



Lactation performance of Surti goats under field conditions

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Goats form an important component of livestock industry and play a vital role in the socio-economic structure of rural poor. In terms of goat milk production, India ranked first in the world with the total milk production of 4 million MT in 2008 and growth rate of 31.53% during last decade (Anonymous 2011). Surti goat of South Gujarat possess high milk producing ability, however, very little work had been done in this regard. Thus present investigation was carried out to analyse the data on milk production of Surti goats and various associated fixed factors.

Data on milk yield were taken randomly using proportionate sampling method from 51, 75 and 105 goats that completed their lactation during 2009, 2010 and 2011 respectively from six clusters. Fortnightly one time test day milk yield was recorded on each goat. General Linear Model (GLM) procedure in the SPSS statistical software (version 17.0) was used to analyze the non orthogonal data. To determine the fixed effect of year, season, cluster and parity on milk yield, following linear model was used:

$$M = \mu + Y_i + S_j + C_k + P_l + e_{ijkl}$$

(where i, 1, 2, 3; j, 1, 2, 3; k, 1, 2, 3, 4, 5, 6 and l, 1, 2, 3, 4, 5, 6, 7 and 8)

Where M is lactation length (LL) days, 90 days milk yield (90 DMY) litres, 150 days milk yield (150 DMY) litres or total milk yield (TMY) litres, μ is population mean, Y_i is the effect of year, S_j is the effect of season, C_k is effect of cluster, P_l is effect of parity and e_{ijkl} is the random error associated with each observation.

Lactation performance data of 231 Surti goats, those had completed their lactation between April 2009 to March 2011 were presented in Table 1. The 90 DMY of Surti goat was higher as compared to reported yield in other goat breed of Western India (Agnihotri and Rajkumar, 2007). The TMY of Surti goat was 33.12% higher than reported national average of 132.5 kg milk per doe in India (Aziz, 2010). The milk yield per day in Surti goats was higher than reported

daily average milk yield of 1.060 kg for 115 days of lactation in Jakhrana, 0.617 kg per day for 198 days of lactation in Sirohi, 0.561 kg for 196 days of lactation in Marwari and 0.557 kg for 202 days of lactation in Kutchi breeds (Khan and Roy 2000). The minimum and maximum LL, 90 DMY, 150 DMY and TMY were (104, 254), (68, 178), (132.90, 235.30) and (133.60, 291.80) in Surti goats respectively. This accounts for existing variability and scope for future improvement in Surti goats.

Significant gain in the lactation performance was observed over a period of 3 years. However, LL and 90 DMY were at a par in initial 2 years, but 150 DMY and TMY had shown significant downward trend. This lowered trend during 2010 may be attributed to climatic stress of higher humidity and rainfall that was observed in the year. In subsequent year, 2011, additional 5.02, 12.79, 4.40 and 7.76% improvement was observed in LL, 90 DMY, 150 DMY and TMY respectively. The mean LL, 90 DMY, 150 DMY and TMY varied significantly between different seasons. The smallest and highest LL, 90 DMY, 150 DMY, TMY were observed in goats kidded during rainy and winter respectively. The LL of goats kidded during summer and winter were 19.03 and 31.68% higher than those kidded during rainy season. Whereas, 10.63% higher LL was observed in goats kidded during winter as compared to rainy season. The 90 DMY, 150 DMY and TMY being highly correlated traits with LL showed similar seasonal trends. Significantly lower lactation performance of Surti goats kidded during rainy season might be attributed to climatic stress of higher humidity and rainfall during rainy season. The 90 DMY of goats kidded during summer and winter was 24.81 and 37.91% higher as compared to goats kidded during rainy season. The seasonal variation of 10.49% in 90 DMY was observed in goats kidded during summer and winter. This might have occurred because major part of initial 90 day lactation yield was in climatic stress of higher humidity and rainfall in goats kidded during rainy season. As compared to 90 DMY, reduced difference of 7.87% in 150 DMY was observed in goats kidded during summer as compared to rainy season. This again might have happened due to stressful impact of rainy season on late

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Table 1. Least square means of milk production parameters in Surti goat under field conditions

