

Exploring Reproductive Effectiveness, Milk Delivery, and Associated Factors in Southeastern Dairy Female Cows

Dr. Kuldeep Maurya^{1*}, Garima², Adlin Jebakumari S³

¹Assistant Professor, Department of Agriculture, Sanskriti University, Mathura, Uttar Pradesh, India, Email Id- kuldeepmsoa@sanskriti.edu.in, Orcid Id- 0009-0009-3550-187X

²Assistant Professor, Department of Computer Science & Engineering, Vivekananda Global University, Jaipur, India, Email Id- garima@vgu.ac.in, Orcid Id- 0000-0002-4729-6732

³Assistant Professor, Department of Computer Science and Information Technology, Jain (Deemed to be University), Bangalore, India, Email Id- j.adlin@jainuniversity.ac.in, Orcid Id- 0000-0003-0392-4367

Abstract

The dairy industry will benefit from better management methods as a result of the findings, which will improve our knowledge of the dynamics of reproduction and production of milk. The purpose of this research is to determine an average reproduction and productive features in female Red Sindhi animals and determine whether or not these traits have an impact on the breed's milk supply. Data on productive and reproductive characteristics with 250 dairy cattle of the Sindhi breed were provided. The analysis of variance was followed by an examination of the relationships between the traits related to reproduction and those related to milk yield. The mean values for the following parameters are including, dry phase (DP), lactation period (LP), milk yield (MY), calving ages (CA), the total amount of milk yield (TMY), reproductive effectiveness (RE), ages of first calve (AFC) and calving intervals (CI). When the attributes AFC, CA, CI, RE, LP and calving ordered (CO) were divided into groups, there was no difference in MY between the groups, but there is a positive link between LP and CO. It can be determined by the dairy cows of the Red Sindhi breed had intermediate averages for MY, CI, RE and high averages for AFC.

Keywords: Red Sindhi, Breed, Milk Yield (MY), Dairy Cows, Lactation Period (LP)

INTRODUCTION

The supply chain for dairy products in Indonesia faces two significant obstacles. The first difficulty is the mismatch between demand as well as supply and the second is the poor quality of the milk that the animals are producing (1). One of the agricultural economies' fastest-growing subsectors is livestock. Food security and living are dependent on livestock production for around a billion people worldwide (2). Cattle perform a significant role in the economy, especially when it comes to foreign exchange revenues. Cattle exports include meat, drought power, manure and near-cash capital stock (3). For dairy farmers, durability is an important feature. There are several reasons why a dairy herd's profitability can increase with the longevity and increased productive existence of the cows (4). Small-scale dairy farmers get little or no money from selling milk to their neighbors. There is room for growth in that field, giving locals work and a means of subsistence. Investigations on cow nutrition as well as enhancing reproduction and productive efficiency are necessary given the growth of the dairy industry (5). Millions of people worldwide depend on cattle products for their livelihood and nutrition. Based on the location of the world, rising yields per cow, an augmentation in the quantity of cows, or a mix of both have been able to satisfy the growing demand for milk (6). The cattle industry is one of the agricultural sectors that contribute to the social, cultural and economic advancement of the rural community. The majority of livestock are cattle, which are raised in agro-ecologies (7). The native breeds are primarily used for meat, milk, cash income and insurance that has been identified as an

essential component of programs aimed at reducing poverty. Numerous methods of production are used to raise them, such as small-scale mixed crop-livestock farming along with rural and semi-pastoral grazing systems (8).

