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Sustainability of dairy breeding practices in humid southern plain IV B zone, Rajasthan

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Abstract
The breeding practices followed by the farmers affect the genetic potential of the animals and hence, have long-run implications for sustainability of dairy farming. With the use of low quality germplasm, the productive breeds are getting progressively diluted and face degeneration. Such a loss of animal genetic diversity puts in jeopardy the sustainability of animal husbandry and the ability of the sector to respond to the changing environmental conditions. The present study therefore examines the sustainability of dairy breeding practices followed by farmers in humid southern plain IV B zone of Rajasthan based on primary data collected from 160 sample households of the zone. A composite index on 100 point scale was developed based on standardized scores assigned to each breeding practices as per their implications on sustainability. Results of the study showed that the livestock breeding practice were low sustainable in the zone as the average value of index was only 50 on the scale. The sustainability was comparatively higher on large farmers (value of index 53.36) as compared to small farmers (value of index 48.42). Results of the study showed that the livestock breeding practice were low sustainable in the zone. The breeding infrastructural facilities were poor in the study area. Study suggests for strengthening infrastructural facilities, extension facilities, vocational trainings particularly for farm women, etc. for improving the sustainability of breeding practices in the zone.

Keywords: Sustainability, dairy breeding, indexing, genetic diversity

Introduction
Livestock is an economic enterprise and can also be considered as a "survival enterprise" for millions of herds people in India, especially in the arid and semi- arid Rajasthan. It is the major component of agriculture in arid region while in other agro-climatic zones it is next to agriculture. The dominant role of livestock in the agrarian economy of Rajasthan is evident from the fact that the contribution of livestock sector is much higher in the state as compared to other parts of country. The contribution of livestock in value of output from agriculture at current prices in the state during 2008-09 was 36.84 percent while the corresponding figure at all India level was 26.87 percent (CSO, 2011) [2]. The contribution of livestock in household income in arid and semi-arid region of Rajasthan some time goes up to 60-65 percent in situation of drought and famine (GoR, 2007) [4]. Dairy is the major component of livestock in the state. The value of milk group alone was to the tune of Rs 89708 thousand crore in 2017-18, which was much higher than the value of output from total oilseeds (₹ 1184440 lakh), the second largest contributor to agriculture (CSO, 2011) [2].

The livelihood contribution of livestock has been well acknowledged. But there are a number of sustainability issues in livestock production in the country in general and in Rajasthan state in particular. The traditional package of practices for breeding, feeding, housing, management and health usually followed by farmers for rearing dairy animals, particularly of high production potentials do not result in further enhancing and sustaining the productivity of animals. There are several gaps/constraints, which may affect the production of indigenous and crossbred cattle and buffaloes, and make them unsustainable in the long run. The breeding practices followed by the farmers affect the genetic potential of the animals and hence, have long-run implications for sustainability of dairy farming (Joshi, 2004; Joshi and Chakravarty, 2004) [4, 5].

With the use of low quality germplasm, the productive breeds are getting progressively diluted and face degeneration. In recent years, several breeds have been reduced in number due to neglect and lack of concentrated breeding efforts. Such a loss of animal genetic diversity puts in jeopardy the sustainability of animal agriculture and the ability of the sector to respond to changing environmental conditions. Good breeding practices are therefore, essential pre-

requisite for bringing genetic improvement of animals and thereby improving the productivity and sustainability of animals. With this background, the present study was undertaken to assess the sustainability of dairy breeding practices in semi-arid eastern plain zone of Rajasthan.

Methodology

The study was entirely based on primary data collected from Jaipur district of semi-arid eastern plain zone of Rajasthan. The district was selected purposively as it advances in dairy production in the state. From the selected district, four tehsils and consequently four villages from each tehsils were selected randomly. The selected villages were completely enumerated to ascertain the herd size of milch animals. Three-herd size categories based on number of milch animals (both, cows and buffaloes); small (1-2 animals), medium (3-4 animals) and large (5 and above animals) were formed using cumulative square root frequency method. Total numbers of 120 households were selected as per the probability proportion to number of households in each category. The data were collected for the year 2018- 19 (March 2018 to February 2019) by conventional survey method on a well structured and pre-tested schedule through personal interview from selected households for three seasons, *viz*., summer (March to June), rainy (July to October) and winter (November to February).

To examine whether the breeding practices in the study area are congenial from sustainability angle, some pre-decided questions were asked to dairy farmers regarding to breeding practices followed by them. For instance, in case of natural service whether selected or scrub was used, in case of A.I. whether service of trained person is taken or not, etc. These practices were scored according to their implications for sustainability – the lower score for worst practice. Raw scores were converted into standard scores. Standard scores were converted by converting raw scores into 'z' score and then 'X' scores. The formula used to transform raw scores into '*z*' scores entails subtracting the mean from the raw score and dividing by the standard deviation.

$$Z = \frac{X - M}{SD}$$

While *z* scores are relatively simple to use, they do have some computational disadvantages. Because a *z* score can be equal to 0 or can be negative, certain types of data manipulation become awkward. For these reasons, as well as others, alternative standard score systems have been developed to linearly transform *z* scores (as well as raw scores) to a scale that does not contain negative numbers. Such systems are all "standardized" to the extent that both the mean and the standard deviation of the new scale have been arbitrarily set. The general formula for linearly converting a *z* score to a standardized score (X') is expressed as follows:

$$X' = SD(z) + M$$

Where: X' (called X prime) is the new standard score, and M and SD are the values of the mean and standard deviation, respectively, of the new distribution. Finally, the Sustainable Dairy Breeding Index (SDBI) on 100-point scale was calculated from these standard scores by assigning equal weight to each breeding practice.

