Full Length Article

DEVELOPMENTAL PROSPECTIVE ANALYSIS OF LIVESTOCK POPULATION AND SUITABILITY OF GOAT FARMING IN TIRUVARUR DISTRICT OF TAMIL NADU

V. Sujatha*[1], P. Selvaraj[2], V. Leela[3], M. Ramachandran[4], V. Ranganathan[5], T.C. Balamurugan[6] and M. Kathirchelvan[7]

Farmers Training Centre
Tamil Nadu Veterinary and Animal Sciences University
Tiruvarur – 610 004

ABSTRACT

A study was planned to analyze the changes in livestock population growth rates and its trends in Tiruvarur district. Tiruvarur shares 2.94 per cent of goat and 2.1 per cent of cattle population to the respective population of Tamil Nadu. The remaining livestock species (buffalo, sheep, pig and poultry) including poultry share of Tiruvarur to states respective species population was negligible, contributing less than one per cent. Recent 20th census, evinced a positive growth rate with highest favourable growth rate of 64.65 per cent for poultry, followed by 2.3 per cent in cattle and 1.44 per cent for goat population of Tiruvarur. Negative growth rates were recorded for other species, which was found to be similar to the state population growth trend. Tiruvarur had a decrease in total livestock population and species-wise too showing negative growth rates between inter census period. Percentage population change over from the base year was 3.23% for goat whereas this was on negative trend for all other species. Analyzing the compositional share of livestock population, goat had the highest share with 53.03±2.62 per cent. All other livestock showed a decreasing trend from 16th to 20th census in Tiruvarur livestock population change. Inadequate infrastructure facilities (77.3%) topped among the five constraints analysed, followed by non-availability of feeds and fodders, mortality and environmental factors. Least constraint was found to be marketing facility. It can be concluded that increasing demand for goat meat, which fetch high remunerative price along with easy managemental practices and favorable conducive environment than other livestock, makes goat farming a highly suitable farming system for Tiruvarur.

Keywords: Tiruvarur, Livestock Census, Goat, Growth trend, Livestock Population Trend, Tamil Nadu]

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[1]*Assistant Professor, Corresponding author Email Id:drsujathavasu@gmail.com
[2]Professor and Head, Department of Veterinary Physiology, VC&RI, Namakkal
[3]Professor and Head, Department of Veterinary Physiology, MVC, Chennai
[4]Professor and Head, Department of Animal Nutrition, VC&RI, Orathanadu
[5]Professor and Head, Department of Veterinary Pharmacology, VC&RI, Orathanadu
[6]Assistant Professor, Department of Veterinary Physiology, VC&RI, Salem
[7]Associate Professor and Head, Farmers Training Centre, Tiruvarur

INTRODUCTION

Tiruvarur district was carved out of Thanjavur on 01.01.1997, which is between 10° 20' and 11° 07' North latitudes and 79° 15' and 79°45' East longitudes at a mean sea level of 10 meters altitude. This heritage district has total area of 2374 Sq.km and it is the part of the Cauvery delta zone by agroclimatic classification. About 60% of the land area of the district is covered with sandy alluvium and red soil favouring paddy cultivation. Producing more rice per hectare, three time high intensive cultivation has made the district to be the "Rice bowl of Tamil Nadu" and Paddy cultivation remains as the primary occupation of the farmers. Agriculture is purely based on the vagaries of monsoon, through canal irrigation from Cauvery River. When there is a failure of monsoon, the animal husbandry becomes the alternate occupation for livelihood of the farmers. Days are shifting from cereal based vegetarian diets to livestock produce based diets with increasing trend among young growing and youth population group (Delgado, 2005). Thus, food expenditure pattern of the society also increases the demands on livestock produce. Consequently, creating demand to intensify the livestock production in commercial mode to supply the increasing demand without shortfall.

Tiruvarur covers 1.83% of the total land area of Tamil Nadu (1.3 lakh Sq.km). Total livestock population of the district was 4.94 Lakhs in 2019, which accounts for 2.02 percent of the Tamil Nadu population which includes goat, cattle, sheep, buffalo and pig except poultry. In 2018-19, 103880 tonnes of milk which contributes from Tiruvarur to 1.24% of state's total milk production. The meat (2620 tonnes) and eggs (124.98 Lakh) produced in Tiruvarur are less than 1% of the State's production (TNAHD&F, 2020).

