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Current status and strategies for conservation of Hariana cattle

MANOJ KUMAR[1], S P DAHIYA[2] and POONAM RATWAN[3]

Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana 125 004 India

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ABSTRACT

In the present review, an attempt was made to explore Hariana cattle, an important dual purpose breed for its genetic improvement, conservation and further research. The production, reproduction and functional traits of Hariana cattle are reviewed. Average lactation milk yield, wet average, lactation milk yield per day of calving interval, average lactation length, dry period, age at first calving, service period and calving interval varied from 721.18±13.3–2215.07±24.58 kg, 2.45±0.05–4.97±0.09 kg, 1.10±0.03–2.38±0.13 kg, 252.30±2.95–336.00±4.3 days, 133.03±10.12–336±4.3 days, 1037.93±5.95–1762±12 days, 154.0±9.30–302.70±6.50 days and 421–630.8±9.0 days, respectively. The heritability estimates for the above mentioned traits varied from 0.11±0.08–0.50±0.16, 0.16±0.09–0.27±0.14, 0.33±0.14–0.39±0.22, 0.09±0.08–0.80, 0.09±0.08–0.32±0.32, 0.18±0.13–0.67±0.15, 0.05±0.19–0.24±0.16 and 0.02±0.06–0.41±0.14, respectively. Major factors for the decline of Hariana cattle population were marketing problem, low milk yield, less milk fat percentage as compared to buffalo milk, and mechanization of agriculture. Hariana cattle is famous for its remarkable power of endurance for hot climate of tropics, resistance to tropical diseases and has low maintenance cost besides providing A2 milk. Hariana cattle can be conserved by creating public awareness about good qualities of the breed. Government should provide incentives to the farmers in terms of semen supply and treatment of the animals. There is a need of raising progeny tested bulls and development of pastures at community as well as panchayat land. Government or NGOs should participate actively and there is a need to start registered societies for propagation and conservation of Hariana cattle.

Key words: Conservation, Hariana breed, Performance traits, Population

Total cattle population of India is 190.9 million, which includes 151.17 million indigenous cattle (Livestock Census 2012) distributed all over the country. Cattle play very vital role in animal husbandry sector of India and provides livelihood to millions of rural people. Indigenous cattle which constitutes about 79% of total cattle population (19th Livestock Census) is endowed with 43 recognized breeds spread over various states across the country (NBAGR 2018). Each breed is known for its own characteristic features and utility, whether specific for milk production, draught power or both. Among indigenous cattle breeds, Hariana is one of the important dual purpose breeds originally developed and reared in the northwest part of India (Joshi *et al.* 1995). This breed was also known as Hansi. The name of Hariana cattle is based on the region known as Haryana in North India. There were two strains of cattle, viz. Hisar and Hansi, found in this region and known after the name of their native towns. It seems that Hariana cattle have originated from these two strains. The native breeding tract of Hariana cattle comprises large part of Rohtak, Hisar and Gurgaon districts of Haryana. Purebred Hariana cattle were abundant in Jind, Bhiwani, Hisar, Rohtak and Gurgaon district of Haryana and this region was a leading trading centre particularly for Hariana bullocks. Owing to outstanding draught ability, the Hariana bullocks were considered a prized possession though the milking qualities of Hariana cows received belated attention. A large number of farmers were dependent on these draught animals for carrying out agriculture operations. The milk yield of Hariana cattle ranges from 809 to 1,731 kg and bullocks are good for agricultural operations (Mishra *et al.* 1980, Upadhyay and Madan 1985). Hariana is the most important cattle breed in Haryana with an average standard milk yield of 997 kg with highest recorded milk yield as 1,745 kg. Hariana cattle is famous for its remarkable power of endurance under hot climate of tropics, resistance to tropical diseases and has low maintenance cost. Of late, Hariana breed is also getting importance due to presence of A2 allele in milk, which is considered good for human health (Mishra *et al.* 2009). The breed has been used extensively for grading up the non-descript cattle mainly to improve their draught ability in Indo-Gangetic plains. Number of studies have been conducted for the evaluation of crosses of Hariana cattle with various exotic cattle breeds (Saini *et al.* 1988, Dahiya

