Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6[7] June 2017: 106-110

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Developing Dairy Zones Based on Natural Resources Endowment - A Multivariate Approach

Vinoth Kumar G.D*,A.Serma Saravana Pandian, and R.Kiruthiga
Department of Animal Husbandry Economics
Madras Veterinary College
TANUVAS, Chennai-600 007
*Corresponding author: vinoth.govindh@gmail.com

ABSTRACT
A study was attempt designed to segment milk production in the state of Tamil Nadu into homogenous milk zones. By applying multidimensional scaling method, the state of Tamil Nadu was segmented into four homogenous milk zones based on the resource endowment of the districts favourable for dairy development.The results of multidimensional scaling zone I comprises twelve districtsviz.,Thoothukudi, Tirunelveli, Virudhunagar, Sivagangai, Ramanathpuram, Kanyakumari Nilagiri,Theni, Dindigul, Karur, Erode, Tiruppur, and Coimbatore classified in the first carved groups.In the zone II there were eleven districts which includesDharmapuri, Salem, Namakkal, Krishnagiri, Vellore, Kanchipuram, Thiruvallur Thiruchirappalli, Ariyalur, Perambular, Pudukottai and Madurai districts.In the zone III there were six districts Villupuram, Thiruvannamalai, Thanjavur, Thiruvarur , Cuddalore and Nagapattinam districts. The multiple discriminant function analysis was used to check whether the groups of districts (zones) are homogenous or not. The results showed that the first function has the highest percentage of variance (94.1%) and eigen value (7.175), followed by the second function (5.9 %) variance and (0.451) eigen value whereas the both functions have explained 100 percent variation on zones of discriminant function analysis. From the function, it could inferred to explain the estimated discriminant function have effectively discriminated the districts in all three zones and the district in each three zones were homogenous nature.
Keywords : *Dairy zones – resources endowment - Segmenting*

Received 01.03.2017 Revised 15.04.2017 Accepted 18.05.2017

INTRODUCTION

Among the many livestock enterprises, dairying is the most easiest occupation established in the rural setting of our country. Since it develops as part of an integrated agricultural system where dairy and agriculture complement each other. Dairy husbandry provides draught power, manure and cash income and augments the crop production. It is increasingly recognized that dairying could play a more constructive role in promoting rural welfare and reducing poverty. Dairy farming as visualized by the farmers in Tamil Nadu state is part of an integrated agricultural system where dairy and agriculture complement each other [3]. Tamil Nadu, is the Southernmost state of India which is one of the top ten milk producing states in the country with an annual milk production of 7.13 million tonnes [1].This result indicates from the Integrated sample survey, that the per capita availability of milk per person 259gms/day in Tamil Nadu. To increase the milk production for this effective planning and policy making for the development of dairy sector in a state could be brought about by studying the factors associated with the state and factors are often interdependent of each other. To identify the factors which are most related to increase the milk production among the each districts. Keeping these facts in mind the present study was designed to segment milk production in the state of Tamil Nadu into homogenous milk zones.

MATERIAL AND METHODS

The data for the study are collected from the secondary sources like the reports of Directorate of Economics and Statistics and Directorate of Veterinary Services, Government of Tamil Nadu,Chennai. Multidimensional scaling (MDS) is an important multivariate analytical tool for the purpose of grouping.

By applying multidimensional scaling method, the state of Tamil Nadu was segmented into four homogenous milk zones based on the resource endowment of the districts favorable for dairy development. The goal of the analysis is to detect meaningful underlying dimensions that allow the researcher to explain observed similarities or dissimilarities among the investigated objects [2]. MDS is a procedure to "rearrange" objects in an efficient manner, so as to arrive at a configuration that best approximates the observed distances. It actually moves objects around in the space defined by the requested number of dimensions, and checks how well the distances between objects can be reproduced by the new configuration. In more technical terms, it uses a function minimization algorithm that evaluates different configurations with the goal of maximizing the goodness-of-fit or minimizing "lack of fit". The most common measure that is used to evaluate how well a particular configuration reproduces the observed distance matrix is the stress measure.

The raw stress value Phi of a configuration is defined by:

$$\Phi = \delta\ [d_{ij}-f(\delta_{ij})]2$$

In this formula, d_{ij} stands for the reproduced distances, given the respective number of dimensions, and δ_{ij} (delta $_{ij}$) stands for the input data. The expression $f(\delta_{ij})$ indicates a non-metric, monotone transformation of the observed input data.

