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Effect of non-genetic factor in milk production trait in organized dairy farms

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Abstract

This study was undertaken with the objective to characterize milk production traits dairy farm system. The study was undertaken in Pashu Pradarshan Prakshetra, (Dairy farm) Department of Animal Husbandry and Dairying Udai Pratap College, Varanasi and Dairy Farm, Bavanbigha, Varanasi. Milk production traits were monitored over three seasons; the summer, rainy and winter seasons. The study covered 6 years data collected from dairy farm, Udai Pratap College and Dairy Farm, Bavanbigha, Varanasi. In this study we have taken two class of cow herd *i.e.*, Gangatiri and Cross bred. The highest lactating animals population were 30 and 60 of F1 (Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap College, Varanasi) and F2 (Private Dairy Farm, Bavanbigha, Varanasi) respectively in winter season. In F1 farm, highest milk production were 13649.02 liter) in summer season which is higher than winter season (13558.35 liter) and rainy (12475.1 liter) whereas in F2 farm summer season has maximum production *i.e.* 32082.25, which is higher than winter (26610.75 liter) and rainy (20807.75 liter). Intensive health care and management and balanced feed & fodder required for milch animals especially in hot humid months of summer and rainy season to maximize per animal milk production which will result in increased total milk production and number of milch animals.

Keywords: Milk production, non-genetic factors, season, period, dairy farm

Introduction

It is well known fact in the history, the dairy cows have made a great contribution to the health and feeding of mankind. The value of dairy industry can be viewed from several vantage points which aid in understanding the importance of these animals and this industry. India possesses a huge livestock population and the nation derives unimaginable revenue from this industry. According to a recent estimate the country possesses 535.78 million total livestock out of which 192.49 million cattle, 109.85 million buffaloes, 74.26 million sheep, and 148.88 million goat (20th livestock census 2019). Outs of this huge animal population, buffalo's posses half of cattle population but their contribution to the milk production is more. Dairy husbandry in India also accelerated through introducing exotic breed of cattle which play a big role in milk production containing less fat per cent in milk as compared to indigenous dairy cattle. However, milk production is only 239.3 million tons per year which is comparatively low figure for country like us. Per capita availability of milk in our country is 471 g/head/day (BAHS, 2024) ^[1]. The estimated human population by the year 2030 would be around 1.525 billion. To feed this population we need a lot of effort on enhancing milk production capacity of our animals. Malnutrition is the world's number one problem. It adversely affects mental and physical development, productivity and span of life. However, malnutrition dose not arouse the sense of urgency that accompanies on outbreak of contagious diseases such as small pox. If the nutritional status of the world's hungry masses is to improve food production must be increased at an unprecedented rate. The animal product not only can contribute to the health but these can improve the socio-economic condition of the people. Foods of animal origin such as milk provide high quality protein, vitamins, minerals, and other essential dietary elements. Although, the source of animal proteins in the average diet are milk and milk products alone contribute to 77% of the total available proteins in the diet. In this context milk is nearly complete food for humans on account of the balance context of all essential nutrients *viz.*, protein, minerals, fat and

