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Herd Structure, Performance Traits, Pattern of Calving and Culling in an Organized Large Herd of Gir Cattle

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Abstract

Herd structure and herd performance traits of Gir herd of Cattle Breeding Farm, JAU, Junagadh, Gujarat was studied utilizing monthly data over a period of 10 years (2001-2010). A herd with an average of 110 Gir cows had average total strength of 388.38±3.09 and total adult units (AUs) of 259.27 ±13.42. The total females present in the herd were 71.82%. The Gir herd consisted of 28.98 % cows, 22.02 % breedable heifers, 22.34 % calves (female + male) and 12.33 % males above 1 year. Wet average and herd average were 6.77±0.10 and 3.84±0.06 lit/d/cow, and % milch cows and number of milch cows were 57.03±0.85 and 63.12±1.42, respectively. Effect of month was significant on the herd average only. All herd performance traits were significantly influenced by year. Return over feed cost (ROFC) at variable feed cost was estimated to be 116.36±4.24 % at market rate of milk. Calving incidence was significantly ($P<0.05$) influenced by month. Majority (42.08 %) of calving occurred during September to December. Of 562 animals disposed of, the maximum proportion (33.96 %) was cows principally due to old age (>6 lactation) and low yield. Maximum cows, 26.21% were disposed of in their 3rd lactation. Growing/breeding males were sold @ 28.57% and castrated males to the tune of 22.32 %. The correlations among the herd structure and performance traits of the herd were negative, medium in magnitude and significant, - 0.21 to - 0.29 with wet average, -0.16 to -0.21 with herd average and -0.25 to -0.73 ($P<0.05$) with % ROFC. For the Gir herd under the study, herd structure of 30-33% cows, 18-21% breedable heifers and 72-75% total female proportion resulted in optimum wet average (>7.32 lit/d/milch cow) and herd average (> 4.17 lit/d/cow) and also higher ROFC >139.6 %**.**

Key words: Gir cattle, Herd structure, Herd performance, Calving pattern, Culling.

Introduction

Besides the level of milk production, optimum total strength with desirable composition in a dairy herd is must for profitable and sustainable dairy farming. Total strength and herd composition vary widely over the years and also during different periods in a year in a large herd. Number and pattern of calving and culling are the major causes of variation in herd strength and its structure. Herd size and its structure have been regarded as important risk factors that affect performance through difficulties in heat detection and other management practices (Lemma and Kebede, 2011; Gebrekidan *et al.,* 2012; Kumar *et al.,* 2014[a,b]). Thus study on changes in herd structure and total strength and its influence on herd performance traits, viz., wet average, herd average, number &

% milch animals, milch-dry ratio, calving rate etc are important. The herd composition, in turn may also have its impact on income from milk production, feeding cost and return over feed cost (ROFC). There are no documented information on herd composition and herd performance and economics of milk production of Gir cows. Hence, influence of herd structure on herd performance traits and return over feed cost in an organized herd of Gir cows was studied.

Materials and Methods

Data on monthly total herd strength and category-wise strength of animals and performance traits of the herd at respective time in the herd of Cattle Breeding Farm, JAU, Junagadh, Gujarat, over a period of 10 years (2001-2010) were considered. Herd performance traits, viz., total monthly milk production, wet average, herd average, % milch cows and calving rate in Gir cattle were studied. Average daily quantities (kg/AU) of concentrate (3.4), green fodder (19.7) and dry fodder (3.65) fed (total DM @ 2.67 % of adult BWt) in the Gir herd during 2001-10 were taken into account for estimating the feeding cost. The costs of feeds and sale price of milk prevailing (Rs.13 to 22/- at market rate) during different periods were considered to calculate economics of milk production, i.e., return over feed cost.

Variation in total and category-wise strength and composition and herd performance traits, monthly and yearly trend in wet average, herd average, % milch animals, calving rate, pattern of calving and culling, relationship of herd structure with performance traits and desirable herd composition for the herd were investigated.