Present address: [1]Assistant Professor (drmanojneemwal@gmail.com), [2]Professor and Head (dahiya642000@yahoo.com), Department of Livestock Farm Complex; [3]Scientist (punam.ratwan@gmail.com), Department of Animal Genetics and Breeding.

et al. 1992, 1993, 1994). In India, Hardhenu (developed at Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, India), and Vrindavani (developed at Indian Veterinary Research Institute, Izatnagar, India) synthetic crossbred cattle strains have been developed by crossing Hariana breed with exotic cattle breeds for rearing under tropical and sub-tropical conditions.

According to a report by Panse *et al.* (1964), the cattle population consisted of 52% Hariana cattle, 46% non-descript cattle and 2% of Sahiwal, Red Sindhi etc. in rural areas of Punjab and Haryana. Although, Hariana breed accounted for about 39% while 56% were non-descript and 5% other breeds like Red Sindhi and Sahiwal in urban areas. Tantia *et al*. (1994) reported about 8.6% decline in population of Hariana cattle during the period 1977–82. Many programmes have been initiated from time to time to improve its productivity in the past by various government and non-government organizations. However, in spite of all these efforts and usefulness of the breed, it has declined to the extent that its survival is difficult and is in danger of extinction (Joshi *et al.* 1996, Kumar and Dixit 2006).

The main causes of decline in the population of Hariana cattle are mechanization of agriculture and marketing problem for dry animals. The farmers cannot support the maintenance of animals during dry period because it has to compete with other milch animals like Murrah buffaloes and crossbred cattle and besides, major shift in cattle breeding policy in the past toward crossbreeding has led the farmers to rear more crossbred animals as there are economic considerations favouring buffaloes and crossbred cattle as dairy animals. Farmers get more price for buffalo milk as compared to cattle due to higher milk fat per cent and in organized sector, livestock keepers are paid on the basis of fat percentage or fat corrected milk (FCM). Low productivity of Hariana cattle, short lactation length and absence of progeny tested bulls are also reasons for declined population of Hariana cattle. The problem is further extravagant due to mechanization of agriculture. Additionally, there are some behavioural problems of Hariana cattle like aggressiveness resulting into tedious handling by women and children, allowing milking to a particular member of the family and habit of retaining milk in the udder for the calf. Reduction in size of land holdings is another factor responsible for the reduction in number of Hariana breed (Kumar and Dixit 2006).

There is a need to save Hariana cattle because it is suitable breed for tropical environment and Indo-Gangatic plains and can be maintained on low input medium output system. This is unique along with Kankrej and have maximum milk yield among the dual purpose cattle breeds and Hariana cattle are getting importance due to the presence of A2 allele in milk. The draughtability of Hariana cattle makes it useful for agricultural operations, i.e. transporting, ploughing fields, thrashing grains. Hariana cattle is also known for heat tolerance and resistance to diseases like trypanosomiasis, babesiosis and theileriasis. As landholdings are declining day by day and under these circumstances the Hariana cattle may again play an important role in field operations of small farmers in the future besides providing A2 milk to the family.

Population of Hariana cattle in different states of India including Delhi is given in Table 1. Total population of Hariana cattle is maximum in Uttar Pradesh followed by Rajasthan and Haryana. However, pure Hariana cattle is maximum in Uttar Pradesh followed by Haryana and Rajasthan. Breed-wise survey (2013) revealed that the total Hariana population in India is 6,279,963 which comprises 26.1% pure and 73.9% graded Hariana. Further, there is wide variation in population of Hariana cattle across the districts of Haryana (Table 2). Maximum population is recorded in Hisar followed by Bhiwani and Jind districts whereas lowest population is recorded in Panchkula and Yamunanagar.

