The Haryana Veterinarian (December, 2023) **62(2),** 118-121 ISSN 0033-4359 (P) **Research Article**

STUDY ON PRODUCTION PROFILE, DISSEMINATION PATTERN AND ECONOMIC IMPACT OF HARDHENU SYNTHETIC CATTLE

S.S. DHAKA, ANKIT MAGOTRA, YOGESH C. BANGAR, C.S. PATIL*, ANIL CHITRA, Z.S. MALIK and SUMIT MAHAJAN[1]
Department of Animal Genetics and Breeding, College of veterinary Sciences,
[1]Department of Dairy Business Management, College of Dairy Science and Technology,
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125 004, Haryana, India

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ABSTRACT

The present investigation was undertaken to study production profile, dissemination pattern and economic impact of Hardhenu synthetic cattle. The necessary information was retrieved from annual reports of 12 years (2010-11 to 2021-22) maintained at Department of Animal Genetics and Breeding, LUVAS, Hisar. Total herd strength of Hardhenu population at studied location was near to 300. Total 1199 calves born during 2010-11 to 2021-22, out of which 545 calves (45.45%) were female calves, which indicated that sex ratio was skewed towards male calves. The average lactation yield increased from 3045 (2010-11) to 4190 kg (2021-22) with significant increase of around 125 kg per year. Further, wet average i.e. total milk production divided by number cows in milking, also had positive growth (0.59 kg) over the years. During the study period, total 367 female animals (40.37%) out of total 909 animals were disseminated to farmers during study period. Total economic impact of Hardhenu cows at farmer's herd was calculated as revenue generated by average milk production and net return per litre. The economic impact of disseminated Hardhenu cows for lifetime performance was calculated around Rs. 346 lacs at 2021-22 real prices. Considering the production potential of Hardhenu cows in adverse agro-climatic conditions in Haryana and nearby states, it is suggested that the further propagation and conservation of this synthetic population may boost dairy farm returns.

Keywords: Dissemination, Economic impact, Hardhenu cow, Production

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Indian livestock sector plays very important role in Indian economy by contributing 4.90% to total GDP of country during 2020-21. Considering different agro-climatic conditions of the country and additionally, climatic influences on crop production, Indian dairy sector is emerging as a major source of income as well as for employment and it has broader social and economic dimension. The total number of cattle in the country in 2019 is 192.49 million showing an increase of 0.8% over previous Census, out of which Exotic/Crossbred and Indigenous/Non-descript Cattle population are 50.42 million and 142.11 million, respectively (DAHD, 2019). It was also worth to mention here that total female cattle population is 145.12 million, increased by 18.0% over the previous census (2012) and the population of the total Exotic/Crossbred Cattle has increased by 26.9 % in 2019 as compared to previous census.

Lala Lajpat Rai University of Veterinary and Animal Sciences has been maintaining Hardhenu cattle, synthetic population of crossbred cattle having 62.5% exotic inheritance (Holstein Friesian). Hardhenu is a promising breed of dairy cattle most suited to agro-climatic conditions of Haryana and majority northern states (Punjab, Rajasthan and Uttar Pradesh) of the country. Haryana belongs to the Trans Gangetic Plain Region Agro-climatic zone and this region covers nearby states viz., Punjab, Rajasthan and Uttar Pradesh. Crossing of non-descript low producing indigenous cattle with Hardhenu bull of high genetic merit is recommended in the areas with good input and better managemental conditions.

Crossbreeding has been an important production method for improving production, health and growth parameters in dairy sector. There are several reports describing the economic benefits of crossbreeding over pure-breeding (Heins *et al.*, 2012; Clasen *et al.*, 2020). It is well known fact that the crossbreeding in a herd is a long-term investment and needs simultaneous decision making regarding breeding and culling strategy before stabilization of crossbred population. In order to estimate economic impact of crossbreeding, the study of overall production and disposal performance is essential. However, there is very scanty literature available on production, reproduction and culling pattern in Hardhenu cattle (Manjeet *et al.*, 2017; Kumar *et al.*, 2017; Dev *et al.*, 2021; Kamaldeep *et al.*, 2021; Anamika *et al.*, 2022). In addition to this, there is no information reported regarding economic impact of this crossbred population till date.