Data were analyzed in CRD to study the effect of month and year on herd structure and performance traits, Square-root transformation for category-wise composition and % milch animals and Arcsine transformation for calving rate were carried out prior to ANOVA. Multiple comparison test was applied to determine the difference between means (Snedecor and Cochran, 1994). Classes based on 0.5 SD intervals of wet average, herd average, % milch cows and % ROFC, and corresponding means of total cows, breedable females, herd strength at respective performance level were studied to find out desirable herd structure for the Gir herd under investigation.

Results and Discussion

Variation in herd composition of the Gir herd:

Total herd strength and total adult units (AUs) in the Gir herd averaged 388.38±6.09 and 259.27±3.42, respectively. Number of total cows, milch cows, breedable heifers (>2 years), heifers (1-2 year), female calves, male calves and males above 1 year were 111.34±1.47, 63.12±1.42, 85.72±1.85, 38.18±0.72, 42.50±1.05, 45.88±1.74 and 48.04±1.32, respectively. Per cent total female present in the herd was 71.82±0.26 %. Gir herd under the study consisted of 28.98 % cows, 22.02 % breedable heifers, 22.75 % calves below 1 year of age (female + male), 12.33 % males above 1 year and 9.88 % heifers of 1-2 year of age. The number of cows present in the herd ranged from 76 to 152 and the total strength varied from 278 to 520. Kurup (1997) also reported 30.5% cows (females above 3 years), 14.5 % milch and 15.6 % dry cows and 31.5 % young stock in cattle herd. Many researchers (Kumar *et al*., 1997; Badukale *et al.,* 2008) reported higher proportion of cows (51.83-52.79%) and young stock (29.16%) in the dairy cattle and buffalo herds. The herd structure of commercial dairies was reported to have 58.9% cattle calves (and 33.3% buffalo calves) as compared to the milch animals in the respective herd (Tiwari *et al*., 2007).

Thus, findings indicated that maintaining an established breeding herd of an average of 110 Gir cows would result in an average of 388, i.e., around 400 total heads, 260 total adult units and 72% total female population with 85 (22%) breedable heifers, 80 (21%) growing females below 2 years of age and 63 (57% of total cows) milch cows in the herd.

Variation in performance traits and economics of milk production:

Wet average, herd average, % milch cows and number of milch cows were 6.77±0.10 lit/d/milch

cow, 3.84±0.06 lit/d/cow, 57.03±0.85 and 63.12±1.42, respectively. Wet average and herd average ranged from 4.38 to 8.56 and 2.45 to 5.58 lit/d/cow, respectively.

In this Gir herd, during 2001-10, average monthly income from milk production, monthly feeding cost and return over feed cost and % ROFC at variable feed cost and market sale price of milk were Rs. 225856.3±6565.4, Rs. 113037.8±5386.8, Rs. 112818.5±3147.3 and 116.36±4.24%, respectively. ROFC, when estimated at variable feed cost and actual sale price of milk (sold in University campus), was 58.36±2.83 % only. The % ROFC in general, showed a negative trend with number of cows and total strength in the herd (Table 2). The present results are in line with those of Dayakar Rao *et al.* (1991) and Badukale *et al.* (2008).

Effect of month and year on herd structure and performance traits:

Total strength as well as herd structure/category-wise composition did not vary much over months, but significant (P<0.05) year-wise differences were observed. As during most of the years, disposals (sale through tender) of animals were carried out in January-February months, total strength was minimum, around 378 during February-March, maximum around 400 in November-December and almost constant, around 390 during rest of the months. Month-wise data did not differ significantly (P>0.05). The herd had minimum total heads 298 in the year 2003, which gradually increased to 496 in the year 2010. The % total females in the herd were observed from 67 % in 2007 to 75% in 2004 and 2005. The cows category had significantly (P<0.05) higher/maximum strength, i.e., 33% in 2004 and 2005. Similarly breedable females were also maximum, i.e., 54 % in the year 2004**.**