Table 1. Population of pure as well as graded Hariana cattle in different states of India (2012–13)

State/ Union territory	Pure Hariana cattle			Graded Hariana cattle			Total pure + graded Hariana cattle and female
	Male	Female	Pure male	Male and female	Female	Graded male	
Bihar	14,030	36,451	50,481	61,031	255,982	317,013	367,494
Chandigarh	0	0	0	1	7	8	8
Chhattisgarh	10,228	1,742	11,970	55,132	56,401	111,533	123,503
Haryana	100,762	137,762	238,524	69,936	119,741	189,677	428,201
Himachal Pradesh	10,787	658	11,445	23,520	2,325	25,845	37,290
Jharkhand	23,365	12,197	35,562	15,156	17,274	32,430	67,992
Madhya Pradesh	14,862	18,798	33,660	76,784	110,918	187,702	221,362
NCR of Delhi	282	3,134	3,416	459	9,036	9,495	12,911
Odisha	1,283	2,656	3,939	95,683	63,436	159,119	163,058
Punjab	64,577	31,522	96,099	48,673	39,220	87,893	183,992
Rajasthan	34,876	195,706	230,582	33,140	179,609	212,749	443,331
Uttar Pradesh	262,800	652,127	914,927	899,941	2,393,319	3,293,260	4,208,187
Uttarakhand	4,141	4,379	8,520	6,074	7,924	13,998	22,518
West Bengal	56	0	56	50	10	60	116
Total	542,049	1,097,132	1,639,181	1,385,580	3,255,202	4,640,782	6,279,963

Source: DAHD 2013.

Table 2. District-wise population of pure as well as graded Hariana cattle in Haryana (2012–13)

District	Pure Hariana cattle			Graded Hariana cattle			Total pure + graded Hariana cattle
	Male	Female	Pure male and female	Male	Female	Graded male and female	
Ambala	722	869	1,591	1,013	1,762	2,775	4,366
Bhiwani	13,955	27,824	41,779	7,404	8,013	15,417	57,196
Faridabad	195	521	716	832	4,897	5,729	6,445
Fatehabad	2,023	4,353	6,376	9,589	8,908	18,497	24,873
Gurgaon	3,934	10,889	14,823	175	1,209	1,384	16,207
Hisar	16,580	17,987	34,567	15,411	16,065	31,476	66,043
Jhajjar	1,592	2,286	3,878	2,530	10,380	12,910	16,788
Jind	28,454	16,930	45,384	1,383	3,944	5,327	50,711
Kaithal	9,306	7,657	16,963	7,751	10,228	17,979	34,942
Karnal	922	3,152	4,074	1,272	6,187	7,459	11,533
Kurukshetra	430	2,444	2,874	949	2,825	3,774	6,648
Mahendragarh	2,600	9,117	11,717	724	5,019	5,743	17,460
Mewat	728	3,542	4,270	985	7,343	8,328	12,598
Palwal	330	1,582	1,912	1,905	4,399	6,304	8,216
Panchkula	307	498	805	27	478	505	1,310
Panipat	1,087	3,535	4,622	1,978	7,295	9,273	13,895
Rewari	979	5,179	6,158	454	2,205	2,659	8,817
Rohtak	9,384	9,722	19,106	7,299	3,555	10,854	29,960
Sirsa	2,820	2,992	5,812	6,323	9,282	15,605	21,417
Sonipat	4,270	6,617	10,887	1,553	4,224	5,777	16,664
Yamunanagar	144	66	210	379	1,523	1,902	2,112
Total	100,762	137,762	238,524	69,936	119,741	189,677	428,201

Source: DAHD (2013).