Previous researches on soil resources and crop plan (Kannan *et al.,* 2011), land use pattern (Mithra and Bashkaran, 2018), and soil ecosystem (Arulmozhi and Kannahi, 2021) were carried out for development of Agriculture. There is only scanty information available regarding the livestock sector of the district. Hence, this study was taken up with the following objectives, to estimate the trends and developmental changes in the livestock population of the district, and to find the highly suitable livestock species for Tiruvarur district.

MATERIALS AND METHODS

This study was planned to analyze the livestock population trend of Tiruvarur district since the inception of the district for the period of 22 years from 1997 to 2022. Livestockcensus data were collected through desk study from the reports published by the Department of Animal Husbandry, Dairying and Fisheries, India. Collected data were tabulated and then analyzed to understand the dynamics of livestock population in terms of growth rate and percentage share to Tamil Nadu livestock population. Percentage change over across the five censuses was calculated using 1997 as the base year.

Per cent change = (Current Year – Base year)X 100

Base Year

Species wise compositional change in share of the livestock population was arrived for all censuses in the study period. Analysis was done through one way ANOVA with post hoc test Tukey-kramer in Microsoft Excel (Table 2). The growth trend of major livestock species was analyzed by regression equation (Gupta, 2011) utilizing the census data from 1997 to 2019. Prediction of forthcoming census of 2023, 2027 and 2032 was carried out by modified method of Singh *et al.* (1991). Linear regression equation Y=a+bX was used, in which Y is the predicted year (X) estimated population, with b being the slope of the equation and when X=0, Y is equal to a. The prediction for goat population was done for Tiruvarur district and Tamil Nadu state with base years 1997 and 2003.

The data on constraints faced by goat farmers were collected by personal interview through questionnaire (Yes or No type) from 250 goat farmers on a random survey in the need identification programme conducted at Farmers Training Centre, Tiruvarur. Collected data were tabulated by statistical tools like frequencies and percentages to arrive logical conclusion of the constraints.

RESULTS AND DISCUSSION

As per the 20th Livestock census (Figure 1) among the major livestock species, goat population shares the largest share (59%) in Tiruvarur livestock population. Cattle constitutes for 40% whereas buffalo, sheep, and pigs represent less than 1%. Due to the small population and their roles, other livestock such as horses, donkeys, and dogs are not covered in this study.

Trends in growth pattern of Livestock and Poultry

Share of Tiruvarur livestock population to the total Tamil Nadu livestock population of the individual species was given in Figure 2. The growth rate trends between the two subsequent census periods were calculated for each livestock species population of Tiruvarur district and Tamil Nadu (Table 1).

Goat

Goat population makes up the majority of the livestock population in Tiruvarursince1997. The population increased by 33.14%from 2.82 lakhs to 3.75 lakhs between 1997 and 2003, showing the highest positive growth rate. Decreased growth rate was observed in the next two subsequent censuses at the rate of 17.09% and 7.81% between 2003–07 and 2007–12 respectively. But, twentieth census recorded a very little increase (1.44%) in growth rate.

The district goat population proportion to state's goat population (2.94%) is the highest percentage of the all-livestock species under study. Only 3.23% of the district's population increased over the period of 22years, compared to the state's 54.13%

from the base year of 1997 (Table 1). Similar to state's positive growth rate and increase in goat population, throughout India too its share seems to be increasing due to rapid growth rate of goat population and demand for lean meat (Prabu *et al.,* 2012, Behl *et al.*, 2022).

Cattle

Highest number of cattle populations was in 2003 (17th census) with 3.32 lakhs recording 28.82 percentage of increase from 1997. Positive growth rate of 1997-2003 was then continued to decline with negative growth rate of 18.84% and 23.38% in next censuses leading to a population of 1.96 Lakhs in 2012. Last census observed an increase of 2.3% than previous census. During the 22-years period (2003-2019), the cattle population share of Tiruvarur to the state has declined moderately from 2.85% to 2.1%. Despite the state's population being increased by 5.23% from 1997 cattle population, Tiruvarur showed a 22.33% decrease in cattle population.