Thus, it will attempt to reproduce the general rank ordering of distances between the objects in the analysis. Smaller the stress value, the better is the fit of the reproduced distance matrix to the observed distance matrix [3]. The interpretation of dimensions usually represents the final step of the analysis. As mentioned earlier, the actual orientation of the axes from the MDS analysis are arbitrary, and can be rotated in any direction. Two dimensional solutions can be illustrated graphically.

Discriminant function analysis

By applying discriminant function analysis was used to determine which variables discriminant between two or more mutually occurring groups and to check whether the groups are homogeneous or not. [2]. Then multiple discriminant function analysis was used to check whether the groups of districts (zones) are homogenous or not. When there are more than two groups, then we can estimate more than one discriminant function, which could be called as Discriminant functions for multiple groups.

The result has given 'b' regression co-efficient for each variable in each discriminant function, and they can be interpreted as, larger the standardized co-efficient, the greater is the contribution of the respective variable to the discrimination between groups.

Discriminant function analysis is computationally very similar to MANOVA (Multivariate Analysis of Variance). It was assumed that the data (for the variables) represent a sample from a multi-variate normal distribution. It is assumed that the variance/ co-variance matrices of variables are homogeneous across groups. Another assumption of discriminant function analysis is that the variables that are used to discriminate between groups are not completely redundant.

The linear discriminant function used for the study is of the following form.

$Z = b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots + b_i X_i$ (i = 1, 2, 3…..17)

where

Z = Total discriminant score

X_1 = Variables

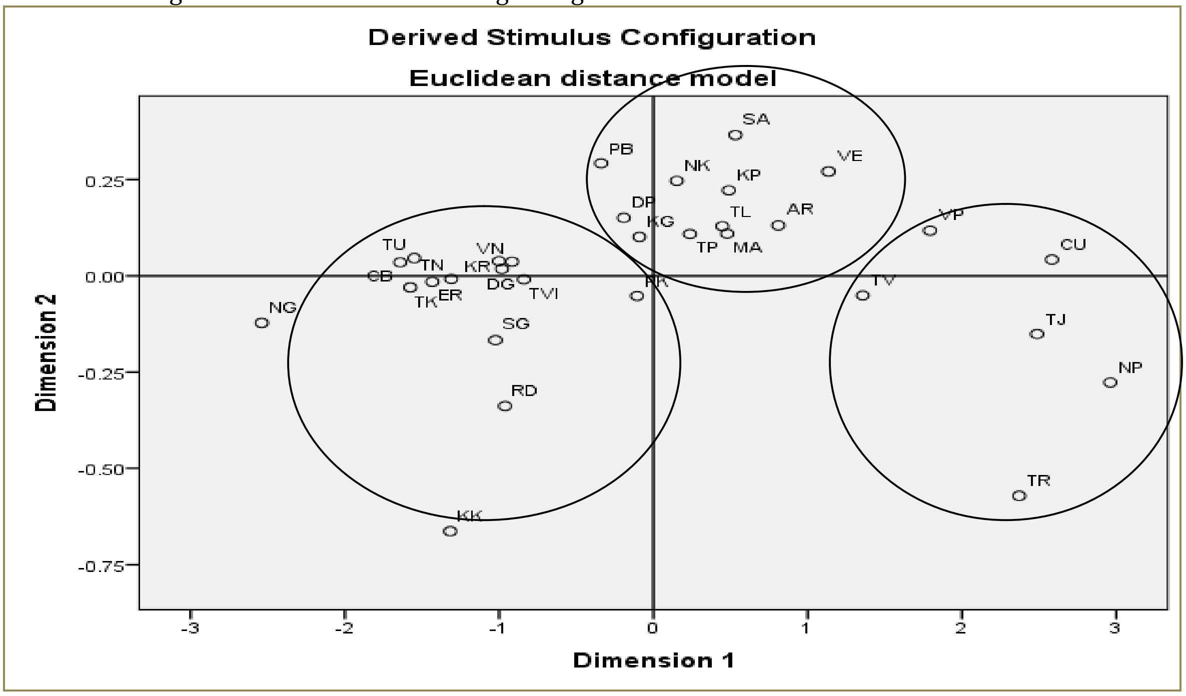
The variables refer to the 13 numbers of dairy related variables which were used in analysing. (X_1 – Milk production ……… X_{17} -Average annual rainfall).The data for the selected variables were tabulated and was run using, IBM SPSS 20.0 for windows, a computer package for the statistical analysis in social sciences.