Therefore, the present work was carried to study production profile, dissemination pattern and economics of Hardhenu cattle during 2010-11 to 2021-22.

*Corresponding author: dr.cspatil03@gmail.com

MATERIALS AND METHODS

Source of the data: The data records used in the present study were obtained from various records maintained on Hardhenu cattle in the Department of Animal Genetics and Breeding, LUVAS, Hisar, India over the period from 2010-11 to 2021-22. Hardhenu cattle is synthetic crossbred cattle having 62.5% exotic inheritance (Holstein Friesian) and 37.5% Indigenous inheritance (Sahiwal and Hariana). It was developed by Department of Animal Genetics and Breeding through interse mating and it has completed 6-8 generations. The current herd strength at department is 300 and number of total disseminated animals from 2010-11 to 2021-22) is 909.

Sample size: The information of herd strength and female population along with calf born and female disseminated during each year was used in this study. For calculation of economic impact, the information of total 367 disseminated cows was used.

Data collection: The annual reports from 2010-11 to 2021-12 were extracted for necessary information pertained to lactation milk yield, lactation length and disposal of animals across the years (Anonymous, 2022a). The Hardhenu cow is shown in Fig. 1.

Statistical analysis

The dissemination of animals was calculated across years and same was tested for possible association with years using chi-square test. The phenotypic trends of lactation milk yield, wet average and mortality (%) over the years were estimated using regression analysis.

The economics of Hardhenu disseminated to farmers was calculated using total number of female animals disseminated to farmers per year. For this purpose, the average lactation milk yield was calculated by dividing lactation milk yield by lactation length for respective year. Then, Net return was calculated as

Net return per day = average milk yield * net return per litre of milk.

The net return per litre of milk in crossbred cows was taken as Rs. 7.0, considering the reported figures from literature as Rs. 5.20 (Lal and Chandel 2016), 7.33 (Agrawal and Raju, 2021) and 8.28 (Kumawat *et al.*, 2014). Further, the calculation of economics was done for one lactation (300 days), and then it was extended for three lactations to demonstrate lifetime income. In order to show real income, we used cost inflation index as per finance act 2022 (Anonymous, 2022b) and the real prices for different years were calculated by considering base year (2021-22).

RESULTS AND DISCUSSION

The percent of female animals out of total animal population ranged from 81.76 to 93.17% during studied years. Total of 1199 calves born during study period, out of which 545 calves (45.45%) were female calves, which indicated that sex ratio was skewed towards male calves. Critical review of the table further revealed that number of female calves born to total calves were less than classical sex ratio of 50% during all twelve-year period except during 2020-21 year where it managed to attain more than half (53.47%). Interestingly, it was as low as 39.80% during 2017-18 indicating that every attempt should be directed to include recent biotechnology of sex sorted semen in order to enhance profitability at farm (Table 1).

Total of 909 animals were disseminated to farmers herds, out of which, female animals contributed to 40.37 % (367/909). The percent dissemination of animals ranged from 12.75 to 52.94% out of total animal strength existed at study location. Whereas, the percent of total female animals disseminated ranged from 4.23 to 32.70 % out of total female strength existed at each year. Chi-square analysis showed that dissemination of animals was significantly ($P<0.01$) different across the years. The dissemination percentage observed in current study was also reported by Upadhyay *et al.* (2014) and Parmar *et al.* (2016). Pinedo *et al.* (2014) reported that overall culling rates across breeds were 30.1, 32.1 and 35.0% for Jersey × Holstein crossbreds, Jerseys and Holsteins cattle, respectively.

The average lactation milk yield of Hardhenu cows over different years is depicted in Fig. 2. The average lactation yield ranged from 2959 (2012-13) to 4190 kg (2021-22). It was worth to mention here that average lactation milk yield showed increasing trends over the years and for last three years i. e. 2019-20, 2020-21 and 2021-22, it was clearly surpassed 4100 kg. The trend line under regression analysis showed that there was significantly ($P < 0.05$) positive growth in milk production (124.70 kg) per year. The coefficient of determination was 90.70% which suggested that high model adequacy for linear trend of milk production over years. The positive trend of milk production in various cattle breeds was reported by several workers (Singh *et al.*, 2002; Nehra *et al.*, 2013; Choudhary *et al.*, 2018). The phenotypic trend of wet average over the years is shown in Fig. 3. The wet average ranged from 8.65 (2011-12) to 14.76 kg/day (2019-20). The regression analysis showed that there was significantly ($P<0.05$) positive growth (0.59 kg) in wet average across the years, with 81% model adequacy. The mortality (%) ranged from 3.62 (2020-21) to 6.06 (2014-15) among studied population (Fig. 4). Overall mortality percentage was below 5%, which is admissible under