The study (9) demonstrated an average rate of morbidity and mortality due to the causes in cattle from birth to six months old. The total mortality incidence found in the research was greater when compared to economically feasible with effective administration. Dairy producers must receive training to increase their knowledge of certain simple troubles such as providing enough colostrum, scheduling timely obstetrics for challenging calving and other management techniques. The research (10) improved the knowledge of reproductive and productive outcomes of small-scale dairy farm (SDF), identifies the prevalence and factors of specific reproduction diseases that can have an impact on these outputs and evaluate the effectiveness of using gender-specific sperm and reproductive hormones to increase the fertility of these cows. These findings imply that farmers can be helped to address Infectious illnesses, limited milk production and poor reproduction in SDF by receiving instruction on bio-security measures, nutritional as well as reproductive management and bovine viral diarrhea virus (BVDV) immunization. The author (11) was involved in utilizing the simulation modeling and an attribution life cycle analysis for the evaluation of impact enhanced feed techniques, higher feed crop yields of production of milk and greenhouse gas emissions arising from cows industry. Utilizing a land footprint indicator, they estimated dairy productions direct non-CO₂ emissions along with the carbon dioxide (CO₂) emissions brought by the necessity of grasslands and croplands. The analysis showed that feed intensification can raise emissions of land use change (LUC) resulting from dairy production the yield increases that are dependent on fertilizer can equalize the rise in emission by preventing emissions from changing land used. The article (12) determined the incidence and prevalence of repeat breeding in crossed dairy cattle as well as associated risk factors. The frequency and prevalence of repeat breeders were correlated with ages, equality, body state, reproductive techniques, MY, state of management and time of insemination. Wellness, accommodation and management of reproduction need to be enhanced with the use of repeat breeders lowering number, related reproductive issues and financial fatalities that cow farms suffer as a consequence. The study (13) executed the cross-sectional investigation to identify the risk factors and the brucellosis sero-prevalence in small scale industry of cattle. To investigate the connections between Brucella serology, animals and management of farm variables, a general mixed-effects regression framework was constructed. A history of abortion and owning goats were found to be substantial predictors for brucellosis in mixed-effects models. The research (14) estimated the possible financial gain from employing the heifers with sexed semen, cattle and lactated cows in stochastic simulation model. The model calculated the financial gain, encompassing genetic gain from the total value of selection rigor. The financial benefit of this study is emphasized in relation to the baseline herd fertility status using gendered seed in a dairy farming system centered on pastures. The author (15) determined the possible risk factors, measured the occurrence of BVDV in dairy livestock and evaluated the relationship between the disease and the development of reproductive issues. Compared the cattle without the history, animals have previous instances of unconsciousness. The study sheds light on the heterogeneity in BVDV position among dairy herds, its correlation with several crucial reproductive performance characteristics and other risk factors. The article (16) objective of the multi-methods was to comprehend the advantages of milk recording for farm performance and the factors that influence its adoption on dairy farms. In dairy production, milk recording was an essential instrument that gave information about individual cows. When properly utilized, the data supports decisions about managing herd health, increasing production on the farm and prescribing antibiotics to veterinarians. The COM-B representation was utilized to synthesize the information to enhance comprehension that influences the target behavior. It found that the primary factors influencing the adoption of milk recording were education in agriculture, location and specialization of farms in cattle industry and farmer membership debate group. The study (17) provides the relationships, difficulties and possibilities surrounding the endocrine system of cattle, as well as the ways in which hormonal reproduction and other factors influence economically significant qualities, the welfare of animals and human health. Hormones control homeostasis, improve reproduction, development along with growth, health as well as the ability of cattle to

produce meat and milk products, among other significant features. The improvement of both primary and applied animal science will result from filling these gaps with transformative and translational research that feeds an expanding population. The research (18) provided the ability of a cow to mother her calves effectively was critical to the healthy growth and nutrition of the calves from birth to weaning in beef production systems. Important factors that contribute to a cow's effectiveness as a mother include the delivery of the calf, the effective passive transmission of immunity, an appropriate supply of nutrition for growth as well as defense against obvious danger and predators. It explored into the impact of prolactin on the behavior of females, the performance of their offspring and the fertility of the calf in beef cattle. Additionally, it explores the usefulness of the behavioral identification to identify maternal behavioral traits.

MATERIALS AND METHODS

Data on reproductive and production capabilities of the Red Sindhi breed, including females, were gathered from the Zebu Breeders Association (ZBA) database. Since the herds are dispersed throughout Brazil, it was not possible to measure the seasonality of rainfall and by extension, the seasonality of feed. The females in this research utilized forage as their primary food source, because of the Northeast's well-established dry season; they are unable to reach their full performance potential. A number of reproductive and productive parameters were assessed: DP, LP, MY, TMY, AFC, CO, CA, CI and RE. The MY was utilized as the variable in the analysis and several parameters, including CA (1 to 5), CI (1 to 4), AFC (1 to 6), LP (1 to 8) and RE (1 to 5) were classified.

The CI alone is the most significant feature in assessing the reproductive performance of livestock, because of its direct effect on farm profitability and the constraints placed on breeding plans. It provides the CI as an essential trait, as it affects the profitability of livestock, reducing the size of animal breeding and the intensity of selection, as a prolonged calving interval results in fewer calves that are weaned and an increase in the time between generations. $RE = (365 \text{ days} * 100) / CI \text{ (in days)}$ can therefore be computed when the RE does not exceed 100% using the calving interval (CI). AFC was calculated using 36% of the entire data, which were removed since they pertained to pluriparous females. The other 64% of the whole information was used to compute RE, DP and CI which are corresponded to single-parent female records. Evaluations were conducted on the impact of parameters. Classes are created and specified the certain traits based on the tables. To analyze the data and examine the impact of each condition of total MY, the following arithmetical framework is applied.

$$X_{jilknm} = \iota + B_j + D_i + K_l + H_i + G_n + J_m + f_{jilknm} \quad (1)$$

Where μ is the constant shared by the observations and X_{jilknm} is the observation associated with the MY (daily). K_l Represent the impact of CI in the classes. H_i , Denote the impact of RE in different classes. G_n Depict CO's impact on different classifications. AFC classes impact J_m . Each observation's random mistake is represented by f_{jilknm} .