There is a central government project, viz. 'Gosamvardhan and Gosanrakshan' worth ₹ 77.90 crore for conservation, upgradation and integrated development of Hariana cattle along with Sahiwal and Gir breeds of indigenous cattle. The main objectives of the project involve improvement in the quality of AI services and making it available at farmers' doorstep, to bring all breedable cows under organised breeding through AI or natural service using disease-free high genetic merit bulls (Business Standard, 19 Feb 2015). Haryana Government is also implementing a scheme (Gausamvardhan) for the conservation and development of indigenous cattle (Hariana, Sahiwal and Belahi). Long term objectives of this scheme are increase in milk production as well as productivity and upgradation of indigenous germplasm through selective breeding. The medium term objectives include identification of top quality germplasm and insemination with quality semen for sustainable genetic improvement, procurement of pedigreed young indigenous bulls for further supply in state/Country and encouraging the farmers to rear better yielding animals. Hariana animals are identified based on their peak yield and cash incentives ranging from ₹ 10,000 to ₹ 20,000 are provided to the owners of Hariana cattle based on milk yield.

Physical characteristics of Hariana cattle

Hariana cattle are generally characterized by a long and narrow face, flat forehead and a well-marked bony prominence at the centre of the poll. Muzzle of Hariana breed is usually black, eyes are large and prominent and they have small horns. Balaine *et al.* (1971) reported that typical Hariana animals have black eye lashes, however it was observed only in 20% animals whereas 78.2% are partially black and 1.8% animals observed with white eye lashes. The head is carried high and gives a graceful appearance. The skin is of black colour and is usually covered with a white or light grey coat. In bulls, the colour in between front and hind quarters is relatively dark or dark grey (Fig. 1). Hump is of medium size in cows and larger in males. Legs are moderately long and lean with small, hard and well-shaped feet. Udder of Hariana cattle is capacious and extends well forward with a well-developed milk vein. The teats are well developed, balanced and medium sized (Fig. 2). The tail is rather short, thin and tapering with a black switch reaching just before the hocks. A coat colour other than white or grey as well as white switch of the tail is considered a marked deviation from the typical attributes and a disqualification from the perspective of breed registration (ICAR, Research bulletin 1979). Sharma *et al.* (1951) observed body confirmation differences between pure Hariana and cattle of Hisar

Figs 1–2. **1**. Male Hariana cattle; **2**. Female Hariana cattle.

Table 3. Mean body parameter measurements of Hariana cattle

Body parameter	Female	Male
Height (cm)	136.1	138.43
Body Length (cm)	139.2	141.02
Heart girth (cm)	169.8	173.96
Birth weight (kg)	21.7	23.30
Body weight (kg)	325	499.00

Source: NBAGR (2018).

District. Most of Indian cattle breeds have permanent dentition at the age of 4.5–5 years. However, Lall (1948) reported completion of permanent dentition slightly late in Hariana cattle. Herd book is available for registration of elite Hariana cattle. These animals are mainly reared under semi-intensive management system. Some of the body measurements like average height, body length, heart girth, birth weight and adult body weight of Hariana cattle are presented in Table 3.

Performance traits and their inheritance in Hariana cattle performance traits, viz. production, reproduction and functional traits have been reported by several workers, mostly from the studies of farms at various locations with the objective of describing the norms of Hariana cattle. The performance traits reviewed here include lactation milk yield, wet average, lactation milk yield per day of calving interval, lactation length, dry period, age at first calving, service period and calving interval which are presented in Table 4.

Table 4. Average estimates of mean as well as heritability of performance traits in Hariana cattle