Fig. 1. Hardhenu cow-Promising dairy cattle most suited to agro-climatic conditions of Haryana and majority states of the country

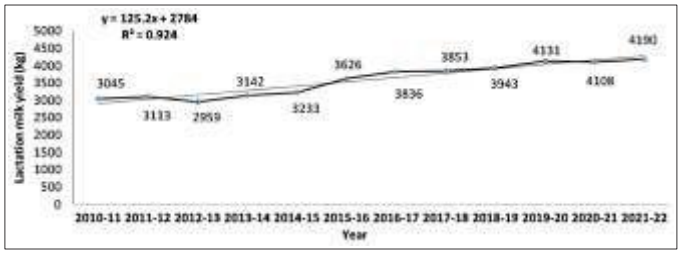

Fig. 2. The phenotypic trend of milk production of Hardhenu cows over years

standard farm practices. In addition to this, the mortality (%) had decreasing trend over the years. The calf mortality ranged from 3.41 to 16.19 whereas adult mortality ranged from 1.05 to 7.98 during the study period (Fig. 5).

The net return per kg of milk in crossbred cow was considered as Rs. 7.0/-. Net return per animal was calculated as multiplying average milk yield per cow in to net return per kg of milk. Total economic impact of Hardhenu cows for one lactation over 10 years since 2010-11 was calculated as Rs. 88.73 lacs. The lifetime period for each cow was considered up to 3 lactations, and thus, total economic impact of Hardhenu cows for lifetime performance over 10 years at since inception of LUVAS was calculated as Rs.

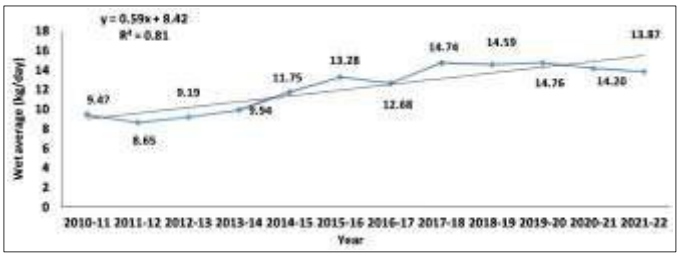

Fig. 3. The phenotypic trend of wet average of Hardhenu cows over years

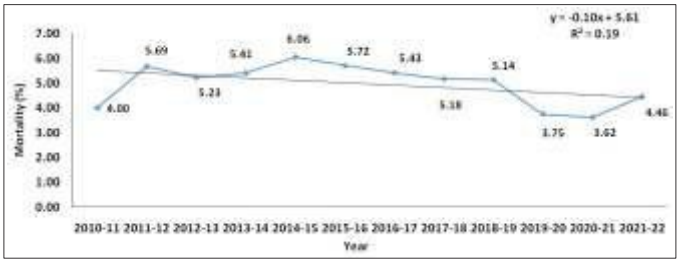

Fig. 4. The trend of mortality (%) in Hardhenu cattle over years

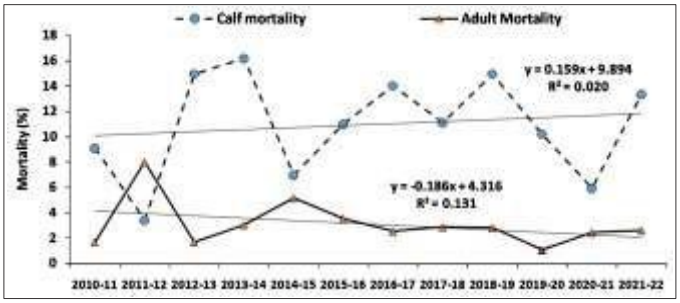

Fig. 5. The trend of calf and adult mortality (%) in Hardhenu cattle over years

266.18 lacs. Further, real income for lifetime performance over 10 years at since inception of LUVAS was calculated as Rs. 345.93 lacs at 2021-22 prices (Table 2).