RESULTS AND DISCUSSION

For lack of information, 150 of the 400 calving were occurred throughout the period of the examination corresponding to calving phases ranging from the first to the ninth order were disregarded. There were 250 calving left, of which 115 belonged to the second via sixth calving orders and 135 to single-parent females. As a result, calves with the first to the sixth lactation periods were included in this research. The average values of the qualities are provided in Table (1).

Table (1). Average Parameters Values (Source: Author)

Parameters	RE%	DP (days)	CA (days)	CI (days)	AFC (days)	LP (days)	TMY (kg)	MY (kg.day ⁻¹)
N	115	115	250	115	135	250	250	250

Environmental factors had a substantial influence on the AFC trait and the breeding season happened to coincide with months when there was a plentiful supply of fodder. As a result, the cows' AFC levels were lower than those of the identical breed that were raised throughout dry periods of the year. As a result, it was evident that diet had an impact on AFC. In contrast, female Zebu in tropical climates displayed slower AFC, most likely as a result of receiving forage as their only source of nutrition and receiving no additional support.

Various indications pertaining to a system or process are included in the parameters used for this evaluation. The values given indicate several characteristics, including TMY (in kg), MY (per day), DP (Days), CA (Days), CI (Days), AFC (Days), LP (Days) and RE%. The variable N, which is assumed to be a factor, has the following values, RE% = 115%, DP = 115 days, CA = 250 days, CI = 115 days, AFC = 135 days, LP = 250 days, TMY = 250 kg and MY = 250 kg/day. These numbers offer information about the technique or system in consideration of yield, duration and efficiency. Averages of the MY, LP and TMY for each class are displayed in Table (2) for MY variance between the various classes for ACF (AFC1–AFC6), CA (CA1 – CA6) and CO (CO1 – CO6).

Table (2). MY, LP and TMY averages based on the CA, AFC and CO variables (Source: Author)

Variables	N	MY (kg)	LP (days)	TMY (kg)
CA1	53	7.51	260	1,952.6
CA2	80	7.89	290	2,288.1
CA3	47	7.45	298	2,220.1
CA4	24	7.21	253	1,824.13
CA5	46	7.53	249	1,874.97
Average		7.518	270	2,031.98
AFC1	25	6.54	269	1,759.26
AFC2	15	6.12	254	1,554.48
AFC3	35	6.65	281	1,868.65
AFC4	20	6.39	255	1,629.45
AFC5	19	6.29	250	1,572.5
AFC6	21	6.40	261	1,670.4
Average		6.3983	261.666	1,675.79
CO1	75	7.45	295	2,197.75
CO2	56	7.32	287	2,100.84

CO3	41	7.27	276	2,006.52
CO4	25	7.15	254	1,816.1
CO5	15	7.06	249	1,757.94
CO6	38	7.85	281	2,205.85
Average		7.35	273.66	2,014.16

Five distinct experimental settings (designated as CA1 through CA5) were examined in this study to evaluate their effects on the development of a particular organism. The initial species (N), the LP in several days and the species in total at the conclusion of the research TMY are the parameters that are measured.

After 7.51 days of experimentation, CA1's milk yield increased to 1,952.6 kg from its initial 53 kg milk yield. During the 7.89-day experimental period, CA2 produced 2,288.1 kg of milk in total, with an average of 80 kg. The milk yield total for CA3 was 2,220.1 kg, with establishing milk in 47 kg and an experimental duration of 7.45 days. A total of 1,824.13 kg of milk yield was produced in CA4 during the 7.21-day experimental period, from an initial 24 kg of milk yield. The milk of CA5 was 46 kg at the beginning of the examination, 7.53 days during the experiment and 1,874.97 kg at the conclusion.

Five lactations of Red Sindhi cows were assessed and the impact was distinguished. Within this investigation, the average CO1 to CO5 provide 7.45 liters and 295 days, 7.32 liters and 287 days, 7.27 liters and 276 days, 7.15 liters and 254 days and 7.06 liters and 249 days. Based on these findings, the authors concluded that while there was an important variation in lactation in total number of days that is an increased production of milk and not a significant difference.

A portion of the energy in females who give birth to their first and second calves is focused on their body's growth and development, reaching peak performance after they finish their growth phase, which happens between the ages of 4 and 5. As they get older, the productive tract's organic capacity grows completely as well as nutrients are used for processes related to milk output and maintenance. It has been noted that as an animal age, there is a decrease in the number of cells that are secreted available for MY, which results in a decline in MY function.

