STUDY OF VARIOUS PERFORMANCE TRAITS IN RATHI CATTLE

P.S. Dangi, Rajbir Singh¹, R.K. Pundir, Avtar Singh², Vijay Chaudhary³ and N.K. Verma

National Bureau of Animal Genetic Resources,
Karnal – 132 001, India

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ABSTRACT

Data on production (lactation milk yield, lactation length, dry period) and reproduction performance traits (service period and calving interval) of Rathi cattle maintained at Livestock Research Station (LRS) Nohar, District Hanumangarh (Rajasthan) during the period 1979-2002 were analyzed to study the effect of non-genetic factors on these traits. The overall least square means for lactation milk yield (LMY), lactation length (LL), dry period (DP), service period (SP) and calving interval (CI) were 1589.49± 75.55 kg, 267.09± 08.04 days, 155.28± 09.65 days, 153.03± 22.80 days and 427.44± 12.30 days, respectively. The analysis of variance revealed that effects of parity, season and period on the overall lactations production and reproduction traits was significant (P<0.01) except the effects of parity and season on LMY, season on SP and effect of parity and periods on DP.

Key words: Calving interval, Dry period, Lactation milk yield, Rathi cattle, Service period

INTRODUCTION

The variability in overall lactation milk yield indicates the possibility of improvement of genetic potential of Rathi cattle for its production efficiency through selection. Lactation milk yield is affected by various management and environmental factors like parity, season of calving and period of calving.

Lactation milk yield is the most important trait of a dairy animal. Higher milk yield increases the profitability and decreases the rearing cost of dairy animals. The Rathi breed is well known among Zebu cattle for its superior dairy qualities and adaption in harsh geo-climatic conditions of Western Rajasthan. High capacity to face adverse environmental conditions and a remarkable longevity (up to 10 years production period) of Rathi cattle has also been appreciated. There is also an urgent need to conserve Rathi breed due to a decreasing trend of purebred population in the breeding tract.

MATERIALS AND METHODS

Data on performance traits obtained from the Rathi cows maintained at Livestock Research Station (LRS), Nohar, district Hanumangarh, Rajasthan was used for present study. Geographically this farm is located on Ganganagar-Hisar Highway at 29°11’ to 29°15.6’ North latitude and 74° 45.7’ to 74°49’ East longitudes at 185 meters above the mean Sea level in the North-Western Arid-Region of Rajasthan under the administrative control of Rajasthan Agricultural University, Bikaner. 772 lactation records pertaining to 180 Rathi cows’ progeny of 17 sire spread over a period of 24 years from 1979 to 2002 were included in the present study.

Normal lactation records were considered for present investigation. An animal having abnormal lactation records due to other pathological conditions including abortion, still births etc., lactation duration less than 100 days and sire less than five progeny were excluded from the present study.

To estimate the effects of various non-genetic factors, data were classified according to parities, seasons of calving and period of calving to quantify their effects on various performance traits. To find out the effects of parity on the production and reproduction traits all completed lactation records
have been grouped in to ten lactations. To estimate the effects of different seasons of calving, each year was further divided into four seasons (Gahlot, et al., 1989) depending upon the climatic conditions existing in the region as follows i.e. winter (November to January), summer (February to April), rainy (May to July), hot humid (July to September) and autumn (August to October). In the present study, data of Rathi cattle was spread over 24 years (year of calving). Therefore, it is quite apparent that there might be a few difference in performance of animals’ from year to year due to erratic effects of different non-genetic factors like availability of feed and fodders, management practices and changing environment. Therefore, all the data has been classified under five periods (Period-1 consisted of 1979-1983, period-2 consisted of 1984-1988, period-3 consisted of 1989-1993, period-4 consisted of 1994-1998 and period 5th comprised 1999-2002 with the aims to minimize within period variance and maximizing between period variance.

Records on different production and reproduction traits of Rathi cows being in non-orthogonal nature were analyzed by Least Square Maximum Likelihood Technique (Harvey, 1990). The difference between two pairs of factor was tested by using modified Duncan’s multiple range test by Kramer (1957).

RESULTS AND DISCUSSION

Lactation milk yield: The population least square mean for lactation milk yield over the period of 24 years was 1589.49 ± 75.55 kg for 772 lactation records of Rathi cows kept at Livestock Research Station (LRS), Nohar, District Hanumangarh, Rajasthan (Table 1). These values are similar to those reported by Ohri and Singh (1971), Gahlot (1972), Saraswat (1980), Singh and Raut (1980) and Gahlot et al. (1989). However, these means were lower than the values reported by Joshi (1989), Mittal and Prasad (1989), Arya (1991), Panwar et al. (1997) and Anonymous (2008), and higher estimates than those reported by Ohri and Joshi (1961), Chourasia et al. (1983), Gahlot (1986) and Jat et al. (1996) in Rathi cattle reared either at Bikaner or LRS Nohar (Hanumangarh). The least squares mean for lactation milk yield was highest during the period 1994-1998 and lowest during period 1979-1983 & 1984-1988. The difference were significant (P<0.01). The variation in lactation milk yield observed in different periods indicates difference in management as well as environmental effects. The level of management varies according to the ability of the Farm Manager, his efficiency in supervision of the staff, system of crop husbandry, methods and intensity of culling. The high milk yield during 4th period 1994-1998 in the herd might be due to good nutrition and other management practices during this period.