Subhash and Kaur (2013) in Punjab and Soju and Meena (2017) in Rajasthan both reported a similar, unfavourable pattern of growth rate in cattle. Moreover, in recent years, the national growth rate for cattle has also slowed down in recent years. According to Prabu *et al*. (2012) analysis of Tamil Nadu's trend, the cattle population was declining, possibly as a result of the non-remunerative milk prices, rising urbanisation, shrinking grazing land, decreased indigenous population and expensive labour.

Buffalo and sheep

Tiruvarur district and Tamil Nadu state showed similar trends in the growth pattern of both buffalo and sheep population. Both the buffalo and sheep populations of Tiruvarur substantially declined between 1997 and 2019. Consistent negative growth rates between the censuses were noted in Tiruvarur district. Though, state buffalo's population increased between 2003 and 2007, thereafter it showed a sharp declining trend. State sheep populations rose until 2007 before seeing a sharp drop. The most significant negative trend was observed in the per cent change over of Tiruvarur buffalo population (-98.29%) during the research period. According to Oviya *et al.* (2021) 80 and 52.94 per cent of the respondents in Tamil Nadu had decreased their buffalo and sheep herd size respectively due to shrinking grazing land.

Pig

Among the Tiruvarur's livestock populations being studied, pig species numbers were found to be the least once. The number of pigs was at its peak in 2003 then decreased by 48.41 and 54.43 per cent in 18th and 20th census respectively before reaching its lowest level of 551 pigs in 2019. Pigs like sheep and buffalo, do not contribute even 1% of the state's population. Tiruvarur pig population fluctuated, although the entire states pig population declined and reached a new low in 2019. Tiruvarur pig population's percentage share has increased slightly from

0.64 to 0.83 per cent indicating a modest divergence in trend between the state and district pig populations.

Total livestock population trend

Overall, the number of livestock and its share in Tiruvarur declined steadily from 7.41 lakhs in 1997 to 4.9 lakhs in 2012, and it ended with a little gain of 0.77% and ended with 4.94 lakhs in 2019.Tiruvarur livestock percentage share of the state's population fell from 2.61 per cent in 1997 to 2.02 per cent in 2019, representing an overall decline of -21.35% while the state's population increased by 1.76% during the same period.

Poultry

Tiruvarur poultry numbers were continuously decreasing from 5.35 to 2.25 lakhs between 1997 and 2012. But during recent years 64.65 per cent (2012-19) increase was noted with more of desi-fowls. Tamil Nadu registered a rapid increase in poultry population of over 137.61% and 51.58% between 1997-03 and 2003-07 respectively. A negative growth rate of 10.59% between 2007 and 2012 was noted. 20th censuses ended with an increase of 2.92% growth rate during 2012-19. Tamil Nadu tops the nation in 2019 (20th livestock census) and holds 35 % share of India's poultry population. Reasons attributed for this positive and higher growth rate in state includes introduction of high yielding layers and broilers, good quality chicks, good infrastructure facilities, veterinary health care and services, good managemental practices, updated knowledge on par with global level, proper pricing mechanism, changes in lifestyle preferring for lean meat and quick returns.

Tiruvarur poultry population does not contribute to even a one per cent share to Tamil Nadu population. It shows that commercial poultry rearing has still not geared up in the district. The positive trend noticed in last 2019 census because of increase in backyard native chicken due to initiatives taken by state Government (Animal Husbandry Policy note, 2022).

Changes in the composition of livestock population of Tiruvarur

To determine the hierarchy of the livestock population, the changes in the composition of livestock species, census wise was tabulated in Table2. Changes in composition mean that variation of a livestock species in each census and their shares in the total population. This study revealed that the average goat population share to total Tiruvarur livestock population was 53.03±2.62 per cent. It was found that goat population remained significantly higher than the other livestock populations in Tiruvarur. There was persistent increase in goat population share of Tiruvarur district from 2003 to 2019. Goat population showed positive growth trends in Tamil Nadu and India might be due to increasing demand for lean meat, chevon by the consumers (Prabu *et al*., 2012; Sonavale *et al*., 2020). Cattle population share of Tiruvaur across the census averaged 42.31±1.14%, which has second highest significant share in livestock composition with undulating trends.