lactose. The famous nutritionist Dr. E.V. McCollum has stated here under "The people who have achieved, who have become large, strong, vigorous people, who have best trade in the world, who have an appreciation of art, literature and music, who are progressive in science and in activity in human intellect, are the people who have used liberal amount of milk production". Considering all the goodness and beneficial nutritional properties in milk, it has been recommended that for optimum nutrition, an adult human should consume 280 g of milk per day to supply a balanced assortment of amino-acid. Despite large development and massive investment especially from 1971 through the "Operation Flood" program, the annual milk production has exceeded 112 million tonnes as against the aforesaid requirement. To bridge this gap between the demand and supply, steps are needed to exploit our land and livestock resources to the fullest extent through accelerated rate in the country. India is home to 20% world cattle population and 16% of human population to be sustained and progressed on 2% of total geographical areas. Due to ever increasing population pressure of human, arable land is mainly used for food and cash crops, thus there is little chance of having good quality arable land available for fodder production, and until milk production is remunerative to the farmer as compared to other crops. The supply of feed and fodder in the year of 2016 was 619 million tonnes (green), 387 million tonnes (dry) and the demand was 491 million tonnes (green) and 619 million tonnes (dry). But the supply and demand of feed and fodder is expected to increase up to 411.3 million tonnes (green), 488 million tonnes (dry) and 1170 million tonnes (green), 650 million tonnes (dry) respectively till 2025. The concentrates available was 58 million tonnes and concentrate demand was 87 million tonnes in 2015 (Draft report of the working group on Animal Husbandry and Dairying for twelve year plan. 20012-2017, Government of India, Planning Commission. Breeding, feeding and management including disease control are the basic tools of livestock production. Milk production traits are the inherited potentiality in cows that sets the upper limit of production under the best environmental condition. The performance limit set by the animals own heredity and any best possible environment will not allow cows that individual to exceed its own genetic potential. In other words, even the most sophisticated management and feeding will fail to develop a superior herd from cows with poor inheritance. It employed, therefore, that for a successful dairy enterprise, it is imperative to have a basal stock of high productive cows and to the profit graph up word, one has to implement such step that increase the frequency of more desirable ones in future population. This can be accomplished through breeding mates who are superior and possess more desirable character. In other words, it is essential to practice the process what we call as "selection" in which certain individuals in population are preferred over others for production of next generations. Thus obviously proper selection, if followed with proper feeding and management can give us a path that will lead a better performing herd. It is now recognized that most of the economic character in animals are influenced by both the heredity and the environment. It is understood that cows which maintain high level of production over long period of time are good cows and must therefore, be retained and selected for breeding for the future herd. Such selection especially for a breeder may be misleading and erroneous, unless the environmental

conditions are taken into account. Some of the cows might be taken as superior in milk production due to extravagant specially feeding by extreme practice of milking four times a day may get selected whereas real good producer may remain inferior due to half starvation and neglected care and can thus get eliminated. Such a selection will not produce better progeny or offspring; since superiority due to environment will not be transmitted and genetic estimates will be transmitted by the parent. Consequently, selection of animal for breeding should be based on differences in performance due to heredity alone. It does not, however, mean that environment can be ignored. Environment provides an opportunity to the cow to demonstrate her inherent ability to secrete milk. About 70% of the productivity of the cow is attributable to environmental effect, which is more variable than heredity as it include a good number of factors such as disease, nutrient supply, whether effect and accidents and others which the individual may encounter from the time of conception until its deaths. As such due consideration must be given to the environmental effects, while making selection. It therefore important to increase our knowledge and understanding about the influence of various environmental factors as related to milk production in dairy cattle. In this context, while attempts as elaborated is elsewhere, have been made by different workers to collect information about the influence of season/month of calving on milk yield and other economic traits, the findings are varying greatly which make difficult to draw any conclusion. In India, being a vast country, wide differences in climate prevail amongst different months and regions. Since this variation; affects both the physiological behavior of the animals and the availability and quality of feeds in different parts of the country.

Materials and Methods

The data used for the present investigation have been obtained from the Pashu Pradarshan Prakshetra (Dairy farm) Department of Animal Husbandry and Dairying, Udai Pratap College, Varanasi and Dairy Farm, Bavanbigha, Varanasi (UP). Varanasi is located at an elevation of 80.71 metres (264.8 ft) in the centre of the Ganges valley of North India, in the Eastern part of the state of Uttar Pradesh, along the left crescent-shaped bank of the Ganges, averaging between 15 metres (50 ft) and 21 metres (70 ft) above the river.

Method of expression of various records

Farm

- Pashu Pradarshan Prakshetra (Dairy Farm), Deptt of Animal Husbandry and dairying, Udai Pratap College, Varanasi (F1)
- Private Dairy Farm, Bavanbigha, Varanasi (F2)

Season

- Rainy Season (July - October)
- Winter Season (November - February)
- Summer Season (March - June)

Period

- P1 (2010-2011)
- P2 (2012-2013)
- P3 (2014-2015)

Recording of milk

All the cows of all the dairy farm were branded for identification and record. Milk yield of each cow was weighed in kg by "salter" balance in the morning as well as evening in daily milk sheet and finally entered in the milk record register. Now it is obvious to note that the system of management followed at the dairy was standard; based on scientific pattern.

Dairy records surveyed

During the study, information pertaining to species of animals, breed of animals, number of animals, date of calving, season of calving, month of calving, lactation length in days, milk production in that lactation of each cow at both dairy farms of the Varanasi were noted and recorded

- Livestock register
- Service register
- Calving register
- Milk record register.
- Feed register.

Method of expression various records

Various attributes responsible to express the milk production are lactation length, calving interval, season of calving and month of calving, calving interval of cows and buffaloes has inherent errors or flaws.

