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TREND STUDIES OF THE LIVESTOCK POPULATION VIS-A-VIS HUMAN POPULATION IN INDIA

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SUMMARY

An attempt has been made to compare trend of livestock population and human population. Apart from studying the growth pattern of populations, the position of present and projected milk supply and demand has also been discussed.

Keywords : Trend; Logistic, exponential, quadratic; supply and demand.

Introduction

India, although, possesses a large number of cows, the per capita availability of milk is very low. Mehla *et al* [1] observed that there was constant genetic degradation in Indian cows since 1951 to 1976. They also observed that ratio of milch cows to total cows was largely between 40 to 42 percent. In order to have an overview of the milk situation in the country, an attempt has been made to investigate the pattern of growth both for human and livestock populations.

Material and Methods

An investigation into the population figures of cattle since 1945 through 1977 indicated a possible stability in its size. Therefore, the following form of logistic growth curve has been fitted to total cattle population as well as to female cattle populations.

$$Y_c = \frac{K}{1 + 10^{a+bx}}$$

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Where,

Y_c : Trend value

K : asymptotic value of the population

a and b : parameters of the equation.

This curve was fitted by the method of selected points i.e. by choosing three years x_0, x_1 and x_2 equidistant from each other, one in the beginning of the period, 2nd in the middle and the last near the end. The three selected values through which the fitted curve will pass are the Y values associated with these three years designated as y_0, y_1 and y_2. The origin on the X-axis is at the year designated x_0 and n is the number of years from x_0 to x_1 or from x_1 to x_2. The three constants are obtained as follows :

$$K = \frac{2y_0y_1y_2 - y_1^2(y_0 + y_2)}{y_0y_2 - y_1^2}$$

$$a = \log\left(\frac{K - y_0}{y_0}\right), \text{ and}$$

$$b = \frac{1}{n}\log\left[\frac{y_0(k - y_1)}{y_1(k - y_0)}\right]$$

y_0 is the geometric mean of the population of the years 1945, 1951 and 1956; y_1 that of the populations of 1956, 1961 and 1966; and y_2 of 1966, 1972 and 1977. Buffalo and Goat populations indicated exponential growth. The equation of growth curve is

$$Y = AB^x$$

Where

Y : Trend values,

A and B : parameters of the equation,

X : years

For human population the quadratic equation

$Y = a + bx + cx^2$; has been fitted

Where

Y : trend value of the population

a, b and c : constants

X : years

Results and Discussion

Logistic curve has fitted very closely to all the data of cattle population. Table 1 indicates trend of total cattle population, whereas Table 2 shows

TABLE 1—CATTLE POPULATION OF INDIA UNDER DIFFERENT CENSUSES AND TREND VALUES

Year	*Cattle population in millions*	*Trend values* (Y_c)
1945 (−1)	135.76	132.11
1951 (0)	155.10	149.49
1956 (1)	158.67	169.83
1961 (2)	175.56	169.97
1966 (3)	176.18	175.07
1972 (4)	178.34	178.07
1977 (5)	180.00	180.01

$$Y_c = \frac{182.63}{1 + 10^{-0.645229 - 0.236839 4X}}$$

χ^2 (Cal.) = 1.24

χ^2 (tab.) = 9.49

TABLE 2—FEMALE CATTLE POPULATION OF INDIA UNDER DIFFERENT CENSUSES AND TREND VALUES

Year	*X*	*Population in millions*	*Trend values* (Y_c)
1945	(−1)	61.76	62.16
1951	(0)	71.30	68.17
1956	(1)	71.95	72.89
1961	(2)	78.14	76.45
1966	(3)	79.47	79.03
1972	(4)	80.57	80.85
1977	(5)	82.58	82.12
1982 (projected)	(6)		83.01

$$Y_c = \frac{84.85}{1 + 10^{-0.6115973 - 0.1738501\ X}}$$

χ^2 (Cal.) = 0.20

χ^2 (tab.) = 9.49

the trend values of female cattle population. In all the cases the trend values are very close to observed values. It is observed from Table 1 that total cattle population increased considerably upto the period of 1961 and thereafter the growth was almost stabilised. Table 2 shows that female cattle population was 61.76 million in 1945, increased to 78.14 million in 1961 and thereafter the increase was almost negligible. Trend values of female cattle population was also similar. Table 3 provides the trend values of buffalo and goat populations. It is observed that exponential growth curve is very good fit to both sets of data. Human popula-

TABLE 3–BUFFALO AND GOAT POPULATION IN INDIA UNDER DIFFERENT CENSUSES AND TREND VALUES

(In Millions)

Year	(*X*)	*Buffalo Population*	*Trend (Values Y)*	*Goat Population*	*Trend Values*
1945	(1)	40.59	40.24	46.29	45.73
1951	(2)	43.40	43.21	47.11	49.72
1956	(3)	44.91	46.41	55.44	54.06
1961	(4)	51.21	49.83	60.86	58.77
1966	(5)	52.92	53.52	64.56	63.91
1972	(6)	57.43	57.48	67.51	69.49
1977	(7)	62.02	61.72	75.62	75.56