During the study period cattle topped the Tamil Nadu's livestock compositional share, contributing on an average of 37.68±0.51% followed by goat (33.18±2.35) at second majority and at third place by sheep population (21.95±1.23%) significantly contributing for the state's population. Buffalo share was less than 10% (6.02 ±1.6%) and least contribution of 1.16±0.38% by pig population for Tamil Nadu total population.

A consistent decreasing trend in the share of other livestock species composition of Tiruvarur was noted that contributing on an average of 3.15±2.08%, 1.25±0.35% and 0.27±0.07% by buffalo, sheep with pig populations. There was no significant difference between buffalo, sheep and pig population share at both district and state level. Due to slow growth rate, bovine and sheep population share to total livestock composition was found to be declining in India (Sonavale *et al*., 2020).

Prediction of future growth trend in goat population

Goat population prediction (Table 3) revealed that Tamil Nadu population was increasing while Tiruvarur goat population has declining trend. Similarly, Behl *et al*. (2022) also estimated goat population trend of India for subsequent census to be carried out and found to be having increasing trend for the years 2023, 2027 and 2031. Hence, a detailed constraint analysis for Tiruvarur district was needed to frame appropriate policies and schemes to increase the livestock population of the region.

Constraints vs Suitability for Goat farming

To find the factors determining the present livestock population trend in Tiruvarur, a questionnaire was prepared. Major five constraints of the goat farming were taken for the study. Each constraint was with four sub-factors (Table 4). The response of the goat farmers (N=250) having the constraints were recorded as frequencies in Table 4.

a. Inadequate infrastructure facilities

Majority of the livestock rearing farmers have not increased their animal numbers, because of the non-availability of labours (88.4%) and they devote much of their time in crop agriculture. Hence, they cannot spend much time towards their livestock rearing (84%), 77.6 percent of the farmers accepted that they have limited land area for fodder production and 59.2 percent of the farmers said that cost of construction of permanent livestock houses are high.

Tiruvarur has sandy alluvium and red soil covered for 60% of the land which are favourable for paddy cultivation. Cauvery Delta Zone agrarian community has more than 75% small farmers with land holdings of less than a hectare. Paddy cultivation is a labour intensive work, where much mechanization is required (Cauvery Delta Sub Basin, 2011). Since, the mechanization in small land holdings would not be economical, when farmers are in paddy cultivation season; they spend most of their time in paddy cultivation. Milch animals require a fixed time work throughout the year, which will not be feasible for the farmers

engaged in higher intensive paddy cultivation. Similarly, inadequate infrastructural constraint was also faced by the goat farmers of Mewar district (Gujar and Pathodiya, 2008). Similarly infrastructure facilities like land and time to get trained constraints were reported by Ravikumar and Kumaravel (2017) and Kumar *et al*. (2020).

Advantages of Goat farming: Goat management requires less time in cleaning with housing pattern has slatted flooring. Controlled seasonal breeding by selling their bucks in hard seasons and breeding during comfort zone to get kidding during the lush pasture season was practiced by farmers. Hence, it is easy for the farmers to devote and manage the goats. Thus, goat farming was becoming popular and integral part of the livestock rearing in this region.

b. Adverse environmental factors

The most unsuitable environmental factor that affected the livestock of the farmers was water logging and flood (77.6%), the other climatic factors have affected only 21-32 % of the farmers. North-East monsoon which brings more rain around 700 mm of rainfall is generally associated with cyclones. This North east monsoon has failed during 2002, 2003, 2012, 2019, 2017 and 2018 and caused drought in Tiruvarur (Kokilavani *et al*., 2021). Drought and reduced rainfall have a direct impact on grazing pastures and its expansion (Nardone *et al*., 2010).

Floods and drainage are a complex problem in Tiruvarur. A sudden heavy rainfall or flow from the upper position of Cauvery delta or a heavy shower leaves making draining into sea difficult. Low lying areas have stagnation of water for 7 to 15 days in the rainy months, which destroy not only standing paddy crops but also fodders like Hybrid cumbu-napier varieties etc., easily and in turn affecting the livestock farming.