Lactational yield

To express the lactational yield, the definition of standard lactation, adopted by the milk marketing board in England and Wales was used. It included the total quantity of milk in kilogram the fourth day after calving till the date of drying or till the 305 days which ever was earlier. However, it did not include such lactation which were less than 100 days or were incomplete due to death, transfer or sale of animals were seriously affected by illness or injury to the cow.

Average daily yield during lactation

This was calculated by dividing the total yield by the number of day, animal remained in milk.

Length of lactation

The period during which the cows secreted milk following each parturition was taken as length of lactation and expressed in days counted from the date of calving to the date of non-lactating.

Seasons

The twelve calendar months were divided into three seasons, viz., summer season, spreading from March to June, rainy season covering from July to October, and the winter season extending from November to February.

Statistical methods

To give sense out of the data collected different statistical tools were employed based on the available data obtained. The computer software Excel was used for data managing and most of the data were analyzed with SPSS version 12.1 software. Simple descriptive statistics such as mean, amount of milk produced. ANOVA (Analysis of variance): was used to test the variability of different variables among, season, period, amount of indigenous & cross bred cow and buffalo

milk produced. The observation of the above parameter noted and arranged by lateen square design (LSD) in various tables. The statistical methods as recommended by Snedecor and Cochran (1967) ^[10] and a Handbook of Agricultural Statistics recommended by Chandel, S.R.S was followed.

Result and Discussion

During the present investigation the data were collected from various dairy farms of Varanasi (UP), like Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap Autonomous College, Varanasi (F1) and Dairy Farm, Bavanbigha, Varanasi (F2).

Effect of season on milch animal population at organized dairy farms

The highest lactating animals population were 30 and 60 of F1 (Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap College, Varanasi) and F2 (Dairy Farm, Bavanbigha, Varanasi) respectively in winter season. Similarly lowest lactating animals population were 20, and 55 of F1, and F2 respectively in rainy season. Highest dry animal population were 10, and 120 of F1 and F2 in rainy season respectively as well as lowest dry animal population 7 and 120 F1, and F2, in summer season respectively. Highest Heifer animal population were 11 and 90 of F1, and F2 in summer season respectively as well as lowest heifer animal population were found 10 and 88 F1 and F2 in winter season respectively. Highest calves population were 15 and 30 of F1 and F2 in winter season respectively as well as lowest calves animal population 17 and 25 F1 and F2 in summer season respectively Table 1.

It has been found that in F1 farm animal numbers were high in summer season, it may be due to highest calving at this season whereas in F2 farm animals number were found highest in winter season and it is due to increased number of calves and dry animals. Singh *et al.*, (2015) ^[8] reported the significant effect of season on the lactation length in crossbred cattle. Choudhary *et al.*, (2019) ^[3] reported a significant effect of calving seasons on lactation length in Tharparkar cattle.

Table 1: Number of animals present at various dairy farms in different season

DF	Rainy					Winter					Summer				
	A1	A2	A3	A4	Total	A1	A2	A3	A4	Total	A1	A2	A3	A4	Total
F1	20	10	15	10	55	30	5	10	15	60	30	7	11	17	65
F2	55	120	80	40	295	60	130	88	30	308	66	120	90	25	301

F1 = Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap (UP) College, Varanasi, UP.
F2= Dairy Farm, Bavanbigha, Varanasi

A1=lactating, A2 - Dry, A3 = Heifer, A4 - Calves

Effect of periods in animal population of different dairy farms

The highest animal population in F1 was found in the period of P1 (2010-2011) i.e. 40 and in F2 farm highest number of animals were found in the period of P3 (2014-2015) i.e. 320. Whereas in F1 farm lowest animal population was found in period P2 (2012-2013) i.e. 29 and in F2 farm in P1 (2010-2011) i.e. 250 Table. 4.2. In F1 farm there were no any trends found it may be due disposal of animals whereas in F2 farm increasing trend was found.