Variables	Lactation length (days)	90 days Milk yield (litres)	150 days milk yield (litres)	Total milk yield (litres)
Overall mean	168.11 ± 1.84 (231)	110.70 ± 1.10 (231)	166.08 ± 1.64 (193)	176.39 ± 2.27 (193)
Milk yield (litres)/ day	—	1.23 ± 0.01 (231)	1.11 ± 0.01 (193)	1.03 ± 0.01 (193)
Year				
2009	165.58 ^a ± 3.26 (51)	105.61 ^a ± 1.94 (51)	167.76 ^b ± 2.70 (44)	176.96 ^b ± 3.75 (44)
2010	165.22 ^a ± 2.73 (75)	106.44 ^a ± 1.62 (75)	161.68 ^a ± 2.51 (58)	169.53 ^a ± 3.47 (58)
2011	173.52 ^b ± 2.27 (105)	120.05 ^b ± 1.35 (105)	168.79 ^b ± 1.96 (91)	182.69 ^b ± 2.72 (91)
Season				
Summer	171.16 ^b ± 2.84 (74)	114.28 ^b ± 1.69 (74)	161.26 ^b ± 2.32 (68)	171.43 ^b ± 3.22 (61)
Rainy	143.80 ^a ± 2.93 (63)	91.56 ^a ± 1.75 (63)	149.50 ^a ± 3.06 (34)	150.69 ^a ± 4.23 (34)
Winter	189.36 ^c ± 2.45 (94)	126.27 ^c ± 1.46 (94)	187.48 ^c ± 1.96 (91)	207.06 ^c ± 2.71 (91)
Cluster				
Bharuch	182.87 ^c ± 3.72 (35)	118.17 ^b ± 2.21 (35)	177.17 ^b ± 2.96 (33)	193.26 ^b ± 4.11 (33)
Karjan	180.88 ^{bc} ± 5.84 (14)	118.68 ^b ± 3.48 (14)	175.31 ^b ± 4.72 (13)	196.13 ^b ± 6.53 (13)
Jambusar	173.26 ^b ± 3.29 (45)	114.03 ^b ± 1.96 (45)	172.40 ^b ± 2.60 (43)	182.94 ^b ± 3.61 (43)
Navsari	153.29 ^a ± 3.76 (33)	102.27 ^a ± 2.24 (33)	153.48 ^a ± 3.81 (20)	156.82 ^a ± 5.28 (20)
Bilimora	157.24 ^a ± 3.36 (42)	105.15 ^a ± 2.00 (42)	158.94 ^a ± 3.11 (31)	162.70 ^a ± 4.31 (31)
Vapi	161.08 ^a ± 2.97 (62)	105.91 ^a ± 1.77 (62)	159.18 ^a ± 2.52 (53)	166.50 ^a ± 3.50 (53)
Parity				
1	165.40 ± 5.74 (14)	104.76 ^a ± 3.41 (14)	159.48 ^{ab} ± 5.01 (11)	172.66 ^{ab} ± 6.95 (11)
2	167.24 ± 3.39 (38)	110.34 ^{ab} ± 2.02 (38)	164.55 ^{ad} ± 3.26 (26)	174.52 ^{abc} ± 4.52 (26)
3	173.15 ± 3.05 (56)	114.09 ^{bc} ± 1.81 (56)	172.71 ^{cc} ± 2.43 (53)	186.33 ^c ± 3.37 (53)
4	176.00 ± 3.52 (39)	114.45 ^{bc} ± 2.09 (39)	170.75 ^{cde} ± 2.90 (34)	185.23 ^{bc} ± 4.02 (34)
5	167.04 ± 3.50 (38)	116.65 ^c ± 2.08 (38)	174.07 ^c ± 2.96 (32)	183.98 ^{bc} ± 4.11 (32)
6	161.14 ± 4.34 (24)	104.69 ^a ± 2.58 (24)	154.68 ^a ± 3.91 (18)	161.22 ^a ± 5.42 (18)
7	170.41 ± 5.81 (13)	108.15 ^{ab} ± 3.46 (13)	163.03 ^{ac} ± 4.63 (12)	171.92 ^{ab} ± 6.41 (12)
>7	164.46 ± 7.09 (9)	112.49 ^{abc} ± 4.22 (13)	169.36 ^{bcd} ± 6.16 (7)	175.27 ^{abc} ± 8.54 (7)

lactation period of goats kidded during summer. The 150 DMY of goats kidded during winter season was 16.26% higher to those kidded during summer. This difference broadened to 20.78% for TMY, since most conducive climate during entire lactation length was exhibited by goats, kidded in winter. Overall winter was significantly favorable to all lactation performance parameters in Surti goats, followed by summer and rainy season. These seasonal differences in lactation performance calls for implementation of mating plans with proven bucks to minimize seasonal differences and fulfilling demand of goat milk throughout the year.

The least square means of lactation performance differed significantly among clusters under study. These differences may be attributed to differences in managerial practices between clusters. The LL of Jambusar cluster was 13.03, 10.19 and 7.56% higher than Navsari, Bilimora and Vapi clusters respectively. These differences were significant ($P < 0.05$) however lactation length of Navsari, Bilimora and Vapi cluster were at a par with one another. Significantly highest lactation length was observed in Bharuch cluster. The clusters may be reorganized into two groups based on 90 DMY; 150 DMY and TMY; Bharuch, Karjan and Jambusar in one group with significantly higher 90 DMY, 150 DMY and TMY as compared to Navsari, Bilimora and Vapi cluster to other group. There was no significant effect of parity on

LL of Surti goats. However, 90 DMY, 150 DMY and TMY were significantly affected by parity of lactating does. The maximum and minimum LL was observed in fourth and sixth parity respectively. The minimum 90 DMY was observed in first and sixth parity which was at a par with second, seventh and >7th parity, however it differed significantly from 90 DMY obtained in third, fourth and fifth parity. Maximum 90 DMY and 150 DMY was obtained in goats of fifth parity. Similar results were obtained for higher milk yield per day in fifth parity of other goats in Western India (Agnihotri and Rajkumar 2007). Minimum 150 DMY was observed in sixth parity and it was at a par with first, second and seventh parity. In contrast to 90 DMY and 150 DMY, the maximum TMY was observed in goats of third parity, which may be attributed to their longer LL. Higher TMY in third parity was also reported in Black Bengal goats (Dhara *et al.* 2012). The TMY of does in their mid parity was higher as compared to does in their early and late parity.

SUMMARY

The total milk yield (TMY) of Surti goat was 33.12% higher than reported national average of 132.5 kg milk/doe in India. The milk yield/day in Surti goats was higher than reported daily average milk yield of other goat breeds of western India. Year, season of kidding, cluster and parity had significantly affected lactation performance of Surti

goats. Milk potential, variability and factors affecting lactation performance deciphered in this study paves the baseline information for further genetic improvement of Surti goats for milk production.

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