STATISTICAL ANALYSIS OF MILK PRODUCTION FOR FUTURE PLANNING WITH SPECIAL REFERENCE TO RAJASTHAN

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Abstract: Every Government department has an Official Statistics, even then the Government do not provide the data. Rajasthan has desert of 55% of total area. Livestock of Rajasthan is one of the main source of livelihood. Livestock is also a provider for food security and insurance against poverty. Livestock is the main source of protein for the population. Milk production is also an important part of livestock products. Contribution of animal husbandry sector to the GDP of the State has been estimated to be around 10.21%. About 35% of the income of small and marginal farmers come from dairy and animal husbandry. Milk production plays a prominent role for protein in routine life. The State contributed 12 percent of milk to the nation's production in the year 2016-17. Rajasthan is at second rank in production of milk in india. In this paper, best fitted regression model for production of milk is obtained by considering artificial insemination and medical facility as independent variables. By using time series data the forcasted value of milk production from year 2020 to 2030 is obtained.

Key words: Livestock, Regression analysis, Milk production, Time series analysis and Forecasting.

Cite this article

1. Introduction

The study considers livestock production in Rajasthan. The maximum number of total contribution of livestock products at current prices of total value in agriculture department. In food supply chain, animal production plays a very important role. Animals are mostly related to the rural area person because it is not only economically profitable but also needs of animal products for health. Milk production mostly depends on six factors. First factor is land size and family size of livestock farmers. The second factor is the number of different types of milky animals. Third factor is that which types of fodders are available and how many fodder feeds

by cattlemen. Fourth factor is that how many times check-up are available for milky animal's health and vaccinate of animal time to time. Fifth factor is that which types of breeding method does animal keeper use. Sixth factor is that how much knowledge and training are gained by the stock farmer about milky animals.

2.   Objectives of the Study

1.   To find out the trend of milk production and yearly variation in livestock census.
2.   To find out regression model and forecasting value of milk production.
3.   To analysis the gap between demand and supply of milk production.
4.   To find out compound annual growth rate of per capita availability of milk.
5.   To provide suggestions for improvement of milk production.

3.   Review of Literature

Abdurehman and Ameha (2018) explained the interaction between climate change and animal production. Taue et al. (2020) forecasted the cow milk production by using the time series analysis on secondary data. Singh and Banerjie (2020) have explained the minimization of feed's cost of dairy cows by applying linear programming techniques. They have also provided a development plan with some restrictions on livestock enterprises. Chakravorty and Debarun (2018) studied the current position of livestock market value and checked the impact of livestock business sector in India. Chauhan (2012) studied on livestock management and obtained that the women can only increase animal husbandry very well in rural area. His area of research was Navasari district of South Gujarat. Dostain et al. (2018) applied a time series ARIMA model and regression model on red meat production in Baluchistan (Pakistan) and found the forecasting value of red meat production in future. Gashaw et al. (2014) focused on the effects of climate change on livestock production in Ethiopia. Grigoras (2017) presented that the animal production are a branch of Romania's economy and obtained the trend analysis of animal production in the period 2007-2016 in Romania. Iqubal (2013) discussed about the livestock husbandry and environment problems. He had also given the livestock growth rate in India by using trend analysis. Macciotta et al. (2012) elucidated the relationship between milk yield, Coagulation properties in brown Swiss cows and their composition.

Patel et al. (2016) explained the contribution of women, which are much more in livestock sector and farming activities. They also explained benefits for women like decision-making, income source, self-esteem and access to credit. Shah (2016) told about significantly diversification of agriculture sector to livestock sectors in these eras. He also mentioned that livestock play an important role in income generation and employment. Soju and Meena (2017) gave the output from livestock population of Rajasthan. They had given that the cattle population are increasing or not during 1956 to 2012. Tabrez and Khan (2014) had given a geographical study of livestock in Uttar Pradesh by using secondary data of animal husbandry. Thornton (2010) established that the demand of animal products are increasing day by day in developing countries. He has obtained many factors such as urbanization, growth in income, population, and economic changes of demand for livestock products.

4. Analysis

As the need for business is increasing, animals are being seen as a business due to which the production of animals increasing rapidly. In order to increase their income, the cattle owner keeps more quantity of animals, which are giving more products or getting higher prices. Due to which the quantity of animal producer is increasing but its quality of product is decreasing.