Advantages of Goat farming: Marginal or undulating grazing lands were unsuitable for most of livestock species. But small ruminants can easily thrive on tree fodder that is grown on the borders as bio-fencing like *Glyricidia*. To escape from stagnated water in flooding areas, a wide type of housing system for goats with a use of simple wood logs to highly organised slatted flooring can be constructed.

c. Non-availability of grazing land

Fodder availability restricted the farmers (71.8%) from increasing the stock density in the farm. In the villages, animals should not be allowed for grazing during paddy cultivation time. Hence, during this period farmers have to depend on cultivated fodder. During rainy season too, animals cannot not be let out for grazing. Thus, increase in crop agriculture simultaneously decreases the relative grazing area. Non-availability of grazing land and fodder remains a second major constraint for Animal Husbandry activities (Table 4).

Tiruvarur has a largest net cultivable land area of about 64.9 per cent under paddy cultivation and producing largest share of tonnes of paddy grains in the state. Area under paddy cultivation in Tiruvarur remains

the largest area of land among the districts of Tamil Nadu. Area of 1.86 and 1.92 hectares with production of 7.9 and 8.52 tonnes rice respectively was recorded (Kumar and Manimannan, 2014; Vasanthakumar, 2017). Hence, Tiruvarur can be rightly called as Rice Bowl of Tamil Nadu. In the state, Tiruvarur has the lowest forest cover area of 3.08 per cent of the geographical area of the district. Only 14-15 per cent is under permanent pastures and other grazing land including current fallows, miscellaneous tree crops and groves which are not included in the net sown area. Oviya *et al.* (2021) also reported that extensive system of rearing for all the species has been reduced in Tamil Nadu and farmers were shifting for semi-intensive system of livestock rearing due to reduction in grazing land. Non-availability of grazing area and fodder topped the constraint rank list among small ruminant farmers of Rajasthan (Gujar and Pathodiya, 2008; Choudhary *et al*., 2018).

Advantages of Goat farming: Goats are hardy animals that adapt to wide variety of feeding practices. They are browsers and opportunistic grazers. They can adapt to harsh climatic condition and able to thrive on hard drought conditions, better utilizing the poor quality fodder resources (Sejian *et al*., 2021).

d. Mortality of animals

The prevalence of abrupt death in their goat flocks was recorded by 60.3% of the farmers. Primary challenge faced by goat farmers in the Tiruvarur area was nursing kid mortality, which was observed to be 92% from the respondents. Mortality rates for the adult doe, buck, and yearling groups were then 70%, 45.6%, and 33.6%, respectively. Sangameswaran and Prasad (2016) reported a similar high death rate in Salem district does and kids. Since, twinning and triplets are very common among the does farmers continue to get an average of 3-5 kids per annum. But, farmers lose up to 40-50% of their kids before the age of five months. Hence, kid mortality was the economically important issue to be offered.

According to Ravikumar and Kumaravel (2017), the most priority constraint (69.1%) experienced by goat farmers of Salem and Tiruchirappalli districts in Tamil Nadu were the high cost of medicines and treatments. Tanwar (2011), Rajkumar and Kavithaa (2014), Abd-Allah *et al*. (2019) and Kumar *et al*. (2020) revealed similar high health issue constraints in goat farms of Rajasthan, Tamil Nadu, Nile, and Uttar Pradesh, respectively. Therefore, untreated animals or a lack of timely veterinary care were the main causes of high mortality. To raise the goat number of Tiruvarur, a thorough analysis of the causes of mortality must be conducted.

e. Lack of marketing opportunities

Marketing remained a least (11.1%) constraint faced by the goat farmers. Farmers are able to sell their goats as and when they require financial support for their family. Yearling goats have wide marketable age as per the need and preference of the farmer and consumer, they are sold. Generally male kids are sold at their marketable age, whereas female's kids were retained for breeding.