Parity showed non-significant (P ≤ 0.05) variation for the said trait. Saraswat (1980) and Singh and Raut (1980) also had similar observations in Rathi cattle. However, Chourasia et al. (1983), Joshi (1989), Jat et al. (1996), and Nehra (2004) reported significant effect of parity on overall lactation milk yield. This indicates that cows starting lactation at early age are not fully mature and their mammary glands are not fully functional and give less lactation yield compared to the cows which are in the 3rd, 4th, 5th or 6th lactation and are fully mature. The reduction in the lactation milk yield in later lactations (parities) can also be due to some other biological reasons.

Season of calving showed non-significant (P ≤ 0.05) variation for the said trait. Saraswat (1980) and Joshi (1989) also made similar observations in their studies. However, Gahlot (1972) and Joshi (1989) reported significant effect of season on overall lactation milk yield, which could be due to the seasonal influences as well as the type of feed and fodder, temperature, humidity and management practices which varies greatly during different seasons.

Lactation length: The population least squares mean for lactation length was 267 ± 8 days for 772 lactation records of Rathi cows (Table 1). Higher lactation length was observed in the cows that calved during 5th period as compared to those calved during 2nd and 3rd periods. The cows calved in winter season had the longest lactation (274± 9 days), while the cows calved in autumn season had the shortest lactation length (256± 9 days). Cows those calved during second and third periods had stayed for short time in lactation 252± 11 and 252± 9 days respectively, as compared to those calved during fifth period 283±14 days. Least squares analysis of variance marked highly significant (P≤0.01) effect
Rathi breed of cattle. Contrary to this, Joshi (1989), agreement with those reported by Gahlot (1972) in present study (Table 2). These results were in agreement with those reported by Gahlot (1972) in Rathi breed of cattle. Contrary to this, Joshi (1989), of period of calving on overall lactation length in the present study (Table 2). These results were in agreement with those reported by Gahlot (1972) in Rathi breed of cattle. Contrary to this, Joshi (1989), Jat et al. (1996) and Nehra (2004) found non-significant effect of period of calving in Rathi. Furthermore, the year/period, season of calving and parity had significant effect on the trait. Syrstad
TABLE 2: Analysis of variance for different production traits (pooled) in Rathi cattle.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>d. f.</th>
<th>MEAN SUM OF SQUARES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LMY</td>
</tr>
<tr>
<td>Sire</td>
<td>16</td>
<td>760595.852740**</td>
</tr>
<tr>
<td>Parity</td>
<td>9</td>
<td>195951.721179</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>331859.091548</td>
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<tr>
<td>Season</td>
<td>3</td>
<td>540505.863442</td>
</tr>
<tr>
<td>Period</td>
<td>4</td>
<td>964043.210530**</td>
</tr>
<tr>
<td>Error</td>
<td>738</td>
<td>244491.774473</td>
</tr>
</tbody>
</table>

**Significant P <0.01, *Significant P <0.05, DF = Degree of freedom.

(1993) has reported that generally the lactation length is much smaller in Zebu cattle than Taurines. Although the milk yield increased with the increase of lactation length, yet it did not seem advantageous to have lactation length, exceeding 10 months. The daily milk yield in the later stages of lactation became low and hence affected the life time productivity. Moreover, longer lactation length prolongs the calving interval and decreases the number of calves that could be obtained during the life span of a cow. Thus, attempts should be made to select cows on the basis of regularity in breeding so that they produce calves every year with a lactation period of about 10 months.

Dry period: The population least squares mean for dry period was 155.28 ± 9.65 days for 772 lactation records of Rathi cows (Table 1). The dry period was longer during the fourth period of study compared to second and first periods; the difference between latter two periods was non-significant (Table 1). Higher mean value of dry period (234.4 ± 18.4 days) was reported by Chourasia et al. (1983) for the overall lactation in Rathi cattle, while it was 116.3 ± 40.6 days for the cows kept at RAU, Bikaner (Pant et al., 1986). The cows calved in rainy season had the longest dry period (167.69 ± 11.53 days), while the cows calved in winter season had the shortest dry period (143 ± 10.31 days). Similarly the longest mean dry period was observed in the second lactation (176 ± 11.57 days), while the shortest (141 ± 23.79 days) was noted in the tenth lactation. Analysis of variance (Table 2) showed that season of calving had significant (P<0.05) effect on the dry period, while period of calving and lactation number (parity) showed non-significant variation for this trait. Similar results have been reported by Gahlot (1972) and Nehra (2004). It is generally believed that milk yield is affected by the preceding dry period. Considering the biological limits and economics of the operation involved, many workers in tropical and sub-tropical regions have set a range of 40-60 days as an optimum dry period for the perspective of cow’s health and farmers’ profit. Dry periods of Rathi cattle were above this optimum level. A considerable reduction was achieved (Mahadevan, 1955) in the dry periods of Zebu cattle through improved management practices in Sri Lanka. This also indicates that length of dry period is largely influenced by environment. Emphasis should be given to select the animals on the basis of their production level and higher persistency of lactation, which should automatically lead to a decrease in dry period. It should be pointed out that increase of true production in a fixed lactation period (e.g. 305 days) is needed, rather than of 305 days corrected records of actually short lactations.