Milk production is producing on a very large scale in Rajasthan, in which Exotic/cross breed cows, non-
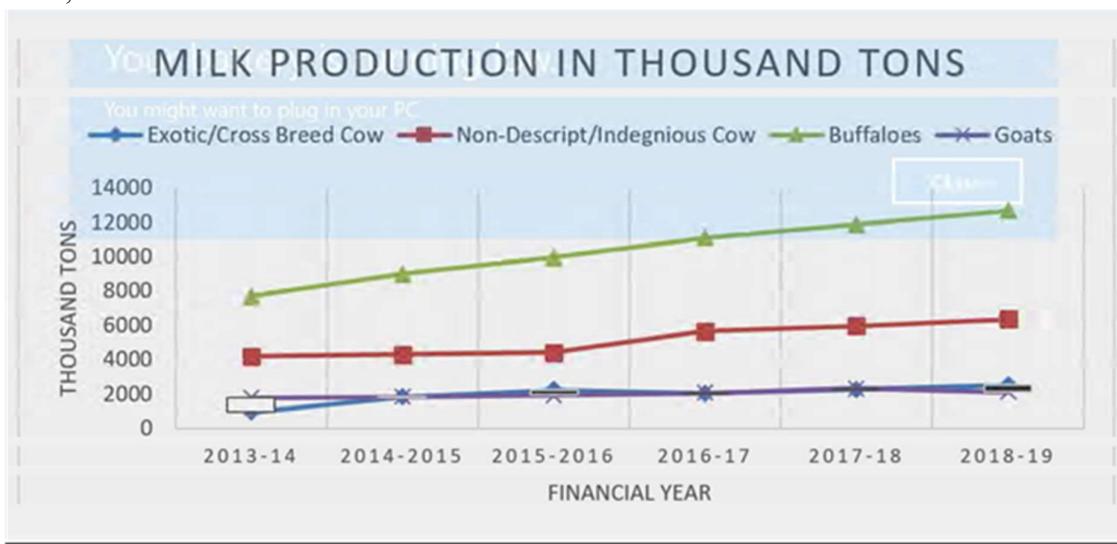
Fig. 1: Milk production in thousand tons in Rajasthan

Source: Annual report of animal husbandry department of Rajasthan

Species	Cattle	Buffaloes	Sheep	Goats
Series4 — 2019	13912457	13693316	7903857	20840203
Series3 — 2012	13324462	12976095	9079702	21665939
Series2 — 2007	12119512	11091974	11189855	21502996
Series1 — 2003	10853510	10413830	10054100	16808520
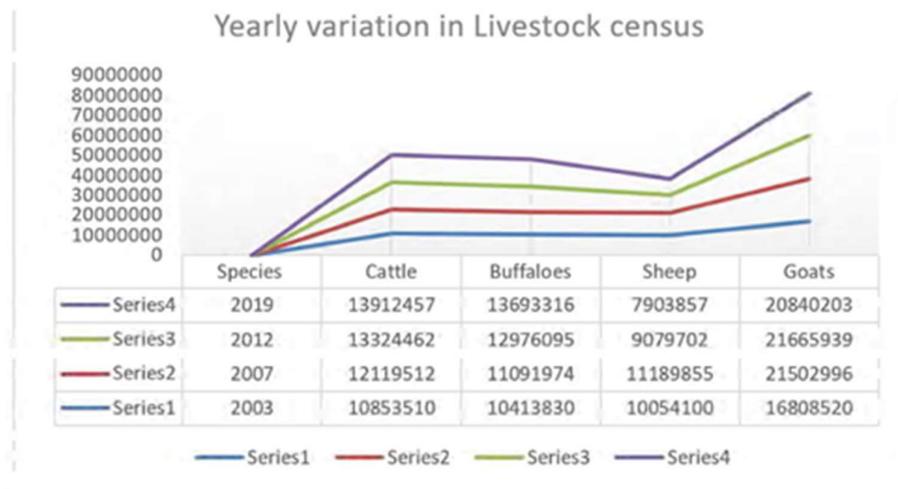
Fig. 2: Yearly variation in Livestock census in Rajasthan.

Source: Annual report of animal husbandry department of Rajasthan.

Table 1: Regression analysis of milk production of Rajasthan state.

