±36.38, 1,629.36±41.72, 1,223.00 ±33.84 and 1227.20 ±26.36 days in the years 2011, 2012, 2013, 2014 and 2015 respectively. The overall average age at first calving observed during the study period was 1360.12 ±34.13 days which was little earlier than 1390 ± 3.9 days as reported by Rehman *et al*. (2008). Comparable age at first calvings of 1320 and 1440 days were recorded at Government Livestock Farm, Hisar in 2008-2009 and 2009-2010 (Anonymous, 2016[a]).

However, Singh *et al.* (2001) and Raja (2010) reported much lower age at first calving (1188.79±15.95 and 1117±05.2 days) than the present findings whereas Upadhyay *et al*. (2011) reported a moderate age at first calving of 1225.58±10.15 days in Sahiwal cattle. The Sahiwal herd at NDRI, Karnal was found to mature earliest with age at first calving of 1062 days (Anonymous, 2016[b]). As per the report of XV Annual Review Meet of AICRP on Cattle, Pantnagar centre recorded lowest age at first calving in Sahiwal cattle in contrast to highest value (1673 days) recorded at CBF, Anjora, Durg centre (Anonymous, 2016[c]).

**Table 1:** Means of various important economic traits of Sahiwal under AICRP- Cattle (DRU) – Pantnagar

| Year | AFC (days) | FLMY (kg) | FLL (days) | FPY (kg) | FDP (days) | FSP (days) | FCI (days) | WA (kg) | HA (kg) |
|---|---|---|---|---|---|---|---|---|---|
| **2011** | 1,362.3±32.34 | 1,490.62±66.06 | 284.18±31.23 | 7.42±1.14 | 145.3±19.02 | 138.42±14.08 | 428.28±16.60 | 5.24±0.47 | 3.60±0.14 |
| **n** | 52 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 |
| **2012** | 1,358.62±36.38 | 1,486.54±84.13 | 281.23±34.28 | 7.48±1.82 | 147.8±21.82 | 146.32±16.08 | 428.36±18.34 | 5.32±0.66 | 3.80±0.14 |
| **n** | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| **2013** | 1,629.36±41.72 | 1,434.17±69.35 | 256.14±18.66 | 7.34±1.42 | 159.80±17.78 | 147.46±13.34 | 430.48±18.37 | 5.83±0.78 | 2.87±0.18 |
| **n** | 33 | 33 | 33 | 33 | 26 | 26 | 26 | 33 | 67 |
| **2014** | 1,223.00±33.84 | 1,608.08±25.83 | 296.09 ±5.20 | 9.7 ±0.24 | 154.27±19.23 | 140.13±5.87 | 427.63±11.32 | 5.42±0.09 | 4.00±0.05 |
| **n** | 46 | 33 | 33 | 46 | 30 | 39 | 30 | 33 | 26 |
| **2015** | 1227.20 ±26.36 | 1636.76 ±39.03 | 290.11 ±7.66 | 9.85±1.32 | 150.58±19.44 | 145.50 ±8.80 | 482.85 ±6.27 | 5.64±0.35 | 3.81±0.26 |
| **n** | 67 | 27 | 27 | 67 | 17 | 20 | 14 | 27 | 47 |
| **Overall** | 1360.12 ±34.13 | 1531.23±56.88 | 288.55±19.41 | 8.36±1.19 | 151.55±19.46 | 143.57±11.63 | 439.52±14.18 | 5.49±0.47 | 3.62±0.15 |
| **n** | 210 | 163 | 163 | 216 | 143 | 155 | 150 | 163 | 210 |
| **Rate of change/ year (trend)** | -40.58 | 41.38 | 2.67 | 0.71 | 1.70 | 0.80 | 10.84 | 0.09 | 0.06 |

**First lactation milk yield (FLMY)**

The average first lactation milk yields in the years 2011, 2012, 2013, 2014 and 2015 were observed as 1,490.62 ±66.06, 1,486.54 ±84.13, 1,434.17 ±69.35, 1,608.08 ±25.83 and 1636.76 ±39.03 kg respectively with an overall mean of 1531.23±56.88 kg which was comparable with the first lactation milk yields of 1511.06±29.42, 1537±9.03 and 1572.29 ± 22.57 kg as reported by Singh *et al*. (2001), Zafar *et al.* (2008) and Dhawan *et al.* (2014) respectively. However, lesser yields of milk in first lactation as 1457±65 and 1,429 ± 11 kg were reported by Bajwa *et al.* (2004) and Rehman *et al*. (2008) respectively whereas higher first milk yield of 1693.05±733.30 kg was reported by Javed *et al*. (2000). When compared with other centers of AICRP on Cattle-Sahiwal, Pantnagar centre showed intermediate yield with highest first lactation milk yield (2846kg) recorded at Shri Gaushala, Bhiwani (Anonymous, 2016[c]).