CONCLUSIONS

There was positive trend (125 litre increase per year) of lactation yield over years and it was ranged from 3045 kg (2010-11) to 4190 kg (2021-22). During study period,

Table 1. Herd strength of Hardhenu cattle and female born from 2010-11 to 2021-22

Year	Total strength	Female Population (%)	Total calves born	Total Female born (%)	Total animals Disseminated (%)	Female disseminated (%)
2010-11	298	250 (83.89)	99	47 (47.47)	38 (12.75)	15 (6.00)
2011-12	238	211 (88.66)	88	41 (46.59)	126 (52.94)	69 (32.7)
2012-13	239	211 (88.28)	87	38 (43.68)	69 (28.87)	26 (12.32)
2013-14	231	213 (92.21)	105	48 (45.71)	89 (38.53)	33 (15.49)
2014-15	253	228 (90.12)	115	53 (46.09)	72 (28.46)	23 (10.09)
2015-16	283	260 (91.87)	109	46 (42.2)	46 (16.25)	11 (4.23)
2016-17	278	255 (91.73)	107	50 (46.73)	106 (38.13)	30 (11.76)
2017-18	282	252 (89.36)	108	43 (39.81)	84 (29.79)	33 (13.10)
2018-19	249	232 (93.17)	107	43 (40.19)	108 (43.37)	50 (21.55)
2019-20	285	246 (86.32)	98	45 (45.92)	50 (17.54)	24 (9.76)
2020-21	329	269 (81.76)	101	54 (53.47)	43 (13.07)	22 (8.18)
2021-22	308	266 (86.36)	75	37 (49.33)	78 (25.32)	31 (11.65)
Total			**1199**	545 (45.45)	909 (27.77)	367 (12.69)
Chi-square value					237.81**	129.91**

Table 2. Calculation of economic impact of Hardhenu cows

Year	Disseminated Hardhenu cows	Lactation milk yield/ cow (kg)	Lactation length/ cow (days)	Average Milk/ cow (kg)	*Net return/ day/cow (Rs)	Net return/ month (Rs.)	Net return/ lactation (Rs. in lacs)	Net return/ Three lactations (Rs. in lacs)	Base prices to 2021-22	Real prices (Rs. in lacs)
A	B	C	D	E=C/D	F=E*7	G=B*F*30	H=G*10/100000	I=H*3	J	K=I*J
2010-11	15	3045	322	9.5	66.20	29788.0	2.98	8.94	1.90	16.96
2011-12	69	3113	327	9.5	66.64	137943.0	13.79	41.38	1.72	71.30
2012-13	26	2959	332	8.9	62.39	48663.1	4.87	14.60	1.59	23.14
2013-14	33	3142	338	9.3	65.07	64420.3	6.44	19.33	1.44	27.85
2014-15	23	3233	309	10.5	73.24	50535.2	5.05	15.16	1.32	20.02
2015-16	11	3626	300	12.1	84.61	27920.2	2.79	8.38	1.25	10.45
2016-17	30	3836	301	12.7	89.21	80288.4	8.03	24.09	1.20	28.92
2017-18	33	3853	303	12.7	89.01	88123.1	8.81	26.44	1.17	30.81
2018-19	50	3943	288	13.7	95.84	143755.2	14.38	43.13	1.13	48.83
2019-20	24	4131	316	13.1	91.51	65886.8	6.59	19.77	1.10	21.68
2020-21	22	4108	305	13.5	94.28	62226.1	6.22	18.67	1.05	19.66
2021-22	31	4190	311	13.5	94.31	87707.1	8.77	26.31	1.00	26.31
Total	367					887257	88.73	266.18		345.93

*The net return per kg of milk in crossbred cows was considered as Rs. 7.0/-

total 909 animals were disseminated to farmers for improvement of their herds, out of which, total 367 were female animals. The economic impact of disseminated Hardhenu cows for lifetime performance (i.e. three lactations) was calculated as approximately Rs. 346 lacs at 2021-22 real prices. It was concluded that more emphasis towards propagation and conservation of Hardhenu cattle is essential for more productivity and profitability to farmers.

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