Table 1. Livestock population trends in Tiruvarur District from the year 1997-2019

Species	Area	Livestock census (Lakhs)					Percentage change in population* (%)				Percentage change over the base population (1997 to 2019)
		16th (1997)	17th (2003)	18th (2007)	19th (2012)	20th (2019)	Between 1997 and 2003	Between 2003 and 2007	Between 2007 and 2012	Between 2012 and 2019	
Goat	**Tiruvarur**	**2.82**	**3.75**	**3.11**	**2.87**	**2.90**	**33.14**	**-17.09**	**-7.81**	**1.44**	**3.23**
	TN	64.16	81.77	92.74	81.43	98.88	27.45	13.42	-12.2	21.43	54.13
Cattle	**Tiruvarur**	**2.58**	**3.32**	**2.69**	**1.96**	**2.00**	**28.82**	**-18.84**	**-27.38**	**2.3**	**-22.33**
	TN	90.46	91.41	111.88	88.14	95.18	1.05	22.4	-21.22	7.99	5.23
Buffalo	**Tiruvarur**	**0.71**	**0.018**	**0.08**	**0.02**	**0.01**	**-74.31**	**-58.08**	**-72.99**	**-41.45**	**-98.29**
	TN	27.41	16.50	20.09	7.80	5.19	-39.79	21.73	-61.2	-33.52	-81.07
Sheep	**Tiruvarur**	**0.14**	**0.13**	**0.06**	**0.04**	**0.01**	**-6.70**	**-55.62**	**-21.94**	**-72.14**	**-90.99**
	TN	52.5	55.93	79.90	47.87	45.00	6.36	42.86	-40.1	-5.98	-14.42
Pig	**Tiruvarur**	**0.034**	**0.02**	**0.01**	**0.012**	**0.005**	**-40.15**	**-48.41**	**14.49**	**-54.43**	**-83.89**
	TN	6.09	3.21	2.84	1.82	0.67	-47.31	-11.39	-35.3	-63.26	-89.04
Total Livestock population	**Tiruvarur**	6.28 (2.61)	7.41 (2.98)	5.95 (1.94)	4.90 (2.16)	4.94 (2.02)	**18.02**	**-19.74**	**-17.61**	**0.77**	**-21.35**
	TN	240.71	248.83	307.47	227.06	244.93	3.37	23.57	-26.15	7.87	1.76
Poultry	**Tiruvarur**	**5.35**	**3.39**	**3.11**	**2.25**	**3.70**	**-36.55**	**-8.18**	**-27.72**	**64.65**	**-30.66**
	TN	365.11	865.91	1510.30	1173.48	1207.81	137.61	51.58	-10.59	2.92	230.81

* To study the percentage change over the base year 1997 taken us the base year census

The decline from the base year census is indicated by ("-") Sign and Figures in the parentheses indicate percentage share of Tiruvarur to Tamil Nadu (TN) state livestock population..

Table 2. Changes in composition of the livestock population of Tiruvarur and Tamil Nadu (in percentage)

Species / Year	Goat		Cattle		Buffalo		Sheep		Pig	
	TVR	TN	**TVR**	TN	**TVR**	TN	**TVR**	TN	**TVR**	TN
1997	**44.85**	26.65	**41.02**	37.58	**11.33**	11.38	**2.26**	21.84	**0.54**	2.53
2003	**50.65**	32.86	**44.82**	36.74	**2.47**	6.63	**1.79**	22.48	**0.28**	1.29
2007	**52.27**	30.16	**45.28**	36.39	**1.29**	6.53	**0.99**	25.99	**0.18**	0.92
2012	**58.49**	35.86	**39.91**	38.82	**0.42**	3.44	**0.94**	21.08	**0.25**	0.80
2019	**58.87**	40.37	**40.51**	38.86	**0.25**	2.12	**0.26**	18.37	**0.11**	0.27
Average (mean±S.E)	**53.03^{a} ±2.62**	33.18^{A} ±2.35	**42.31^{b} ±1.14**	37.68^{A} ±0.51	**3.15^{c} ±2.08**	6.02^{B} ±1.6	**1.25^{c} ±0.35**	21.95^{B} ±1.23	**0.27^{c} ±0.07**	1.16^{C} ±0.38

TVR – Tiruvarur and TN – Tamil Nadu; S.E –Standard error

a,b,c superscript for difference in mean between Tiruvarur district species groups

A,B,C superscript for difference in mean between Tamil Nadu species groups

Table 3. Goat population trend prediction for Tiruvarur district and T amil Nadu state (in nos.)