The averages of MY, LP and TMY for each class broken down by CI, RE and LP are displayed in Table (3). Between the classes for CI1 – CI4 and RE1 – RE5, there was no difference ($P \geq 0.05$) for MY. The average MY and LP values for the class were 6.95 kg of milk, 252 days of lactation for CI1 – CI4 along with 6.998 kg of milk and 247 days of lactation of RE1 – RE5.

Table (3). Averages of MY, LP and TMY determined by the CI and RE variables (Source: Author)

Variables	N	MY (kg)	LP (days)	TMY (kg)
CI1	29.5	7.01	254	1,780.54
CI2	10.75	6.40	236	1,510.4
CI3	28	6.45	245	1,580.25
CI4	46.75	7.95	273	2,170.35
Average		6.95	252	1,760.38

RE1	13	6.57	232	1,524.24
RE2	23	7.03	241	1,694.23
RE3	20	6.72	245	1,646.4
RE4	33	7.38	268	1,977.84
RE5	26	7.29	250	1,822.5
Average		6.998	247	1,733.04

A variable reliant on CI is called RE. There was no class-specific influence on MY in our investigation. When compared numerically, the females with the longest CI and lowest RE were shown to have the highest production. This phenomenon can occur from the stimulation of the udder, which inhibits the hypothalamus's secretion of gonadotrophin-releasing hormone (GnRH), thereby inhibiting the estrus cycle and ovulation. It becomes important to remember that zebu females become weaned at approximately seven months old, however, the traditional methods used for beef cattle weaning are used for them. With a substantial relationship among CI and DP in RE of -0.91 ($P < 0.05$) in Table (4), it is evident that when DP rises, CI rises and RE falls. This resulted in a negative relationship ($r = -0.54$) between the two interdependent variables, indicating that the CI had an impact on the RE. The rise in CI was caused by the increase in DP ($r = -0.32$), which is rare to the RE.

Table (4). Significant statistical differences and the relationship between the parameters (Source: Author)

Parameters	MY	RE	DP	CI	CA	CO	AFC
LP	0.07	0.08	-0.08	-0.08	0.14	0.26	0.06
	0.1082	0.2185	0.2415	0.2415	0.0006	<0.0001	0.2833
	250	115	115	115	250	250	135
MY	----	0.03	-0.02	-0.02	0.05	0.1	-0.03
	----	0.6865	0.7596	0.7596	0.2687	0.0136	0.6292
	----	115	115	115	250	250	135
RE	----	----	-0.91	-0.91	-0.18	0.1	----
	----	----	<0.0001	<0.0001	0.0067	0.1409	0
	----	----	115	115	115	115	----
DP	----	----	----	1	0.22	-0.11	----
	----	----	----	<0.0001	0.001	0.1032	----
	----	----	----	115	115	115	----

CI	----	----	----	----	0.22	-0.11	----
	----	----	----	----	0.001	0.1032	0
	----	----	----	----	115	115	----
CA	----	----	----	----	----	0.66	1
	----	----	----	----	----	<0.0001	<0.0001
	----	----	----	----	----	250	135
CO	----	----	----	----	----	----	----
	----	----	----	----	----	----	----
	----	----	----	----	----	----	135

A correlation between CO and LP ($r=0.26$) was found by comparing reproductive and productive parameters. This correlation indicated that LP decreased when CO was lower because lactation in primiparous females is limited due to the energy requirements for growth.

DISCUSSION

Comprehensive research on the milk production and efficiency of reproduction in female cows in Southeastern States conducted, which clarifies important issues. The objective of the investigation is to understand the complex interactions that exist between various parameters, the lactation and reproductive development of dairy cows by investigating variables including ages, dietary habits along with environmental factors. To maximize herd management techniques and assure sustainable milk production, it is essential to understand the aspects of reproductive efficiency. This investigation contributes to the larger agricultural environment by assisting local growers and practitioners in putting focused ideas into practice to improve the general well-being and output of their dairy herds. This study tackles a critical intersection of issues, offering insightful information for promoting the welfare of Southern dairy cows and improving milk production processes as the dairy sector examines changing obstacles. In contrast to zebu breed averages for reproductive characteristics, it can be determined by the females of the Red Sindhi breed had a higher average of AFC as well as intermediate average for CI and RE.

CONCLUSION

Our research provided important discoveries about reproductive efficiency, milk production and related variables in dairy female cows from the Southeast. Diverse reproductive outcomes were noted, underscoring the effect of several factors on reproductive cow's performance, including health, nutrition and management techniques. There is a need for focused interventions to maximize milk production because the study population's milk delivery patterns differed. Our results underscore the complex interplay between several factors influencing production of milk and reproductive success in female cows in Southeast, proposing a comprehensive approach to management practice development. When it comes to making decisions that will improve milk yield along with reproductive efficiency in this particular geographic setting, this research is a priceless asset for producers of milk, veterinarians and legislators.

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