**First lactation length (FLL)**

The first lactation length (days) in the years 2011, 2012, 2013, 2014 and 2015 were found as 284.18 ±31.23, 281.23 ±34.28, 256.14 ±18.66, 296.09 ±5.20 and 290.11 ±7.66 respectively with an overall mean value of 288.55±19.41 days which was comparable to the values of 268±4.53 and 295.33 ± 4.36 days as reported by Rehman *et al*. (2006) and Dhawan *et al*. (2014). Higher lactation lengths of 318 and 330.49±5.89 days was reported by Javed *et al*. (2000) and Shah and Kumar (2010) whereas shorter lactation lengths of 239, 248± 67, 254.25±3.79 and 235 ± 20 days were reported by Talbott *et al*. (1997), Bajwa *et al.* (2004), Naskar *et al.* (2005) and Rehman *et al*. (2008) respectively. Hisar centre of AICRP on Cattle – Sahiwal, recorded lengthiest first lactation length of 339.00 days (Anonymous, 2016[c]) which is undesirable in achieving maximum lifetime milk yield.

**First peak yield (FPY)**

The first peak yield in the years 2011, 2012, 2013, 2014 and 2015 were found to be 7.42±1.14, 7.48±1.82, 7.34±1.42, 9.7±0.24 and 9.85±1.32 kg respectively with an overall mean value of 8.36±1.19 kg which was higher than the value of 7.94 ± 0.12 kg as reported by Dhawan *et al.* (2014) but lower than the value of 8.82±0.18 kg as reported by Singh *et al.* (2001).

**First dry period (FDP)**

The average first dry period of the Sahiwal cattle under the project in the years 2011, 2012, 2013, 2014 and 2015 were observed to be 145.3±19.02, 147.8±21.82, 159.80±17.78, 154.27±19.23 and 150.58 ±19.44 days respectively with an overall mean value of 151.55±19.46 days. The present study showed that the overall mean of first dry period was lower than the values of 191.56±5.69, 202.29±2.74 and 196.69 ± 2.63 days as reported by Kushwaha *et al.* (2003), Upadhyay *et al*. (2011) and Dhawan *et al.* (2014) respectively. Much higher values of average first dry period i.e. 244±3 and 218±8.5 days were reported by Rehman *et al.* (2008) and Rehman and Khan (2012). However, Gaur and Raheja (1996) reported lower value of 127±5.8 days as first dry period in Sahiwal cattle. As per the report of XV Annual Review Meet of AICRP on Cattle, Pantnagar centre recorded shortest dry period whereas CBF, Anjora, Durg centre showed longest dry period of 276 days in Sahiwal cattle (Anonymous, 2016[c]).

**First service period (FSP)**

The average first service period in the years 2011, 2012, 2013, 2014 and 2015 were 138.42±14.08, 146.32±16.08, 147.46±13.34, 140.13±5.87 and 145.50±8.80 days respectively with an overall mean value of 143.57±11.63 days which was comparable to the value of 151±2.8 days as reported by Rehman and Khan (2012). A shorter service period of 119±3.31 days was reported by Gandhi *et al.* (2009) in Sahiwal cattle whereas much longer service periods of 1,78 ± 3, 209.33±2.57 and 214.43 ± 4.59 days were reported by Rehman *et al*. (2008), Upadhyay *et al*. (2011) and Dhawan *et al.* (2014). There is a huge variability in first service period which ranged from 68.07± 2.3 to 271±8.7 days (Dongre *et al.,* 2011) indicating that this trait can be improved by genetic selection and better managemental practices. In comparison to other centers of AICRP on Cattle-Sahiwal, Pantnagar centre showed reasonable service period with highest value of 261.0 days recorded at CBF, Anjora, Durg (Anonymous, 2016[c]).