Trend Equation for Buffaloes :

$Y = 37.472641\ (1.0738133)^X$

χ^2 (Cal.) = 0.13

χ^2 (tab.) = 10.64

Trend Equation for Goats :

$Y = 42.053292\ (1.0873193)^X$

χ^2 (Cal.) = 0.62

χ^2 (tab.) = 10.64

tion, on the other side, showed (Table 4) that quadratic is a good fit. This is perhaps due to good achievements in medicines and health care. The above discussion shows that the cattle population has become stagnant whereas the human population is increasing at an alarming rate. Obviously, if the trends of growth for both the populations do not change, the gap between the required number of cows for the increasing population would go on widening. However, buffalo and goat population showed positive growth rates during the study period. Hence rearing them more efficiently may help to bridge this gap.

The data relating to milk production from cow, buffalo and goat for the period of 1950 to 1983 are given in Table 5. It is noted that milk

TABLE 4—HUMAN POPULATION OF INDIA OVER DIFFERENT CENSUSES AND TREND VALUES

Year	*X*	*Population in millions*	*Trend Value (Y)*	*Percent decades variation*
1951	(1)	361.1	360.970	
1962	(2)	439.2	429.584	21.64
1971	(3)	548.02	547.636	24.80
1981	(4)	685	685.228	25.00

$$Y = 311.80 + 34.4520\,X + 14.72\,X^2$$

production from all sources increased marginally. From 1980 to 1983, growth of cow and goat milk was almost stagnant whereas that of buffalo milk showed a good upward trend. Cow milk production showed slower growth rate although the buffalo and goat milk showed faster growth during the period 1965-1975. Poor production of cow milk increased the demand and supply gap whereas the accelerated growth of buffalo milk helped to bridge the gap considerably.

Contribution from the cows upto 1983 has been well below 50 percent. However, the projected figure for cow milk in 1985 indicates the contribution to be 51.16 percent. National Commission on Agriculture has projected the total maximum demand of about 44200 thousand metric tonnes. According to projections made by Singh and Singh [4] this is unlikely to be achieved. Further at the present status the per capita availability of milk is only 138.4 gm and cows' contribution is only 55.2 gm. It is relevant to mention that there are about 26 million cows which produce milk. The rest of the female cattle population is simply competing with humans for food and other resources. This is perhaps due to the fact that breeding efficiency of Indian cows is very poor with the exception of certain northern states of the country. Further, dairy industry is not so well organised except in case of some western states. Majority of the cows have to feed for themselves. They survive on left overs. Management is also in most of the cases, very poor. As a result, most of the cattle population in India is either not producing or producing low quantity of milk.

Conclusions and Suggestions

keeping in view the present standards. Contribution from cows is very keeping in view the present standards. Contribution from cows is very

TABLE 5—PATTERN OF MILK PRODUCTION IN INDIA (000 metric tonnes)

Species	*Milk Production*							*Production during 1985 as projected by Singh and Singh (1985)*	*Domestic Demand as projected by NCA (1985)*
	1950	*1965*	*1975*	*1980*	*1981*	*1982*	*1983*		
Cow	7743 (44.48)	9196 (44.00)	8400 (33.35)	13000 (42.03)	13500 (39.39)	13800 (39.88)	14000 (40.06)	20117 (51.16)	—
Buffalo	9484 (52.76)	11153 (53.37)	16098 (63.91)	17000 (54.96)	18000 (54.54)	19000 (54.91)	20000 (57.22)	17952 (45.65)	—
Goat	479 (2.75)	547 (2.61)	689 (2.70)	930 (3.01)	940 (2.84)	950 (2.75)	950 (2.72)	1253 (3.19)	—
	17406	20896	25187	30930	33000	34600	34950	39324	44200*

Figures in parenthesis indicate the percentage contribution.

SOURCE : FAO Production Year books 1969, 1976, 1981 and 1983.

* : Higher side.

much below the expectations. As pointed out by Mehla [1] *et al.* the cattle population can be optimized economically if unproductive and low productive cows are replaced by productive cows. This requires the use of proven exotic germ-plasms and selection of half bred bulls by testing their progeny with improved management, followed by drastic culling. However, the culled cows will still remain a burden on the society because of socior-eligious reasons.

Buffaloes on the contrary have always contributed more than 50 percent of the total milk produced in the country. This is in spite of the fact that this animal is subjected to slaughter as well. Since buffalo population has shown positive growth rate, the prospects of both milk and meat are quite high from this animal. Contribution of goats is negligible in terms of milk production. Therefore, it is quite logical to suggest that while research efforts should be aimed at improving the productivity of cows; no stone should also be left unturned for the improvement of buffaloes.

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