List of Resources Variables taken for analyses

1.	Milk Production per 100 sq.km of the district (in '000 tonnes)
2.	Indigenous cattle population per 100 sq.km (in numbers)
3.	Cross bred and Exotic cattle population per 100 sq.km (in numbers)
4.	She-Buffalo population per 100 sq.km (in numbers)
5.	Veterinary Institution per 100 sq.km (in numbers)
6.	Financial Institution per 100 sq.km (in numbers)
7.	Agricultural labour population per 100 sq.km (in numbers)
8.	Area under permanent pasture per 100 sq.km (in ha)
9.	Area under Paddy per 100 sq.km (in ha)
10.	Area under Maize per 100 sq.km (in ha)
11.	Area under Groundnut per 100 sq.km (in ha)
12.	Area under other cereals per 100 sq.km (in ha)
13.	Average Annual Rainfall (in mm)

RESULTS AND DISCUSSION
Multidimensional scaling
Multidimensional scaling were analysed based on the resources carved on dairy related variables for each districts of Tamil Nadu whereas the result depicted in on two dimensions on configuration of districts .

Fig 1 .Multi-dimensional scaling configuration of districts – 2 Dimension view.



From this it helps to identify objects around the space defined by the requisite number of dimensions and checks how well the distances between the objects can be reproduced by new configuration using Multi-dimensional scaling around the districts in Tamil Nadu [4]. On analyzing the orientation of the districts in two dimensional view(fig 1), three distinct groups of districts were carved out based on their proximity or closeness and the districts identified in different zones are given in Table 1. From the Table it could be observed that there were three distinct groups. The goodness of fit is tested through the statistic called stress and the Stress value is 0.01664 and RSQ value is 0.99916.

Table 1. Milk Zones identified through Multidimensional Scaling

SL.NO	DISRTICTS		
	ZONE I	ZONE II	ZONE III
1	Kanyakumari	Madurai	Villupuram
2	Tirunelveli	Tiruchirapalli	Thiruvannamalai
3	Thoothukudi	Pudukottai	Thanjavur
4	Sivagangai	Perambalur	Cuddalore
5	Ramnathapuram	Ariyalur	Thiruvarur
6	Virudhunagar	Namakkal	Nagapattinam
7	Theni	Salem	
8	Dindigul	Dharmapuri	
9	Karur	Krishnagiri	
10	Erode	Vellore	
11	Tiruppur	Kanchipuram	
12	Coimbatore	Thiruvallur	
13	Nilgiris		

From the Table 1, Zone I comprises 12 districtsviz.,Thoothukudi, Tirunelveli and Virudhunagar, Sivagangai, Ramanathpuram, Kanyakumari which are the component districts of southern agro-climatic zone and Nilagiri district which is a hilly agro climatic district fall in Zone I group. In this grouped high fertile districts such as Theni, Dindigul, Karur, Erode, Tiruppur, Coimbatore which fall in Western zoneare classified in the first carved groups..

In the Zone II there were 11 districts which four agro-climatic zones fall in this zone such as North-western agro climatic zone such as Dharmapuri, Salem, Namakkal, Krishnagiri districts and North-eastern agro climatic zone which comprises Vellore, Kanchipuram, Thiruvallur districts and Cauvery delta zone districts are Thiruchirappalli, Ariyalur, Perambular, and Pudukottai. In this Madurai which covers in southern zone districts which are fall into zone II group. In this group, which were less fertile area and less rainfall which fall in closeness of distance to one group.

In the Zone III there were 6 districts which comprises two zones such as North-eastern agro climatic zone and Cauvery delta zone. In this North –eastern zones which comprises Villupuram and Thiruvannamalai districtswhich fall in group and Cauvery delta zone which comprises districts of Thanjavur, Thiruvarur , Cuddalore and Nagapattinam. In this group Cauvery delta agro-climatic zones districts were from the coastal regions which contributes low in cattle population in Tamil Nadu.

Discriminant function analysis based on Zones:

The Multiple discriminant function analysis was used to check whether the groups of districts(zones) are homogenous or not [2]. For this purpose the thirteen numbers of dairy related variables were used for zoning were separately taken for each district under the three different zones. The data are segregated and taken under three groups and subjected to discriminant function analysis. The canonical correlation analysis would determine the successive functions and canonical roots. The results of the discriminant functions analysis

From the Table 2 discriminant function coefficients on dairy related variables of different zones which first function inferred that agriculture labour population, area under groundnut, Cross bred and Exotic cattle population, average annual rainfall and indigenous population have the highest contribution and these variables are effective in discriminate between districts among the zones. In the second function buffalo population, financial institutions, and indigenous population which contribute on discriminant between the zones.