Result	Coefficients	Standard Error	t Stat	P-value
Intercept	2548.808	6828.102	0.373	0.719
Artificial Insemination	3.693	1.897	1.947	0.087
Medical Facility	1.452	5.462	0.266	0.797
R Square		0.855		
Adjusted R Square		0.818		
F test statistics		23.6		

descript/indigenous cow, buffaloes and goat mainly contributed. The Fig. 1 shows the milk production given by different animals' form the year 2013-14 to 2018-19, in which buffaloes plays a first major role and second is indigenous cow. On the other hand, the exotic/cross breed cows and goats are not significantly contributing to enhance in milk production from year 2013-14 to 2018-19.

The cattle, buffalo, sheep, goat, camel, and pig's census data are collected from the livestock census 2019. variation in livestock census has given in Fig. 2. The number of buffaloes and cattle data showed is rapidly increasing from the census year 2003 to 2019, while the population of sheep increased from year 2003 to 2007, and then sharply declined in year 2012 to 2019. The goat population increased in year 2003, 2007 and 2012 but slightly decreased in 2019.

The secondary data on milk production from year 2013-14 to 2018-19 are used to find out the regression model in which dependent variable is milk production and other independent variables are artificial insemination, medical facility. The Table 1 shows the regression analysis of milk production from 2013-14 to 2018-19.

From Table 1, the regression model is obtained and given in the following equation.

Regression Model

$$Y = 2548.808 + 3.693*X_1 + 1.452*X_2$$

where Y is the output of milk production, X1 is artificial insemination and X2 is medical facility. The value of adjusted R square is 0.818, which shows that these two independent variables are contributing 81.8% variability in the production of milk. It is also very important to note that the variables artificial insemination is contributing much more in milk production.

The yearwise total milk production from year 2008 to 2019 are taken from annual report of animal husbandry department of Rajasthan for applying time series technique. The Fig. 3 shows the year wise trend from year 2008 to 2019 and forecasted trend from year 2021 to 2030 of milk production in Rajasthan.
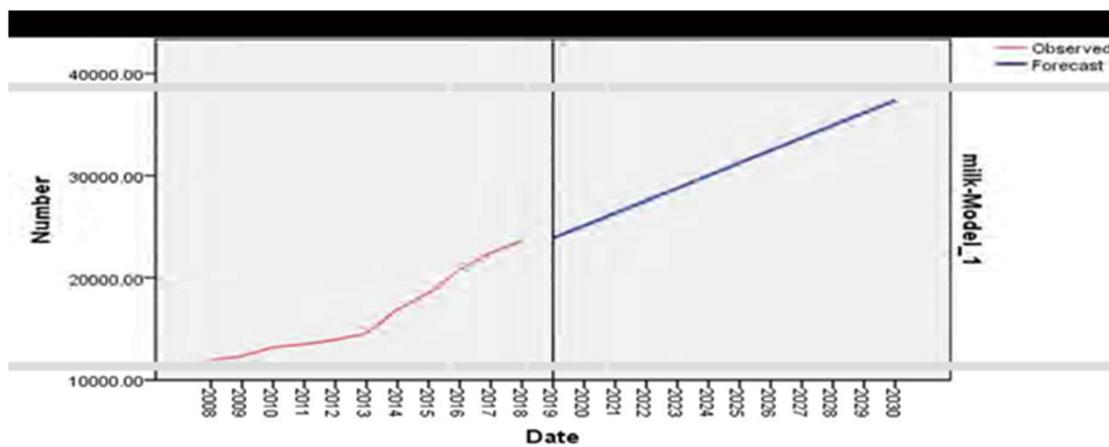
Fig. 3: Trend and Forecasted value of the milk production of Rajasthan.

Table 2: Forecasting values of the milk production from year 2021-22 to 2030-31.

Year	Predicted	95% Confidence interval	
		Lower Limit	Upper Limit
2021-22	26346.7	23701.8	28991.7
2022-23	27573.0	24928.1	30218.0
2023-24	28799.3	26154.3	31444.2
2024-25	30025.5	27380.6	32670.5
2025-26	31251.8	28606.8	33896.8
2026-27	32478.1	29833.1	35123.0
2027-28	33704.3	31059.4	36349.3
2028-29	34930.6	32285.6	37575.5
2029-30	36156.9	33511.9	38801.8
2030-31	37383.1	34738.2	40028.1

The general trend of compound annual growth rate (CAGR) is also increasing except 2011-12. It is also observed that the CAGR value is maximum in year 2014-15 as well as in year 2016-17 which shows that the production of milk in these two years have been increased drastically in comparison to previous years.