Table 2: Number of animals present at various dairy farms in different period

DF	P1 (2010-2011)					P2 (2012-2013)					P3 (2014-2015)				
	A1	A2	A3	A4	Total	A1	A2	A3	A4	Total	A1	A2	A3	A4	Total
F1	15	5	10	10	40	20	5	4	0	29	15	5	6	5	31
F2	55	115	60	20	250	60	100	80	30	270	85	120	90	25	320

F1 = Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap (UP) College, Varanasi, UP.
F2= Dairy Farm, Bavanbigha, Varanasi

A1=lactating, A2 - Dry, A3 = Heifer, A4 - Calves

Effect of season on milk production on various dairy farms

The highest milk production was found in winter season *i.e.* 450 liter in F1 farm and 1320 liter in F2 farm. Similarly, lowest milk productions were 240 liter in F1 farm and 1100 liter in F2 farm in rainy season (table 3). These results corroborate with the results of Akcay *et al.* (2007) [11]. If we compare average milk production per animal (AMPA) winter season is suitable for milk production *i.e.* 15 liter in F1 farm and 22 liter in F2 farm. Whereas lowest milk productions were found in rainy season *i.e.* F1 farm 12 liter and F2 farm 20 liter. In F1 farm milk producing animal number was found maximum in winter and summer season *i.e.* 30 whereas in F2 farm maximum number of milking animals was found in summer season *i.e.* 66. In F1 and F2 farm minimum number of milking animal was found in rainy season *i.e.* 20 and 55 respectively. In both the farms it has been found that winter season was good for milk production whereas rainy season was not fit for maximum milk production it may be due to good fodder availability and maximum number of milking animals availability. Rybanska and Bujko (2002) [7] also showed that winter season was good for milk production. Statistical analysis revealed that season may affect significantly to per animal milk production per day.

Table 3: Milk production traits (in liter) in different seasons of various dairy farms

FA	Rainy (Per day)			Winter (per day)			Summer (per day)		
	AMPA (Liter)	TA	TMP	AMPA (Liter)	TA	TMP	AMPA (Liter)	TA	TMP
F1	12	20	240	15	30	450	11	30	330
F2	20	55	1100	22	60	1320	19	66	1254

F1 = Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap (UP) College, Varanasi, UP.
F2= Dairy Farm, Bavanbigha, Varanasi

AMPA= Average milk production of animal, TA= Total Animal, TMP= Total milk production, RTMP= Total milk production in rainy season, WTMP=Total milk production in winter season, STMP= Total milk production in summer season.

Effect of period on number of animals and their milk production of various dairy farms

The highest milk productions were 14213.2 liter in 2010-11 followed by 13759.27 liter in 2014-2015 and 11710 liter in 2012-2013 at dairy farm of Udai Pratap College, Varanasi. It might be due to uneven presence of milking animals in different period of study. Similarly in Dairy Farm, Bavanbigha, Varanasi highest milk production were found in the period of 2014-2015 (28719.8 liter) followed by in the period of 2012-2013 (25644.5 liter) and in the year of 2010-2011 (25136.50 liter) table 4.

Number of milking animals in the F1 (UP College dairy farm) were found maximum in the period of 2010-2011 (P1)

i.e. 40 followed by period P3 (2014-2014) *i.e.* 31 and period P2 (2012-2013) *i.e.* 29. Whereas Dairy Farm, Bavanbigha, Varanasi highest number of milking animals present in the period P3 (320) followed by P2 (270) and P1 (250). In UP College dairy farm (F1) milking animals were decreased from period P1 to P2, it might be due to auction of surplus animals whereas in Dairy Farm, Bavanbigha, Varanasi (F2) increasing trend was found in milking animal numbers. Statistical analysis revealed that period may affect significantly to milk production. Similar to the present finding many workers also observed significant effect of period of calving in different cattle breeds (Djemali and Berger, 1992; Musani and Meyer, 1997; Kunaka *et al.*, 2001 and Barbosa *et al.*, 2008) [4, 6, 5, 2].

Table 4: Effect of period on number of animals and milk production at various dairy farms

Farms	P1 (2010-2011)		P2 (2012-2013)		P3 (2014-2015)	
	Total Animal	Total Milk Production	Total Animal	Total Milk Production	Total Animal	Total Milk Production
F1	40	14213.2	29	11710	31	13759.27
F2	250	25136.5	270	25644.5	320	28719.8

F1 = Pashu Pradarshan Prakshetra, Department of Animal Husbandry and Dairying, Udai Pratap (UP) College, Varanasi, UP.
F2= Dairy Farm, Bavanbigha, Varanasi

Conclusion

Intensive health care and management and balanced feed & fodder required for milch animals especially in hot humid months of summer and rainy season to maximize per animal milk production which will result in increased total milk production and number of milch animals. Though out the period, milk production can be maintained by proper replacement of the herd (dairy farm) so that milking status of the farm has optimum level of production.

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