Effect of month was significant (P<0.05) on herd average only (Table 1). All the herd performance traits of Gir cows were significantly (P<0.05) influenced by year. Average monthly milk production (14000 to 15800 lit) was more in the month of May and in the years- 2005, 2009 and 2010. Wet average (7.67-7.70 lit) and herd average (4.20-4.69 lit) were higher in the years 2003 and 2004 as compared to those observed in other years of the study. In general, performance of herd in terms of wet average (7.2 vs 6.1 lit), herd average (4.2 vs 3.4 lit) and % milch cows (57-60 vs 54.8-55.2%) remained better from March to May and lower during August-September months (Table 1).

Table 1: Month-wise means ± SE for performance traits of Gir herd

Month	Monthly Milk Prod. Lit	Wet Av, Lit	Herd Av*, Lit	% Milch cows
Jan.	12861.45± 772.94	6.94± 0.33	3.82^{a} ±0.22	55.38± 2.62
Feb.	11779.65± 609.92	7.12± 0.27	3.94^{a} ± 0.17	55.39± 2.77
Mar.	13587.30± 615.82	7.44± 0.31	4.19^{a} ± 0.17	57.01± 3.04
Apr.	13674.42± 792.08	7.24± 0.36	4.26^{a} ± 0.21	58.65± 3.48
May	14114.19±1013.38	7.04± 0.33	4.17^{a} ± 0.26	59.63± 3.55
June	13274.12± 997.15	6.94± 0.35	4.02^{a} ± 0.25	58.43± 3.53
July	12690.23± 992.80	6.65± 0.39	3.73^{a} ± 0.23	56.73± 3.39
Aug.	11447.20± 892.17	6.14± 0.30	3.33^{b} ± 0.18	54.77± 2.62
Sept.	10983.65± 677.31	6.13± 0.23	3.40^{b} ± 0.12	55.21± 2.32
Oct.	11976.20± 688.69	6.27± 0.29	3.53^{b} ± 0.15	57.48± 2.73
Nov.	12432.25± 549.77	6.52± 0.35	3.84^{a} ± 0.17	58.97± 3.36
Dec.	13565.55± 822.84	6.85± 0.33	3.82^{a} ± 0.21	56.69± 2.96
Overall	12698.85± 236.72	6.77± 0.10	3.84 ± 0.06	57.03± 0.85

*Means in a column bearing at least one common superscript do not differ (P<0.05)

Association among the herd structure and performance traits of the herd:

The correlation coefficients of total cows, total breedable females and total strength with wet average were from -0.21 to -0.29 (P<0.05). The association (r-value) of total cows with herd average was -0.21 (P<0.05). All the herd structure traits showed significant (P<0.01) correlation of -0.25 to -0.33 at fixed costs and -0.53 to -0.73 at variable cost with % ROFC. Although R^2 values were very low, there was reduction of 15.0, 10.4 and 3.3 ml in wet average with 1 unit increase in number of cows, total breedable females and total herd strength, respectively (Table 2). Gebrekiden *et al.* (2012) and Kumar *et al.* (2014[a,b]) found non-significant effect of herd size on performance of the herd.

Table 2: Correlation and regression coefficients for herd structure and performance traits of Gir herd