Year	Prediction with Base year 1997		Prediction with Base year 2003	
	Tamil Nadu	**Tiruvarur District**	**Tamil Nadu**	**Tiruvarur District**
2023	**10412243**	**291764**	**10412243**	**253980**
2027	**10940095**	**287222**	**10940095**	**234808**
2032	**11599910**	**281545**	**11599910**	**210843**
Equations and R^2	**y = 1,31,963x - 25,65,48,906 R^2 = 1**	**y = -1,135.46x + 25,88,799.75 R^2 = 0.06**	**y = 79,500.3940x - 15,09,44,644.3800 R^2 = 0.4084**	**y = -4793x + 9950219 R^2 = 1**

Table 4. Constraints faced by Goat farmers of Tiruvarur District

S. No.	Constraints	Frequency (f) of Respondents (n=250)	Percentage of Respondents (%)	Average (%)
a	**Inadequate Infrastructure facilities**			
	Limited land for farm expansion	194	77.6	**77.3**
	High cost for construction of Housing	148	59.2	
	Shrinking oflabour availability	221	88.4	
	Lower Man hours	210	84	
b	**Adverse Environmental Factors**			
	Draught	76	30.4	**40.2**
	Flood or water logging	194	77.6	
	Cyclone	78	31.2	
	Summer Adverse effects	54	21.6	
c	**Non-availability of Grazing land**			
	Limited land for fodder production	188	75.2	**71.8**
	Lower fodder yield during Summer	96	38.4	
	Lower fodder cultivable area during Cropping Season	218	87.2	
	Lower fodder availability during rainy season	216	86.4	
d	**Mortality of animals**			
	Adult Male bucks	114	45.6	**60.3**
	Adult Female does	175	70	
	Yearling goats (both sexes)	84	33.6	
	Nursing Kids	230	92	
e	**Lack of Marketing opportunities**			
	Fair pricing for goat	48	19.2	**11.1**
	Non-marketable	12	4.8	
	Only Seasonal sale for goat meat	15	6	
	Middle man exploitation	36	14.4	

Table 5. Conducive factors favouring for goat farming in Tiruvarur

Sl. No.	Tiruvarur district features	Available resources	Advantages of Goat Farming
1.	Agrarian community - primary paddy cultivation	• Small Land holdings • Family labour	• Easy Managemental Practices • Need less time compared to other livestock
2.	Inundation and water stagnation for 5-7 days during monoon seasons	• water stagnation -Destroys grass fodders	• Goat are opportunistic feeders • Can thrive on Tress fodders
		• Water logging	• wood logs for housing • slatted floor housing system
		• Transportation difficulty	• Any time sale • Wide marketable age
3.	Occupation – majority agriculture daily wages	• No-work during Rain fed / Draught • Non-Fishing Seasons	• Alternate employment with in small area for landless farmers • Goat are hardy animals can thrive in harsh climates