Table 2 Discriminant functions coefficients

Discriminant Function Coefficients		
Variables	Functions	
	1	2
Milk Production per 100 sq.km of the district (X_1)	0.143	-0.599
Indigenous cattle population per 100 sq.km (X_2)	0.4	0.487
Cross bred and Exotic cattle population per100 sq.km(X_3)	0.571	0.407
She-Buffalo population per 100 sq.km (X_4)	-.526	0.682
Veterinary Institution per 100 sq.km (X_5)	0.191	-0.268
Financial Institution per 100 sq.km (X_6)	-.213	0.627
Agricultural labour population per 100 sq.km (X_7)	0.349	-0.147
Area under permanent pasture per 100 sq.km (X_8)	0.128	-1.062
Area under Paddy per 100 sq.km (X_9)	0.147	0.351
Area under Maize per 100 sq.km (X_{10})	0.734	-0.172
Area under Groundnut per 100 sq.km (X_{11})	0.338	0.378
Area under other cereals per 100 sq.km (X_{12})	0.444	0.323
Average Annual Rainfall (X_{13})	0.968	0.286

From the results of Table 3Eigen values and percentage variance explained by the two discriminant functions contribution on dairy related variables, showed that the first function has the highest percentage of variance (94.1%) and eigen value (7.175), followed by the second function (5.9%) variance and (0.451) eigen value whereas the both functions had the explain the 100 percent variation on zones of discriminant function analysis. Based on the value obtained from the discriminant functions from each district, they were classified to check the ability of the discriminant functions is effectively discriminat of zones districts. The results of Table 3 gives % Classification on zones on the estimated discriminant function model is also given in the table. On perusal of the table it could be inferred that the estimated discriminant functions have 100 % correctly classified and effectively discriminated the districts in 3 zones and the districts in each of the 3 zones are of homogenous nature. From the function, it could inferred to explain the estimated discriminant function have effectively discriminated the districts in all 3 zones and the district in each 3 zones were homogenous nature.

Table 3 : Eigen Value

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	7.175[a]	94.1	94.1	.937
2	.451[a]	5.9	100.0	.557
a. First 2 canonical discriminant functions were used in the analysis.				

Classification on Zones on the estimated discriminant function

Classification Results[a]						
Zone			Predicted Group Membership			Total
			1.00	2.00	3.00	
Original	Count	1.00	13	0	0	13
		2.00	0	12	0	12
		3.00	0	0	6	6
	%	1.00	100.0	0.0	0.0	100.0
		2.00	0.0	100.0	0.0	100.0
		3.00	0.0	0.0	100.0	100.0
a. 100.0% of original grouped cases correctly classified.						

CONCLUSION

From the result of study on multidimensional scaling based on the resources three distinct groups were carved on their proximity. These analysis was to check whether the groups of districts are homogenous or not. From the discriminant function analysis, eigen values and % percent of variance showed that first function has 94.1%variance and second function has 5.9 % variance which has contribute 100% variation among the zones. From the function, it could inferred to explain the estimated discriminant function have effectively discriminated the districts in all 3 zones and the district in each 3 zones were homogenous nature.

ACKNOWLEDGEMENT

The authors acknowledge the staff and students of the department of AH Statistics and computer applications, MVC, Chennai-7

CONFLICT OF INTEREST

The authors have no conflict of interest

REFERENCES

1. Government of Tamil Nadu (2015) Statistical Hand book of Tamil Nadu, Directorate of Economics andstatistics, Chennai.
2. Karamathullah N, Lalith Achoth and Sachindrababu A (2002). Capital requirement for Modernisation of dairy farming in Karnataka: Its economic implications and prospects for globalisation, Final Report of the ICAR sponsored scheme of the Department of Dairy Economics and Business management, College of Dairy Science,UAS, Bangalore.
3. Serma Saravana Pandian.A, K.N. Selvakumar and M. Prabu (2008), Segmenting themilk production in the state of Tamil Nadu (India) into homogenous milk zones: A Multi-Dimensional Scaling Approach, Indian J. Sci. Technol., **1(6)**: 1-4
4. Serma Saravana Pandian.A andK.N. Selvakumar(2012).Application of principal component analysis on factors associated with milk production in Tamil Nadu.*Research Journal Of Animal Husbandry And Dairy Science,* **4 (1):**19-22

CITATION OF THIS ARTICLE

Vinoth Kumar G.D, A.Serma Saravana Pandian, and R.Kiruthiga. Developing Dairy Zones Based on Natural Resources Endowment - A Multivariate Approach. Bull. Env. Pharmacol. Life Sci., Vol 6[7] June 2017: 106-110