Short communication

Indian Journal of Animal Sciences **85** (10): 1134–1138, October 2015/Short communication

Performance status of cattle in rural ecology

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Received: 14 January 2015; Accepted: 10 June 2015

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Key words: Calving interval, Cattle, Dry period, Fat, Herd size, Lactation, Milk yield, Rural ecology, SNF, Total solids

The per capita availability of milk was 259 g per day (Aneja *et al.* 2002) and further increased 290 g/day during 2011–12 (Lok Sabha question number 251 which was answered on 27.08.2013) which is higher than 280 g as recommended by Nutritional Advisory Committee of ICMR. The total crossbred cattle in Uttar Pradesh are 7, 91,170 heads (Q. No 251) which produced 1,140,785 tonne of milk in 2011–12. The present study was aimed to assess the nutritional status of cattle, workout feed produce relationship and to estimate the production performance of cattle in different herd size groups and economic holdings in augmenting the income of rural households through increased production of milk. The present study also envisaged the various problems associated with the upkeep of crossbred cows, and also look into the possibility of harvesting maximum returns through a judicious combination of various inputs and outputs.

The district Baghpat was selected as the study area as villagers keep a good number of milch animals, the people are vegetarian and habitual of drinking milk and taking ghee in their diet, the marketing facilities for selling their milk and ghee are available, launching of finance schemes to encourage livestock rearing, mixed farming system and the crop residue based feeding system (wheat *bhoosa*, paddy *pural*, sugarcane tops, etc.), availability of veterinary hospitals / dispensaries, good knowledge of farmers' and their interest for rearing of milch cattle and moreover, a gap in the knowledge about the nutritional status, productive performance and the problems associated with rearing of cattle. Three blocks, viz. Chhaprauli, Baraut and Binauli of the district were selected randomly. A list of villages having adequate number of milch cattle maintained by the farmers' of different categories based on their land holding was prepared. Five villages from each block were randomly selected forming a total of 15 villages in the district. A total of 10 respondents / households from each selected village were selected randomly. Thus, a total of 150 households formed the basis of this investigation.

The cattle were classified according to the herd size groups on the basis of the number of cattle (1, 2 and 3 cattle) reared by the farmers, economic groups of farmers' based on their land holding and the lactation number to which the cattle belonged. The survey study was made through planned questionnaires by interviewing the selected 150 households.

Estimation of milk quality characters: The fat percentage in milk was determined by the standard Gerber's method. The TS per cent in milk was calculated as per Richmond's modified formula. SNF was calculated by taking the difference between TS% and fat%.

Economics of milk production: It was considered in terms of the total maintenance cost incurred on different items of fixed and variable cost, net maintenance cost, cost of production per kg milk, net return per animal and per kg of milk produced and cost-benefit ratio.

The data were collected on the milch cattle lactation number of cattle; performance characters, viz. lactation milk yield, lactation length, dry period, calving interval during different lactations; milk quality characters, viz., percentage of fat, SNF and total solids; price of milk sold; milk disposal pattern, viz., home used milk (used as fluid milk and converted into *dahi* for making ghee and buttermilk as well as occasional to prepare *khoa* on the eve of festivals) and milk sold to either milk vendors or societies; cost of milk production : (i) fixed cost on different items, (ii) variable cost on different items, (iii) value of milk produced and value of dung, (iv) cost of milk per litre, (v) net return, (vi) cost-benefit ratio, (vii) problems associated to breeding, feeding, management and health care.

The data collected on different characters of cattle were subjected to statistical analysis. The analysis of variance was conducted using the following mathematical model:

$$Y_{ijkl} = \mu + P_i + H_j + L_k + e_{ijkl}$$

where, $Y_{ijkl,}$ observations recorded on l^{th} cattle belonging to i^{th} parity, j^{th} herd size and k^{th} land holding; μ overall mean of the character; $P_{i,}$ effect of i^{th} parity order (i = 1 to 4); $H_{j,}$ effect of j^{th} herd size (j = 1 to 3); $L_{k,}$ effect of k^{th} land

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holding (k = 1 to 5); $e_{ijkl,}$ random error.

Lactation milk yield: Milk yield of cattle in first lactation was low than in subsequent lactations (Table 1). The milk yield increased in second and third lactation, while during fourth lactation it remained the same as was in third lactation. Statistical analysis revealed that lactation order had significant (P<0.05) effect on lactation milk yield. Therefore, the first calvers are low yielders than older cows. This may be due to the fact that first calvers are not fully mature and they utilize the nutrients for growth of body besides the milk production.

