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A STATISTICAL STUDY ON CROPPING PATTERN CHANGES IN MADURAI DISTRICT

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ABSTRACT

The study was carried out Madurai district major rainfed crops cultivating taluk of Thirumangalam and Sedapatti taluks. In Thirumangalam and Sedapatti taluk changes in cropping pattern was studied by using Markov chain analysis and the results showed that the rainfed area under green gram was most stable crop and other rainfed crops area was considered in the study have less stability. The result revealed that the retained area was almost similar ranging from 35% to 45% in all rainfed crops in Thirumangalam taluk. In Sedapatti taluk the results showed that the rainfed area under cotton was most stable crop and other rainfed crops area was considered in the study have less stability.

Keywords: Cropping pattern, Markov chain analysis, Rainfed crops.

INTRODUCTION

A change in cropping pattern implies a change in proportion of area under different rainfed crops. It has significant bearing on widening the geographical inequalities in income distribution. A dynamic change has been witnessed in agricultural scene in our country, particularly during post-green revolution period. Cropping pattern refers to adoption of particular type of rainfed crops by the farmers in a particular region. It is expressed at macro level, that is, district, taluk or village level. Hence, present study was conducted with the specific objective to analyze the structural changes in cropping pattern over the years in Thirumangalam and Sedapatti taluk of Madurai district.

ISSN: 2455-6939

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MATERIALS AND METHODS

For the purpose of analyzing the changes in cropping pattern, Thirumangalam and Sedapatti taluk of Madurai district was purposively selected. The major area under cultivation based rainfed crops such as sorghum from cereals, red gram and green gram from pulses, groundnut from oil seeds and cotton from commercial crops were purposively selected for this study. The time series data were obtained for a period of 15 years (2003-04 to 2017-18).The data were collected from various issues of "Regional statistical office of economics and statistics" from 2003-04 to 2017-18.

Markov chain analysis

The Markov chain analysis is an application of dynamic programming to the solution of a stochastic decision process that can be described by a finite number of states. The Markov process was used to study the shifts in the shares of crops which facilitated the understanding of the dynamics of crop changes.

The Markov probability model

A stochastic process is one analyze a set of trials or experiments probabilistically. For stochastic process if N assumed that the movements (transitions) of objects from one division (possible outcome) to another are governed by a probability mechanism or system. A finite Markov process is a stochastic process whereby the outcome of a given trial t (1=1,2,.. T) depends only on the outcome of the preceding trial (t-1) and this dependence is the same at all stage in the sequence of trials. Consistence with this definition,

Let S; represent the r tehsil or possible outcomes; i = 1,2....r.

W_{it} represents the probability that tehsil S_i occurs on trial t or the proportion observed in trial t in alternative outcome tehsil i.e. of a multinomial population based on a sample of size n, i.e. Pr (S_{it}). P_{it} represent the transitional probability that which denotes the probability that if for any time t the process is in state S_i it moves on the next trial to division S_j i.e. Pro (S_{jt} + 1/S_{jt}) = P_{ij}.

P = (P_{ij}) represent the transitional probability matrix which denotes the transitional

probability for every pair of tehsil (i, j = 1,2 .... r) and has the following properties.

$0<P_{ij}<1$ …….. (1) and

$\sum P = 1$, for i = 1,2 ……(2)

ISSN: 2455-6939

Volume: 06, Issue: 03 "May-June 2020"

Given this set of notations and definitions for a first order Markov chain the probability of a particular sequence S_i on trial t and S_t on trial t+1 may be represented by

$Pr (S_{jt} S_{jt} + 1) = Pr (S_{jt}) Pr (S_{jt} +1 / S_{jt}) = W_{it} P_{jt}$ ……..(3) and

the probability of being in division j at trial t+1 may be represented by

$Pr (S_j. t + 1) = \sum W_{it} P_{it}$ or i

$W_t \ t + 1 = \sum W_{it} P_{tj}$ ……(4)

The data for the study are the proportion of area under selected crops. These proportions change from year to year as result of the factors like weather, technology, price and other institutional change. It is reasonable to assume that the combined influence of these individually systematic forces approximate to a stochastic proceeds and the propensity of farmers to move from one crop to another differs according to the crop involved in tehsil. If these assumptions are acceptable, then the process of cropping pattern change may be described in the form of a matrix p of first order transitional probabilities. The element of P_{ij} of the matrix indicates the probability of a farmer in crop division in one period will more to crop division j during the following period. The diagonal element P_{ij} measures the probability that the proportion share of j^{th} category of crop were maintained.

Estimation of Transition Probability Matrix:

Equation (4) as a basis for specifying the statistical model for estimating the transition probabilities. If errors are incorporated in equation (4) to account for the difference between the actual and estimated occurance of (W_j t+l), the sample observations assumed to be generated by the following Linear Statistical Model.