**First Calving interval (FCI)**

The average first calving interval in the years 2011, 2012, 2013, 2014 and 2015 were estimated as 428.28±16.60, 428.36±18.34, 430.48±18.37, 427.63±11.32 and 482.85

±6.27 days respectively with an overall mean value of 439.52±14.18 days which was comparable with the values of 454±2.8 and 455.03±118.36 days as reported by Singh *et al*. (1990) and Dahlin *et al*. (1998). Longer first calving intervals of 492.76±8.18, 505 ± 6.32, 464 ± 30 and 502.12±3.17 days were reported by Singh *et al*. (2001), Kushwaha *et al*. (2003), Rehman *et al.* (2008) and Upadhyay *et al*. (2011) respectively.

**Wet average (WA)**

The wet average in the years 2011, 2012, 2013, 2014 and 2015 were estimated as 5.24±0.47, 5.32±0.66, 5.83±0.78, 5.42±0.09 and 5.64±0.35 kg respectively with an overall mean value of 5.49±0.47 kg whereas Sahiwal herds at NDRI, Karnal and Shri Gaushala, Bhiwani centre of AICRP on Cattle were found very productive with a wet average of 7.7 (Anonymous, 2016b) and 7.8 kg (Anonymous, 2016c). The wet average recorded at Government Livestock Farm, Hisar was 6.6 and 6.1 kg in 2008-2009 and 2009-2010 (Anonymous, 2016[a]).

**Herd average (HA)**

The herd average in the years 2011, 2012, 2013, 2014 and 2015 were 3.60±0.14, 3.80 ±0.14, 2.87±0.18, 4.00 ±0.05 and 3.81±0.26 kg respectively with an overall mean value of 3.62±0.15 kg whereas much higher herd average of 5.6 kg was recorded at NDRI, Karnal (Anonymous, 2016[b]). The herd average recorded at Government Livestock Farm, Hisar was 3.8 and 4.3 kg in 2008-2009 and 2009-2010 (Anonymous, 2016a).

**Phenotypic trends**

In order to obtain the average rates of change per year (trend) in the economic traits under study, the means were regressed over the years (5) and are presented in table 1. The study of trends indicated that the rates of change per year in the traits were -40.58 days in age at first calving, 41.38 kg in first lactation milk yield, 2.67 days in first lactation length, 0.71 kg in first peak yield, 1.70 days in first dry period, 0.80 days first service period, 10.84 days in calving interval, 0.09 kg in wet average and 0.06 kg in herd average from 2011 to 2015. However, almost constancy was observed for first dry period and service period with little increase in first calving interval. Contrary to the present findings, Singh *et al*. (2002) and Rehman *et al*. (2008) observed increasing trend in age at first calving over the years in Hariana and Sahiwal cattle whereas similar trends of increase in first lactation milk yield were reported by Singh and Nagacenkar (2000), Nehara *et al*. (2013) and Kharkar *et al*. (2015) in Sahiwal, Karan Fries and Red Kandhari cattle respectively. Slight increasing trend in lactation length as observed in the present study was in conformity with the reportes of Singh and Nagacenkar (2000) and Rehman *et al*. (2008) in Sahiwal cattle. Little increase in dry period and service period over the years as seen in the present study were corroborated by Singh and Nagacenkar (2000) and Rehman *et al.* (2008) in Sahiwal cattle. Marginal increase in first calving interval, wet and herd average observed in the present study were almost similar to the reports of Singh *et al.* (2002) and Nehara *et al.* (2013) in Hariana cattle and Karan Fries respectively. Thus, it may be inferred that means of the most of the economic traits of Sahiwal herd at Pantnagar centre are shifting towards favourable direction.

## CONCLUSION

The study revealed that the Sahiwal herd under the project is performing well with the moderate performance status compared to other herds at various locations. The study of trends indicated that there has been a marked reduction in the age of puberty (40.58 days) and a substantial increase in first lactation milk yield (41.38 kg), lactation length (2.67 days), peak yield (0.71 kg), wet average (0.09 kg) and herd average (0.06 kg) per year coupled with marginal increase in first dry period (1.7 days) and service period (0.8 days) in a span of five years. Improvement in these traits has been realized by the breeding and management interventions namely: proper heat detection, timely inseminations, use of quality semen from bulls with higher breeding worth and better day to day management.

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