The milk production of cattle kept in different herd size varied (Table 1). The statistical analysis revealed that herd size had significant effect on lactation milk yield of cattle. Singh (1981), Sharma and Singh (1985) and Kumar *et al*. (2011) also found that milk yield decreased with increase in herd size. The milk production of cattle maintained in different herd size can be correlated with the availability of nutrients. The DM, DCP and TDN were lesser in the diets of the cows maintained in herd size of 3 animals (Table 2). This established a relation between feed and fodder supply and milk production.

The milk production of cattle kept by farmers of different land holding varied nonsignificantly. This may be due to the fact that the availability of nutrients for cattle kept by farmers of different land holdings did not differ significantly as the per cent shortage of nutrients were almost of the same order for the cattle of different categories of farmers. Our results are in agreement to those of Sangu *et al.* (2006) who had also reported that land holding had no significant effect. On the other hand, Rajendran and Prabhaharan (1993), Sangu (1994), Devraj and Gupta (1994) and Jagdeeswara Rao *et al*. (2000) reported that there was an increasing trend in milk production of cattle with increase in land holding. Bhakat and Pathak (2011) revealed that land holdings were having significant association with sustainable livelihood of camel dairying (SLCD). Low milk production of cattle kept by landless labourers than other categories of farmers was also observed by Pradeep and Gupta (1988), whereas, Gupta and Agarwal (1996) have found high milk production of cows kept by landless category and low for upper medium category of farmers.

Table 1. Average daily milk yield

Effects	Average daily milk yield (kg)
Lactation order	
I	3.77±0.14 (46)
II	4.80±0.16 (57)
III	5.20±0.16 (60)
IV	5.05±0.17 (61)
Herd size	
One	4.73±0.13 (91)
Two	5.16±0.15 (88)
Three	4.06±0.16 (45)
Land size	
Landless	4.42±0.16 (56)
Marginal	4.95±0.18 (53)
Small	5.07±0.21 (45)
Medium	4.76±0.20 (40)
Large	4.60±0.22 (30)
Overall	4.76±0.08 (224)

Figures in parenthesis are the number of animals.

Lactation length: The average lactation length for cattle for the cattle of different lactation did not differ significantly. Moreover, no specific strand in lactation length was observed with respect to lactation number. The variability in lactation length among the cattle belonging to different herd size was also very low (9 days). This variability among herd size groups was also found nonsignificant. Sharma (1982) also reported low variability in lactation length due to herd size of crossbred cattle.

The lactation length of cattle kept by landless category was higher; whereas, it was lower for those kept by small farmers. The statistical analysis of data showed nonsignificant differences in lactation length with respect to size of land holding. This supported the findings of Devraj and Gupta (1994). On the contrary, Jagdeeswara Rao *et al.* (2000) reported that land holding of the milk producers have significant effect on lactation period of crossbred cattle, having a decreasing trend with increase in land holding size. However, Tanwar *et al.* (2013) studied that lactation length increased with increased farm size.

Dry period: The average dry period of cattle was 119.8±1.3 which was longer for first calvers than old cattle. Statistical analysis revealed that parity order had no effect on length of dry period of cattle. The results further showed that dry period of cattle was lowest for those kept in a herd of 2 animals and highest for the cattle kept in 3 animals size of herd. Statistical analysis indicated that herd size had significant effect on dry period of cattle. Das (1981) reported shorter dry period of crossbred cattle in small herd size and longer in medium herd size.

The analysis further indicated that dry period was significantly affected by the size of land holding. The average dry period showed a decreasing trend with increase in size of land holding. This supported the findings of Jagdeeswara Rao *et al.* (2000) and Tanwar *et al.* (2013) for dry period of crossbred cattle kept by farmers of different land holding.

Calving interval: The calving interval of cattle in the first lactation was longer than in subsequent lactation (Table 3). The differences in calving interval of cattle belonging to different parity of lactation were significant.

The herd size had produced a variability of 17 days in calving interval of cattle. The calving interval was statistically significantly lower for the cattle kept in herd size of 2 animals compared to those kept either single or in a group of 3 animals (Table 3). Statistically, the herd size showed significant effect on calving interval of cattle. Sharma (1982) reported very low variability (5 days) in calving interval of cattle due to herd size, though he observed a decreasing trend in calving interval with increase in herd size.