$W_{jt} = \sum W_t$ t-1 $P_{ij} + U_{jt}$ ……(5)

Or in Matrix form it can be written as

$Y_j = X_j P_j + U_j$ ……(6)

Where,

Y_j is a (T x 1) vectors of observations reflecting the proportion in cropping pattern j in time t, x_j is a (T x R) matrix of realized values of the proportion in cropping pattern i in time t-1, P_j is a (rx1) vector of unknown transition parameters to be estimated and U_j is a vector of random disturbances.

ISSN: 2455-6939

Volume: 06, Issue: 03 "May-June 2020"

RESULT AND DISCUSSION

The results of the transition probability matrix for rainfed crops in Thirumangalam and Sedapatti taluk of Madurai district are given Table 1 and Table 2.

Table 1 revealed that sorghum crop had retained 35.91% of the previous years share of area and lost about 63.99% of its previous years share to green gram. However, its gained about 15.94% area from green gram and 36.48% from cotton crop. Red gram retained 43.21% of the previous years share of area and lost about 40.12% of its previous years share to groundnut and 16.65% to cotton. However, its gained about 2.54% area from groundnut. Green gram retained 45.23% of the previous years share of area and lost about 38.85% to cotton and 15.94 % to sorghum crop. However, its gained about 63.99% from sorghum and 21.56% from cotton crop. Groundnut retained 41.23% of previous years share of area and lost about 56.22% to cotton and 2.54% to red gram. However, it's gained about 40.12% from red gram. Cotton retained 41.94% of the previous years share of area and lost about 36.48% of its previous years share to sorghum crop and 21.56% to green gram. However, its gained about 56.22% from groundnut, 38.85% from green gram and 16.65% from red gram. The result revealed that the retained of area was almost similar ranging from 35% to 45% in all rainfed crops in Thirumangalam taluk.

Similar results was obtained by lamani (2003) and recorded that transitional probability matrix for taluka wise for cropping pattern changes of rainfed crops in Dharwad district. She also obtained result of the retained area was almost similar ranging from 38% to 44% in all rainfed crops in Dharwad taluk of Dharwad district.

Table 2 revealed that the highest retention of area was noticed in Cotton crop (62.13%) followed by groundnut (57.23%), Green gram (52.98%), Sorghum (36.88%) and Red gram (31.21%). Sorghum crop retained 36.88% of the previous years share of area and lost about 63.12% of its previous years share to green gram. However, it gained about 7.15% area from green gram. Red gram retained 31.21% of the previous years share of area and lost about 41.12% of its previous years share to groundnut and 27.57% to cotton. However, its gained about 41.49% area from groundnut, 11.42% from green gram and 7.52% from cotton. Green gram retention 52.98% of the previous years share of area and lost about 28.45% to cotton, 11.42% to red gram and 7.15 % to sorghum crop. However, its gained about 63.12% from sorghum and 18.84% from cotton crop. Groundnut retained 57.23% of previous years share of area and lost about 1.24% to cotton and 41.49% to red gram. However, it's gained about 41.21% to red gram and 11.44% from cotton. Cotton retained 62.13% of the previous years share of area and lost about 18.84% to green gram crop and 7.52% to red gram. However, its gained about 1.24% from groundnut, 28.45% from green gram and 27.57% from red gram. The result showed that highest retained of area was noticed green gram, groundnut and cotton crop ranging from 52% to 62% and other two

ISSN: 2455-6939

Volume: 06, Issue: 03 "May-June 2020"

crop ranging less from 31% to 37%. This was probably because the cultivation of green gram, groundnut and cotton was more remunerative when compared to sorghum and red gram.

Similar results was obtained by kumar and basvaraja (2012) and studied that for structural changes in cropping pattern in northern transitional zone of Karnataka. He obtained cropping pattern changes was probably because the cultivation of paddy, wheat, jowar, groundnut and chickpea was less remunerative when compared to maize and cotton crop.

Table 1: Transitional probability matrix for cropping pattern change in Thirumangalam taluk

Thirumangalam taluk					
Crops	**Sorghum**	**Red gram**	**Green gram**	**Groundnut**	**Cotton**
Sorghum	**0.3591**	0.0000	0.6399	0.0000	0.0000
Red gram	0.0000	**0.4321**	0.0000	0.4012	0.1665
Green gram	0.1594	0.0000	**0.4523**	0.0000	0.3885
Groundnut	0.0000	0.0254	0.0000	**0.4123**	0.5622
Cotton	0.3648	0.0000	0.2156	0.0000	**0.4194**

Table 2: Transitional probability matrix for cropping pattern change in Sedapatti taluk

Sedapatti taluk					
Crops	**Sorghum**	**Red gram**	**Green gram**	**Groundnut**	**Cotton**
Sorghum	**0.3688**	0.0000	0.6312	0.0000	0.0000
Red gram	0.0000	**0.3121**	0.0000	0.4121	0.2757
Green gram	0.0715	0.1142	**0.5298**	0.0000	0.2845
Groundnut	0.0000	0.4149	0.0000	**0.5723**	0.0124
Cotton	0.0000	0.0752	0.1884	0.1144	**0.6213**

ISSN: 2455-6939

Volume: 06, Issue: 03 "May-June 2020"

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