Results and Discussion

The dairy farmers were interviewed to assess the breeding practices followed by them and the results are presented in Tables 1 and 2. It was found that only Artificial Insemination (AI) method of mating was practiced for indigenous cow, whereas, for buffalo, natural services were usually resorted to. In case of local cow, both natural services and AI were practiced but the rate of adoption of AI was low (43.75%). The use of AI was more on large herds than small and medium. The system of mating was indiscriminate (unplanned) on around half of the households for cows and it was as 53.33 percent on small category. Nearly 1/3rd of the farmers were using the scrub bull, i.e., no specific breed characteristics, for natural services and their percentage was as 33.34 percent on small households (Table 1). The percentage of farmers using scrub bull was highest on small category (33.34%) and the lowest on large category (8.45%).

Table 1: Percentage distribution of households based on adoption of selected breeding practices

(1.)Breeding Practices		Small	Medium	Large	Overall
(A) Method of services					
Cow	Natural	46.25	41.23	39.33	43.75
	AI	53.75	58.77	60.67	56.25
Buffalo	Natural	69.50	66.11	65.80	66.88
	AI	30.50	33.89	34.20	33.12
(B) System of matting					
Cow	Indiscriminate	53.33	31.23	18.67	43.25
	Planned	46.67	68.77	81.33	56.25
Buffalo	Indiscriminate	28.89	5.33	2.19	20.63
	Planned	71.11	94.67	97.81	79.37
(C)Phenotype of bull used for natural services	Scrub bull	33.34	16.33	8.45	26.25
	Specific breed bull	66.36	83.67	91.55	73.75

The male calves were generally sold before one year of age due to low demand of draft power animals. Though, the rate of castration of male calves was high (79%), the methods of castration were not scientific in the study area. Majority of farmers are not going for pregnancy diagnosis. The problem of repeat breeding was observed in about 14 percent of households in either one or two animals in a year (Table 2). There were 6 percent of households in which the cases of abortion of animals was found and in most of them in later part of pregnancy (>6 months), which was very dangerous. Dairy activities in the zone were largely performed by farm women and they were not aware about the improved practices which may be the major reason behind non-scientific breeding practices.

Table 2: Other breeding practices followed by farmers

Breeding Practices	Description
Castration of male calves	21.43% non adopters
Scientific Method of castration Pregnancy diagnosis done	63.64% non adopters, 77.50% non adopters
Source of AI	66.67 Private
Gap between heat detection and insemination	35.83 before 12 hours
Case of repeat breeding	14.17
Case of Abortion	5.83

Besides these, the breeding infrastructural facilities were poor in the sample villages. Out of the four villages, the AI centre, trained inseminator, quality semen, veterinary doctor and

village panchayat bull was available in only one village and for three villages, these facilities were available about 2 to 4 km away from villages (Table 3). There was no availability of liquid nitrogen cans and medicines in any village. The village panchayat bull available in only one village was non descriptive in case of cow and of Murrah breed for buffalo. The secondary data also supports these results. The number of veterinary institutions per 10000 of livestock population in Rajasthan is 0.69, while, the all India average is 1.00 (GoI, 2012) [3].

Table 3: Availability of livestock infrastructure facilities villages

Livestock infrastructure facilities	1/4
AI center	1/4
Trained inseminator	1/4
Liquid Nitrogen Canes	1/4
Quality semen	0
Availability of doctor	1/4
Availability of Medicine	1/4
Availability of Bull	0
Breed of Panchayat bull	0

Table 4: Sustainable Dairy Breeding Index in Humid southern plain IV B zone, Rajasthan

Heard size	Value of index		
	Maximum	Minimum	Mean
Small	33.79	63.06	48.42
Medium	38.55	67.07	52.81
Large	40.32	66.40	53.36
Overall	33.79	68.07	50.93

The value of index aggregated from these practices across different herd size categories based on their implication for sustainability is presented in Table 4. Table shows that the average value of index was only around 50 and ranged from 48.42 on small category of households to 53.36 on large category (Table 4). The inter-household variability was the highest on small herds ranged from 33.79 to 63.06 and the lowest on large herds ranging from 40.32 to 66.40. Though the study area was different, similar results were also observed by Yadav (2005) [7] in his comparative study of Bihar and Haryana. A similar study carried out in Lower Gangetic Plain zone of India by Chakravarty (2006) [1] found artificial insemination moderately sustainable.

Conclusion

The study showed that the breeding practices followed by farmers in the study area are not of scientific nature to be sustainable in the longer run. The breeding practices on smaller herds which accounts majority of dairy farmers was found to be less sustainable as compared to larger herds. Inadequate availability of efficient support services was one of the major factors affecting the sustainability and hence policy needs to be focused on development of livestock infrastructural facilities in public private partnership mode. Lack of extension service and awareness about improved practices was also an important determinant of sustainability of breeding practices. Therefore, extension system needs to be strengthened and there is a need to create the awareness about improved breeding practices.

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