The average length of calving interval of cattle showed

Table 2. Average DM requirement, DCP requirement, TDN requirement availability (kg/day) and status for cattle

Effects	Average DM requirement			
	No. of obser-vations	Requirement (kg/day/ animal)	Availability	Status (% short)
Lactation order				
I	46	8.00±0.17	6.90±0.82	13.75
II	57	9.53±0.15	8.53±0.14	10.49
III	60	9.75±0.16	8.85±0.15	9.23
IV	61	10.00±0.19	9.20±0.17	8
Herd size				
One	91	9.46±0.13	8.56±0.11	10.57
Two	88	9.42±0.10	8.54±0.12	9.34
Three	45	9.25±0.20	8.10±0.17	12.43
Land size				
Landless	56	9.30±0.18	8.40±0.15	9.67
Marginal	53	9.40±0.18	8.50±0.14	9.57
Small	45	9.45±0.21	8.55±0.15	9.52
Medium	40	9.50±0.20	8.70±0.17	8.42
Large	30	9.38±0.21	8.58±0.22	8.52
Overall	224	9.40±0.09	8.46±0.07	10
Average DCP requirement				
Lactation order				
I	46	0.39±0.015	0.35±0.009	10.25
II	57	0.48±0.017	0.43±0.011	11.04
III	60	0.51±0.017	0.47±0.011	7.84
IV	61	0.51±0.017	0.46±0.011	9.8
Herd size				
One	91	0.47±0.014	0.44±0.008	8.51
Two	88	0.49±0.015	0.44±0.009	10.2
Three	45	0.45±0.02	0.40±0.011	11.11
Land size				
Landless	56	0.44±0.016	0.39±0.009	11.36
Marginal	53	0.49±0.019	0.43±0.010	12.24
Small	45	0.49±0.02	0.44±0.012	10.2
Medium	40	0.48±0.02	0.44±0.012	8.33
Large	30	0.47±0.02	0.44±0.016	7.12
Overall	224	0.47±0.008	0.43±0.005	8.51
Average TDN requirement				
Lactation order				
I	46	3.76±0.17	3.26±0.09	13.29
II	57	4.18±0.19	3.58±0.10	14.35
III	60	4.78±0.20	4.38±0.12	8.37
IV	61	4.83±0.17	4.43±0.12	8.28
Herd size				
One	91	4.52±0.16	4.32±0.95	4.42
Two	88	4.52±0.17	4.02±0.00	11.06
Three	45	4.22±0.16	3.62±0.10	14.2
Land size				
Landless	56	4.40±0.19	3.90±0.112	11.36
Marginal	53	4.40±0.18	3.80±0.115	13.63
Small	45	4.64±0.20	4.14±0.129	10.77
Medium	40	4.60±0.20	4.20±0.14	8.7
Large	30	4.53±0.20	4.13±0.16	8.83
Overall	224	4.47±0.10	3.96±0.05	8.85

a decreasing trend with increase in land holding. This was due to a decreasing trend in dry period with increase of land holding. Statistical analysis of the data indicated that land holding had significant effect on calving interval of cattle. This was in contrary to the findings of Devraj and Gupta (1994) and Jagdeeswara Rao *et al.* (2000) who could not find any effect of landholding on the calving interval of cattle.

Fat percentage: The overall fat percentage in cows (Table 4) was 5.2±0.05, and during first lactation averaged to be 5.1, which increased during second and third lactation, but this increase was very less. Statistically, the lactation order did not affect significantly the fat percentage in cattle milk. This supported the findings of Yadav *et al.* (1981) and Bhaskar *et al.* (2007) for nonsignificant effect of lactation number on milk fat of crossbred cattle. The variability in fat per cent of cattle milk with respect to herd size and land holding was also negligible (Table 4). The differences in this character due to farmers' land holding were not significant.

SNF percentage: The SNF percent (Table 4) in cattle milk was 9.1±0.8%. It was lower for first calvers than cattle of subsequent lactations (Table 4) but lactation number did not significantly affect the SNF per centage. Bhaskar *et al.* (2007) also found that the SNF percent in milk of crossbred cattle during first lactation was somewhat low than in subsequent lactation, but with nonsignificant effect of lactation number. No trend in SNF per cent in cattle milk was observed with respect to herd size. Further, statistical analysis of data confirmed that the variability was not significant due to herd size. The variability in the character was not statistically significant due to land holding of the milk producers.