Association		Correlation 'r' value	Regression 'b' value	R^2 value %
Wet Average	Total cows	-0.23*	-15.00 ± 5.86 ml	5.26
	Total breedable females	-0.29*	-10.38 ± 3.19 ml	8.24
	Total strength	-0.21*	-3.27 ± 1.43 ml	4.28
Herd Average	Total cows	-0.21*	-8.81 ± 3.69 ml	4.60
	Total breedable females	-0.17	-3.76 ± 2.06 ml	2.74
	Total strength	-0.16	-1.61 ± 0.90 ml	2.63
% Milch cows	Total cows	0.04	0.02 ± 0.05 %	--
	Total breedable females	0.16	0.05 ± 0.03 %	2.58
	Total strength	0.09	0.01 ± 0.01 %	--
% ROFC at fixed cost	Total cows	-0.27**	-0.39 ± 0.13 %	7.32
	Total breedable females	-0.33**	-0.26 ± 0.07 %	11.22
	Total strength	-0.25**	-0.09 ± 0.03 %	6.25
% ROFC at variable cost and market rate of milk	Total cows	-0.53**	-1.52 ± 0.23 %	27.78
	Total breedable females	-0.77**	-1.22 ± 0.09 %	58.91
	Total strength	-0.73**	-0.51 ± 0.04 %	53.17

* P<0.05; **P<0.01.

Desirable herd strength and composition for the herd for higher performance:

Data on classes based on 0.5 SD intervals of wet average, herd average, % milch cows and % ROFC and corresponding means of total cows, breedable females, herd strength at respective performance level revealed that wet average, herd average and % ROFC in general, showed a negative trend with number of cows, breedable females and total strength in the herd. Further, data showed that Gir herd with the herd structure of 330-345 heads with 100-110 (30-33%) cows, 65-70 (18-21%) breedable heifers and 245-250 (72-75%) total female proportion in the herd resulted in optimum wet average (>7.32 lit/d/milch cow) and herd average (>4.17 lit/d/cow) and also higher ROFC >73.9% at actual sale price of milk and >139.6 % at market price of milk when variable costs were considered**.**

Pattern of calving and culling in the Gir herd:

Calving incidence was significantly (P<0.05) influenced by month. Year did not affect the rate of calving in the Gir herd. From December to March, maximum Gir females conceived resulting in majority (42.08 %) of calving during September to December months. Higher calving rate in April and June and lower calving incidence in July and August months have been reported in Kankrej

and Hariana cattle (Patel *et al.*, 1988; Verma *et al.*, 1983). There was relatively uniform calving in Gir heifers during the year, but in cows comparatively more calvings were observed during September to April (9 to 13 % per month). Lemma and Kebede (2011) and Kumar *et al*. (2014[a]) observed non-significant effect of season on calving incidence/interval. Per cent calvings based on primiparous and pluriparous animals present in the herd during the month also revealed same calving pattern.

During the period of 10 years (2001-10), a total of 562 animals were disposed off. Animals in cow category were disposed off on account of different reasons, to a maximum extent (33.81%). Annual disposal of 14.4 % (16/111) cows and annual 32.6 % (28/86) calving/year in heifers indicated a satisfactory replacement rate in the Gir herd. This was followed by growing/ entire males sold for breeding purpose @ 28.57 % (13 each year) and surplus castrated males to the tune of 22.24 % (10 each year) of av. number of animals present in that category. Heifers were sold only @ 6.94 % of the total disposals in the herd. Kumar *et al.* (1997) reported annual disposal of 20.6 % (13.0 % from death, 12.8 % culling) from the crossbred herd.

Maximum cows (26.21%) were disposed off in their 3rd lactation, followed by those in 2nd (20.39 %) and 4th (17.96%) lactation. Cows in each, 5th and 6th lactation were culled to the tune of 9.2 to 9.75 %. Among the causes of disposal, about 49% of the cows were disposed off due to old age, i.e., more than 6 lactations and 44 % on account of low yield. Reproductive problem/infertility accounted only for 1.46 % culling in the Gir cows indicating excellent reproductive performance. A total of 38.8 % cows disposed had the reason of teat blockage or mastitis. As regards to physiological status, of the total cows disposed of 63.11% were in dry stage and 66.02 % in non-pregnant stage in the cows of the low yield category.

Conclusion

The findings of the study tended to indicate that optimum herd size and its structure are crucial for maximum performance and return over feed cost for economical dairy farming from a large dairy herds.

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Conflict of Interest: All authors declare no conflict of interest.

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