Mean±SE	Heritability estimates	References
	Lactation milk yield (*kg*)	
960	0.15±0.04	Singh and Desai (1961)
1011.0±40.0	0.50±0.16	Soof and Singh (1970)
721.18±13.3	0.37±0.10	Balaine (1971)
908.30±13.14	0.29±0.13	Khanna (1977)
827.43±15.58	0.41±0.17	Hingane (1980)
870.68±11.5	0.24±0.16	Arora and Sharma (1981)
1466.0±33.38	0.11±0.08	Yadav (1988)
1132.0±19.50	0.26±0.15	Pundir and Raheja (1994)
1153.46±47.94	–	Dahiya (1994)
2215.07±24.58	–	Kumar *et al.* (1997)
1863.00±141.00	–	Ashraf *et al.* (2000)
1797.17	–	Thakur and Singh (2000)
	Wet average (kg)	
2.45±0.05	–	Kohli *et al.* (1961)
3.11±0.05	0.27±0.14	Hingane (1980)
4.97±0.09	–	Yadav (1988)
4.19±0.13	0.16±0.09	Dhaka (1997)
	Lactation milk yield per day of calving interval (*kg*)	
1.10±0.03	–	Kohli *et al.* (1961)
1.90±0.04	0.39±0.22	Hingane (1980)
2.35±0.04	–	Rana (1985)
–	0.34±0.22	Singh (1994)
2.38±0.13	0.33±0.14	Dhaka (1997)
	Lactation length (*days*)	
285.39±5.31	0.22±0.14	Kohli *et al.* (1961)
302.30±10.15	0.80	Chandiramani and Dadlani (1967)
262.79±01.89	0.12±0.09	Hingane (1980)
252.30±02.95	0.20±0.14	Arora and Sharma (1981)
264.73±02.70	0.21	Rana (1985)
290.63±03.53	0.09±0.08	Yadav (1988)
336.00±04.3	0.26±0.16	Pundir and Raheja (1994)
299.38±9.74	–	Ashraf *et al.* (2000)
320.27	–	Tliakur and Singh (2000)
	Dry period (*days*)	
133.03±10.12	0.32±0.32	Dadlani and Parbhu (1968)
264.73±02.70	0.21	Rana (1985)
290.63±03.53	0.09±0.08	Yadav (1988)
336.00±04.3	0.26±0.16	Pundir and Raheja (1994)
297.0±8.0	–	Pundir (1995)
259.0	–	Singh and Nivsarkar (1998)
299.38±9.74	–	Ashraf *et al.* (2000)
320.27	–	Thakur and Singh (2000)
	Age at first calving (days)	
1401.0±13.5	0.34±0.12	Singh and Desai (1961)
1590.0±09.6	0.38±0.11	Guha *et al.* (1968)
1743.0±21.0	0.67±0.15	Singh *et al.* (1968)
1762.0±12.0	0.44±0.11	Balaine (1971)
1354.3±19.4	0.38±0.19	Tomar *et al.* (1976)
1565.61±07.82	0.25±0.10	Hingane (1980)
1339.1±8.44	0.53±0.13	Koul (1987)
1436.0±I0.70	0.18±0.13	Pundir and Raheja (1994)
1111±30.9	–	Dahiya *et al.* (1996)
1037.93±05.95	–	Kumar *et al.* (1997)
1381.0	–	Singh and Nivsarkar (1998)
1328.62	–	Saha *et al.* (2000)
	Service period (days)	
154.0±9.30	0.05±0.19	Soof and Singh (1970)
302.70±6.50	0.15±0.11	Balaine (1971)
208.34±6.70	0.24±0.16	Arora and Sharma (1981)
270.0±7.7	0.09±0.10	Pundir and Raheja (1994)
159.5±8.39	–	Kumar (1995)
257.0±4.0	–	Pundir (1995)
192.00±7.26	0.10±0.07	Dalal *et al.* (2002)
	Calving interval (days)	
630.8±9.0	0.30±0.18	Kohli *et al.* (1961)
471.7	0.02±0.06	Singh and Desai (1962)
607.0±6.9	0.29±0.16	Singh (1967)
444.1±9.4	0.02±0.45	Dedlani and Chandiramani (1968)
477.59±5.08	0.01±0.13	Hingane (1980)
477.16±4.89	0.07±0.28	Rana (1985)
483.01±3.45	0.41±0.14	Koul (1987)
495.15±7.6	0.03±0.05	Yadav (1988)
423.78±3.44	–	Kumar *et al.* (1997)
421	–	Siagli and Nivsarkar (1998)
499.99	–	Thakur and Singh (2000)