Total solid percentage: The overall values for total solid percentages averaged to be 14.3±0.19. The total solids in cattle milk were 14.0±0.4% for the first calvers, which showed an increasing trend with increase in lactation number. This was due to increasing trend in fat as well as SNF percentage. The lactation number had no significant effect on TS percentage. This supported the findings of

Table 3. Average calving interval (days) in relation to different factors

Effects	Average calving interval (days)
Lactation order	
I	428.0±8.8 (46)
II	416.0±8.3 (57)
III	406.5±8.1 (60)
IV	414.3±8.2 (61)
Herd size	
One	422.5±6.1 (91)
Two	405.1±6.2 (88)
Three	421.4±9.0 (45)
Land size	
Landless	431.0±8.6 (56)
Marginal	420.9±8.5 (53)
Small	406.5±9.2 (45)
Medium	407.0±9.7 (40)
Large	401.8±10.2 (30)
Overall	415.4±4.4 (224)

Figures in parenthesis are the number of animals.

Table 4. Average fat percentage, SNF percent and total solids in relation to different factors

Effects	Cattle
Average fat percentage	
Lactation Order	
I	5.1 ± 0.12 (46)
II	5.2 ± 0.11 (57)
III	5.3 ± 0.10 (60)
IV	5.3 ± 0.10 (61)
Herd Size	
One	5.2 ± 0.08 (91)
Two	5.3 ± 0.08 (88)
Three	5.1 ± 0.12 (45)
Land Size :	
Landless	5.2 ± 0.11 (56)
Marginal	5.1 ± 0.11 (53)
Small	5.2 ± 0.13 (45)
Medium	5.3 ± 0.13 (40)
Large	5.3 ± 0.14 (30)
Overall	5.2 ± 0.05 (224)
Average SNF percent	
Lactation Order	
I	8.9 ± 0.20 (46)
II	9.1 ± 0.18 (57)
III	9.2 ± 0.17 (60)
IV	9.2 ± 0.17 (61)
Herd Size	
One	9.1 ± 0.13 (91)
Two	9.3 ± 0.13 (88)
Three	9.0 ± 0.00 (45)
Land Size	
Landless	9.1 ± 0.18 (56)
Marginal	9.1 ± 0.18 (53)
Small	9.2 ± 0.20 (45)
Medium	9.1 ± 0.21 (40)
Large	9.2 ± 0.23 (30)
Overall	9.1 ± 0.08 (224)
Average total solids	
Lactation Order	
I	14.0 ± 0.40 (46)
II	14.3 ± 0.30 (57)
III	14.5 ± 0.30 (60)
IV	14.4 ± 0.30 (61)
Herd Size	
One	14.3 ± 0.26 (91)
Two	14.5 ± 0.28 (88)
Three	14.1 ± 0.37 (45)
Land Size	
Landless	14.3 ± 0.32 (56)
Marginal	14.2 ± 0.35 (53)
Small	14.4 ± 0.40 (45)
Medium	14.4 ± 0.38 (40)
Large	14.5 ± 0.40 (30)
Overall	14.3 ± 0.19 (224)

Figures in parenthesis are the number of animals.

Bhaskar *et al.* (2007).

Total solids in cattle milk were lowest (Table 4) if they were kept in a herd of 3 animals (14.1±0.37%) and highest when kept with 2 animals (14.5±0.28%). However, statistically the differences in total solids due to herd size were not significant. Total solid contents were low for the cattle kept by marginal and landless groups and high for those of large farmers. This was due to the same trend in fat percentage. The statistical analysis of data indicated that farmers' categories had no significant effect on total solid percentage.

SUMMARY

The aim of study was to assess nutritional status and performance of cattle in rural ecology. Data congregated on 150 households from 15 ecosystems in rural area of Baghpat, Uttar Pradesh. The overall lactation milk yield, lactation length, dry period and calving interval of cattle averaged to be 1408.3±45.8 kg, 295.6±3.2 days, 119.8±1.3 days and 415.4±4.4 days, respectively. The lactation milk yield was affected significantly by the parity order and herd size, dry period by herd size and land holding; whereas, the calving interval by all the 3 factors (parity order, herd size and land holding) for cattle. The average percentage of fat, SNF and total solid in cattle milk were 5.2±0.05, 9.1±0.08 and 14.3±0.19, respectively. None of the milk quality characters was affected significantly by any of the factor in cattle milk.

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