TABLE 3: Analysis of variance for different reproduction traits (pooled) in Rathi cattle.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>d. f.</th>
<th>MEAN SUM OF SQUARES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SP</td>
</tr>
<tr>
<td>Sire</td>
<td>13</td>
<td>12203.000594**</td>
</tr>
<tr>
<td>Parity</td>
<td>7</td>
<td>15022.511327*</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>25209.610061</td>
</tr>
<tr>
<td>Season</td>
<td>3</td>
<td>11388.618078</td>
</tr>
<tr>
<td>Period</td>
<td>3</td>
<td>32315.373226**</td>
</tr>
<tr>
<td>Error</td>
<td>278</td>
<td>6645.672923</td>
</tr>
</tbody>
</table>

**= Significant (P ≤ 0.01) *= Significant (P ≤ 0.05)
**Service period:** Service period has apparent economic importance because a longer service period increases the calving interval, resulting in a reduced lifetime production. The service period is an indicator of breeding efficiency and reproductive management practices followed in a particular herd. Optimum service period is always desirable in dairy cattle breeding plans. The overall mean service period in this study was 153 ± 22.8 days for 306 lactation records of Rathi cows (Table 1). The least squares means for service period were 148 ± 37.31, 139 ± 24.63, 125 ± 24.63 and 100 ± 27.76 days in 1st, 2nd, 3rd and 4th periods, respectively. The service period was longer during period-1st and period-2nd than the period-3rd and 4th. The cows calved in summer season had the longest service period (169 ± 23.79 days), while the cows calved in autumn season had the shortest service period (143 ± 24.35 days). The analysis of variance (Table 3) showed that service period and parity had highly significant (P<0.01) effect on the service period. These results are in agreement with the results reported by Nehra (2004). The ideal service period for Zebu cattle is not apparent from the literature. General guidelines are available such as delaying service period until mobilization of body reserves ceases (Bourchier, 1981). As a rule of thumb a cow is preferably bred during third estrus after calving in most dairy herds. With a lactation length of 300 days, this allows a rest of about 60-65 days prior to carrying another pregnancy. From a practical management point of view, a range of 60-90 days service period should not be less than 40 days.

**Calving interval:** The overall mean calving interval in the present study was 427 ± 12.30 days for 772 lactation records of Rathi cows (Table 1). The least squares means for calving interval were 421 ± 19.11, 402 ± 15.10, 408 ± 13.29, 450 ± 14.66 and 456 ± 18.72 days in 1st, 2nd, 3rd, 4th and 5th periods, respectively. The longest (456 ± 18.72 days) calving interval was observed in the cows calved during 5th period, while the shortest (402 ± 15.10 days) calving interval was found in 2nd period. The cows calved in rainy season showed the longest calving interval (440 ± 14.08 days), while the cows calved in autumn season had the shortest calving interval (418 ± 13.74 days). Similarly, the longest mean calving interval was observed in the first lactation (482 ± 14.47 days), while the shortest (404 ± 16.52 days) calving interval was noted in the 7th lactation. Analysis of variance (Table 3) showed that calving period and lactation number (parity) had highly significant (P<0.01) effect on the calving interval, while season of calving showed significant variation for the said trait. Tiwari (1980) reported that period/year, Nehra (2004) reported that season of calving and Chourasia et al. (1983) reported that lactation number (Parity) had significant effect on calving interval. A calving interval of 365 days is usually considered ideal. Therefore, the calving intervals, as seen in this study, suggest a large need for future improvement. The length of gestation and service period are the two main constituents of calving interval out of which the former cannot be expected to change much for physiological reasons. Kumar (1982) reported that 97 and 98% variation in calving interval due to service period in Hariana and Tharparkar cattle, respectively. Since service period constitutes nearly all of the variation in calving interval, the only way to reduce the calving interval in Zebu cattle would be through an early conception within biological limits. Variation in this trait showed that a further improvement in calving interval is possible in Rathi cows through selection and better management.

**CONCLUSIONS**

The significant effects of parity, period and season of calving on the production and reproduction performance traits indicated important role of feeding and management of the herd in improving its productivity.

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