Lactation milk yield is very important economic trait of the dairy animals' productivity, which decides profitability from dairy farming. The overall means of lactation total milk yield of Hariana cattle maintained at different organized farms varied from 721.18±13.3 kg (Balaine 1971) to 2215.07±24.58 kg (Kumar *et al*. 1997). As per literature, lowest heritability of lactation milk yield was 0.11±0.08 (Yadav 1988) and highest 0.50±0.16 (Soof and Singh 1970). The large amount of variation in the milk production of Hariana cows indicate a sufficient scope for its improvement. Hariana cows have high level of motherly instinct, so the new born calves are usually unweaned. Gehlon and Sekhon (1969), Balaine *et al.* (1971) and Tomar (1978) studied the possibility of weaning of new born calves. There was a decrease in the quantity of milk production and increase in calf mortality (0–15 days). However, postpartum oestrus interval decreased (Gehlon and Sekhon 1969, Aggarwal *et al.* 1972). Ngere (1970) observed that in spite of low yield, calf suckling encouraged milk let down. Cows losing calves produced less milk due to short lactation.

Wet average is the average per day milk yield up to 305 days or less during lactation. It is the most acquainted trait for a dairy farmer. Any selection criterion to be applied in field conditions should be understandable to the farmers. In this concern, wet average may serve as an important trait for selection of dairy animals in Indian scenario. Literature revealed that overall estimates of wet average in Hariana cattle maintained at different organized farms ranged from 2.45±0.05 kg (Kohli *et al*. 1961) to 4.97±0.09 kg (Yadav 1988). Hingane (1980) and Dhaka (1997) reported heritability estimates of wet average as 0.27±0.14 and 0.16±0.09 in Hariana cattle.

The first lactation milk yield is used as a general criterion for selection of dairy animals. However, it is better to select animals based on their milk production efficiency rather than milk yield. High production efficiency in livestock production is an economically desirable trait that targets eventually for genetic upgradation. Dahiya (2005b) and Dahiya and Rathi (2000, 2002) evaluated some zebu cattle herds of India including Hariana cattle based on the production efficiency. The lowest mean of production efficiency measured as lactation milk yield per day of calving interval of Hariana breed was 1.10±0.03 kg (Kohli *et al*. 1961), whereas, highest was 2.38±0.13 kg (Dhaka 1997). Heritability estimates for milk yield per day of calving interval in Hariana cattle ranged from 0.33±0.14 (Dhaka 1997) to 0.39±0.22 (Hingane 1980). Dahiya and Rathi (1997) reported that milk yield per day of productive life at the end of first, second and third lactation were recorded as 2.47±0.10, 2.85±0.08 and 3.04±0.11 kg, respectively, indicating that milk production efficiency of Hariana cattle increases from first to third lactation.

Average lactation length of Hariana cows varied from 252.30±2.95 days (Arora and Sharma 1981) to 336.00±4.3 days (Pundir and Raheja 1994). Literature revealed heritability estimates of lactation length in Hariana cattle as low as 0.09±0.08 (Yadav 1988) and as high as 0.80 (Chandiramani and Dadlani 1967).

The shortest mean dry period of Hariana cattle was found to be 133.03±10.12 days (Dadlani and Parbhu 1968) versus longest one of 336.00±4.3 days (Pundir and Raheja 1994). The heritability estimates of dry period ranged from 0.09±0.08 (Yadav 1988) to 0.32±0.32 (Dadlani and Parbhu 1968) in Hariana cattle.

The ability of a heifer to conceive and give birth to a calf is indicated by age at first calving (AFC). Lower AFC is desirable for early returns as it increases the lifetime production and reduces the generation interval. Moreover, lowered generation interval helps in earlier evaluation of sires resulting in faster genetic gain. The overall mean of age at first calving of Hariana cattle maintained at different organized farms ranged from 1,037.93±5.95 days (Kumar *et al*. 1997) to 1,762±12 days (Balaine 1971). The heritability estimates for age at first calving in Hariana varied from 0.18±0.13 (Pundir and Raheja 1994) to 0.67±0.15 (Singh *et al.* 1968). The large variation in this trait indicated that there is enough scope of improvement through selection and suitable breeding plans.