They are both significant from a statistical point of view for the regression model. In other words, the significant values of all coefficient is lower than 0.05. We also find out compound annual growth rate in percentage. Then we see that two years 2014-15 and 2016-17 CAGR are maximum in 11-year comparison. In addition, CAGR value is negligible in year 2011-12.

5. Suggestions and Recommendation Improvement in Milk Production

By considering the trend as a linear equation the forecasted value of milk production from the year 2021-22 to 2030-31 is shown in Table 2.

From Table 3, it is observed that per capita availability of milk is increasing day by day. In the year 2018-19, it is the highest 870 gm per day whereas the ICMR recommendation provides

the per capita demand 300 gm/day. It is concluded that there is a gap between demand and supply of milk production in Rajasthan, which is also increasing every year.

Compound annual growth rate formula

$$CAGR = \frac{End\ value}{Start\ value}^{\frac{1}{number\ of\ years}} - 1$$

As the breeds of animals are being improving by artificial insemination to produce more milk, the production of milk is increasing, but the quality of milk is decreasing. Milk is a very good source of protein for vegetarians.

By regression analysis, artificial insemination is a positive role in this model. Therefore, to increase milk production, the government should emphasize on increasing artificial insemination, medical facility like first grade Veterinary hospital (VHF)/ Veterinary hospital (VH) and the number of animals giving good and more quality milk.

Although Rajasthan is a second state in milk production, but Uttar Pradesh is the highest milk production state because milk production by buffaloes is 16.2 million tones whereas in Rajasthan 7.2 million

Table 3: Gap between demand and supply in milk production in Rajasthan.

Year	Per Capita Availability of Milk (In gram/day)	Gap in Demand- Supply	CAGR %
2008-09	501	201	–
2009-10	509	209	1.597
2010-11	538	238	5.697
2011-12	539	239	0.186
2012-13	555	255	2.968
2013-14	572	272	3.063
2014-15	655	355	14.510
2015-16	704	404	7.481
2016-17	785	485	11.506
2017-18	834	534	6.242
2018-19	870	570	–

tones. Therefore, the government should start a subsidy scheme for cattlemen to purchase more buffaloes in Rajasthan show that production of milk will be increase.

Due to less rain in Rajasthan and scarcity of ground water the green fodder for animals are not available in sufficient quantity, due to which the quantity of milk is not increasing. So, the alternative healthy fodder items should made available by the government at a cheaper rate to the cattlemen. Since the business of supply of milk is in the hand of unorganized sector,

therefore, the cattlemen are not getting reasonable price of milk. The government should established the milk production center at village level so that cattlemen can easily sell the milk.

The government should benefit more and more people through seminars or training related to their maintenance and source of earing good income from animal husbandry at animal fairs or other popular places. The government should provide the facilities for the health of animals at the village level by establishing mobile veterinary hospitals.

For rearing of animals the land area is decreasing everyday by encroachment so government should take a policy decision that transit land should not be occupied by anybody.

6. Conclusion

The study is conducted by the secondary data of animal husbandry. In Rajasthan, the milk production is rapidly increasing every year. It is concluded that the maximum quantity of milk is obtained from buffaloes and non-descript/indigenous cow. Year wise variation in livestock census is increasing but the rate of increasing is not so high. In the planned way, it should be increased. Line of regression is obtained and find out that milk production is affected by artificial insemination and medical facilities. Therefore, it is concluded that increasing of artificial insemination center and medical facility center will certainly enhance the production of milk. If similar condition remains same, the forecasted value of production of milk from year 2021-22 to 2030-31 is given for future planning.

The gap between demand and supply in milk production is given. In addition, find out that the per capita availability of milk in Rajasthan. It is sufficient but in these years, the number of products made from milk is also increasing due to which the demand of milk is also increasing. Therefore, the gap between demand and supply may be increasing more. The general trend of CAGR is increasing except 2011-12 and CAGR is maximum in the year 2014-15 as well as 2016-17, which show that in these two years production of milk has been increased in comparison to previous years.

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