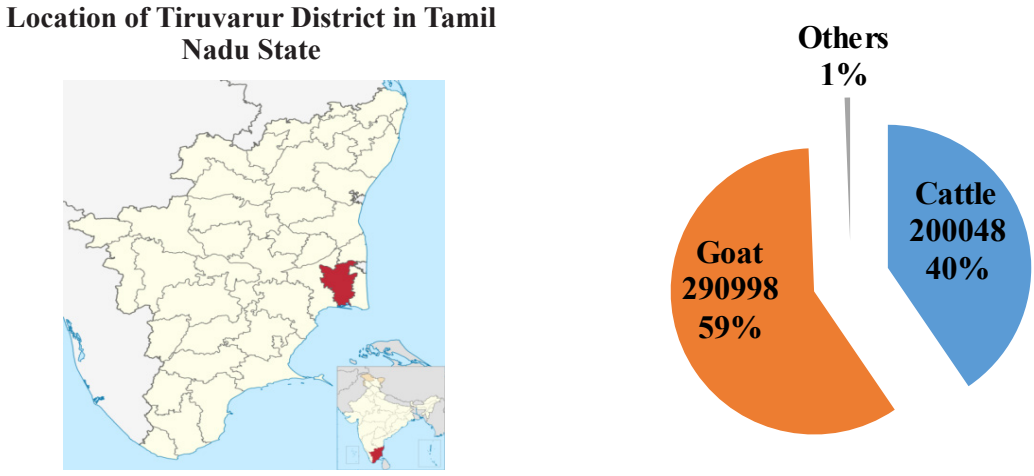
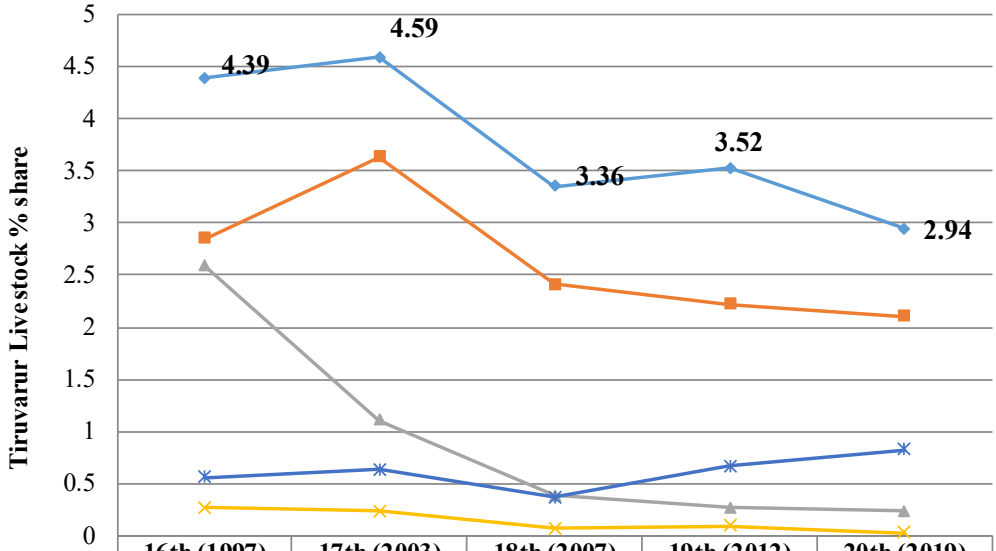


Fig. 1. Tiruvarur Livestock population (2019) share of major species



	16th (1997)	17th (2003)	18th (2007)	19th (2012)	20th (2019)
Goat	4.39	4.59	3.36	3.52	2.94
Cattle	2.85	3.63	2.41	2.22	2.10
Buffalo	2.59	1.11	0.38	0.27	0.23
Sheep	0.27	0.24	0.07	0.10	0.03
Pig	0.56	0.64	0.37	0.67	0.83

Fig. 2. Species wise share of Tiruvarur Livestock population to respective Tamil Nadu Livestock Population

Kumar *et al*. (2020) also reported similar low marketing difficulties. On the contradictory marketing constraints was found to be more than 50 % among the constraints faced by goat farmers in the earlier studies reported by Tanwar (2011), Rajkumar and Kavithaa (2014) and Ravikumar and Kumaravel (2017).

Advantages of Goat marketing: Farmers market their goats as ATMS or mobile banks to fulfil their basic requirements. Goats were their resource which fetched them money during the COVID crisis for livelihood. Thus goat farming remains highly suitable primary occupation from animal husbandry sector in Tiruvarur.

CONCLUSION

The results of this study showed that from 1997 to 2019, the overall livestock population in Tiruvarur substantially decreased. Growth trend analysis of Tiruvarur district along with Tamil Nadu state population revealed that all livestock species had negative growth rate and decreased percentage share to state population except goat. From Livestock compositional share analysis, it can be observed that goat constitute the majority of total livestock population followed by cattle whereas other livestock species are less than 10%. This growth trend analysis will be useful for effective planning by the policy makers, extension functionaries and research professional for development of animal husbandry sector in this region. It could be concluded from the constraint analysis study that goat is the highly suitable species for profitable farming in Tiruvarur district (Table 5). In drought and flood prone areas, risk of goat farming is very much less as compared to other livestock species. Addressing the major issues like kid mortality, fodder scarcity and credit facility for climate resilient housing system will motivate the rural youth farmers to practice goat farming as primary occupation. Development of area specific package of practices for goat farming, dissemination of newer scientific technologies and massive awareness programmes and skill development trainings through existing extension functionaries will enrich the skills of goat farmers to adopt the commercial goat farming and novel marketing practices to ensure the doubling in their income from the animal husbandry sector.

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