Service period is time for successful conception after calving. The service period affects the production efficiency as it has direct effect on calving interval. Any variability in service period is directly reflected into variation in calving interval. Longer service period also affects the lactation length and dry period. The average service period in Hariana cattle varied from 154.0±9.30 (Soof and Singh 1970) to 302.70±6.50 days (Balaine 1971). The variability in service period of Hariana cattle at different herds and period might be due to differential herd management and feeding practices. Lowest heritability estimate for service period was found to be 0.05±0.19 (Soof and Singh 1970), however, the highest value reported was 0.24±0.16 (Arora and Sharma 1981).

Calving interval is the period between two successive calving. Longer calving interval leads to less total number of calvings and decline in lifetime milk production. Average calving interval in Hariana cows ranged from 421 days (Singh and Nivsarkar 1998) to 630.8±9.0 days (Kohli *et al.* 1961). The heritability estimates for calving interval varied from 0.02±0.06 (Singh and Desai 1962) to 0.41±0.14 (Koul 1987) in Hariana cattle.

The increase in number of services per conception leads to higher age at first calving, service period, calving interval which affects the overall productivity of animals. The average number of services per conception in Hariana cows was recorded as 2.39±0.03 ranging from 1.40 (Kohli and Suri 1957) to 2.81 (Choudhary *et al*. 1984).

Functional traits in Hariana cattle

The term functional trait represents those characters of an animal, which increases efficiency not by higher output of product but by reduced cost of input (Groen 1996). Sethi (1976) reported incidence of mastitis, three days sickness, FMD and retention of placenta as 40.86, 17.51, 8.62 and

21.31% in Hariana cattle, respectively. Luktuke and Choudhary (1965) reported early embryonic mortality, abortion and still birth as 1.64, 1.64 and 1.09% in Hariana heifers and 5.01, 3.34 and 0.34% in cows, respectively. Incidence of dystocia was 1.01% in adult cows. Sharda and Lohia (1966) reported 2.90% abnormal calving of Hariana cows which included 51.1, 37.8 and 11.1% abortions, still births and premature births, respectively.

In the modern dairying, the cow is under extreme pressures than her predecessors for high production potential as well as body and strength to sustain it over a long time. Dairymen have long mooted the relative emphasis of type and production in dairy selection programmes. About one-third of cows are culled annually, but only 42% of these are culled for low production (Murril 1974) and rest of other tangible and intangible causes, viz. body conformation, reproduction problems, diseases etc. The phenotype of the cow is equally important as production in determining the sale price and length of herd life of dairy cow. Type traits can be appraised readily and accurately during first lactation and are moderately heritable. The concept of linear analysis of type traits was introduced in 1976; the first programme for linear evaluations was implemented and tested by 1979. Today, almost all breed associations and virtually all the AI organizations in developed countries use one or the other form of linear evaluation for conformation analysis of dairy cattle. In the new linear type scoring systems, the methods depend on the range of scale, i.e. 1–3, 1–9 or 1–50. The latest method utilizes 50–99 point linear scale. Now-a-days more importance on individual linear type traits has been suggested in contrast to genetic selection for final type score. Dairy cattle breeders in the developed countries have studied the genetic importance of linear type traits but only a few studies have been conducted in indigenous cattle. Hariana cows were scored for 13 linear types traits to identify the indicators for production and reproductive performance (Dahiya and Rathi 1996, Dahiya 2005a and Dahiya 2006). Distribution of Hariana cattle (%) under subclasses of scores of different linear type traits and their least-squares means (points) on 50–99 point scale along with coefficients of variation (CV) are presented in Table 5.

Strategies for conservation of Hariana cattle

There is a need to create public awareness about good qualities of Hariana cattle like disease resistance and production of A2 milk. Mechanization is not economical for small farmers, so popularizing the breed among small farmers or landless livestock keepers can be helpful for conservation of cattle; which will also have additional benefits of organic farming. Livestock keepers rearing Hariana cattle breed should be provided some incentives by government in terms of semen supply and treatment of the animals, which in turn will motivate more farmers to keep the breed. There is a need to raise progeny tested bulls so that farmers can get good quality semen to get their animals inseminated to enhance the production performance and improve the present population of Hariana cattle.

Semen production facilities need to be strengthened for production of disease free high quality semen from high genetic merit bulls and disseminated at the farmers' doorstep. This can be achieved by establishing infrastructure for production and selection of genetically superior breeding bulls especially in the breeding tract of Hariana cattle. Facilities of data recording for production, reproduction, growth and diseases by registering more number of Hariana cattle in database for identification and evaluation of genetically superior animals is also important. Additionally, upgradation with pure Hariana bulls will also helpful in conservation. The dilution of the breed in its breeding tract could be checked by strictly following the pure breeding programmes. Development of pastures at community and panchayat land may help small and marginal farmers to rear cattle on almost zero input system. A registered society

Table 5. Distribution of Hariana cattle (%) under subclasses of scores of different linear type traits and their least-squares means (points) and coefficient of variation (%)

Trait	No. of animals	Sub-classes					Mean score±SE	CV
		50–59	60–69	70–79	80–89	90–99		
Stature	307	8.63	21.41	29.71	29.07	11.18	75.79±0.75	16.10
Chest and body	307	7.35	20.77	31.95	31.63	8.30	76.75±0.73	14.56
Dairy character	307	0.0	14.7	35.14	33.87	16.29	79.04±0.72	11.25
Foot shape	307	0.0	15.65	30.67	35.14	18.54	78.23±0.73	11.54
Rear legs	307	13.1	30.67	33.23	20.45	2.55	72.21±0.77	13.90
Pelvic angle	307	3.15	11.82	30.67	38.66	154.34	79.49±0.78	12.57
Rump width	307	5.43	29.07	30.67	30.04	7.79	74.53±0.69	14.80
Fore udder attachment	298	6.25	20.72	23.68	32.24	17.11	78.41±0.73	14.53
Rear udder width	298	4.93	21.38	32.89	31.58	9.22	76.77±0.67	13.59
Rear udder height	298	5.26	20.07	31.58	29.60	13.49	76.85±0.67	13.36
Teat placement	298	3.95	21.05	36.84	25.99	12.17	77.28±0.68	12.94
Suspensory ligament	298	5.92	18.75	28.62	31.58	15.13	77.89±0.70	14.06
Udder depth	298	0.33	4.60	31.91	42.11	21.05	81.38±0.54	10.09

Source: Dahiya (1994).

for propagation and conservation should be started by Government or NGOs. *In situ* breed conservation centers and storage of cryopreserved germplasm in the form of frozen semen and embryo can also play a significant role in the conservation of breed.

Conclusion

Hariana cattle is famous for its remarkable power of endurance for hot climate of tropics, resistance to tropical diseases and low maintenance cost. This breed has played an important role in green revolution of the country by providing good quality bullocks for farm operations. In India, Hardhenu and Vrindavani synthetic crossbred cattle strains have been developed by crossing Hariana breed with exotic breeds. The strength of this cattle breed lies in the fact that its milk production is least affected under adverse environmental conditions. Hariana cattle are also getting importance due to the presence of A2 allele in milk, which is considered good for human health. Indigenous cattle have a high heat-resistance by virtue of their extensive dewlaps as compared to exotic breeds of cattle. The population of this important cattle breed is declining in the natural breeding tract which is a matter of great concern. Various factors identified which are responsible for decline in the population of Hariana cattle which need to be taken into consideration for the conservation programme. The production potential of these animals has deteriorated over a period of time due to lack of selection and progeny tested bulls. Landholdings are declining day by day in India and under these circumstances the Hariana cattle may again play an important role in farm operations of small or marginal farmers. Consequently, a new look is needed from the breeding policy point of view which will recognize the importance of this dual purpose breed and put forward options for improvement of milk production and draught power so that the Hariana cattle can be saved for the use of future generations.

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