International Journal of Environment and Climate Change

Volume 13, Issue 11, Page 1658-1661, 2023; Article no.IJECC.104175
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

A Probe into Shifts in Cropping Pattern in Telangana State, India: A Markov Chain Approach

Kotla Saritha [a++*], Md. Ali Baba [b#], D. A. Rajini Devi [c#] and K. Madhu Babu [d†]

[a] Department of Agricultural Economics, PJTSAU, Rajendranagar, Telangana, India.
[b] IFS, PJTSAU, Rajendranagar, Telangana, India.
[c] RARS, Polasa, Jagitial, Telangana, India.
[d] Department of Agricultural Extension, PJTSAU, Rajendranagar, Telangana, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i113320

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/104175

Short Research Article

Received: 02/06/2023
Accepted: 07/08/2023
Published: 26/10/2023

ABSTRACT

Assessing variations in cropping patterns across various locations is crucial for a better understanding of the agricultural development plan. The goal of the current study was to look at Telangana state's changing cropping patterns. Data spanning the years 2000-01 to 2020-21 were gathered from the Directorate of Economics and Statistics, Government of Telangana and they were then evaluated using the Markov chain method. The research's key findings showed that none of the crops in Telangana kept their acreage; instead, the area devoted to each crop changed continually during the course of the study, from one crop to another. The area under crops other than cereals, major oil seeds, pulses has more retention while it lost area to rice, cotton, black gram, chillies, cow gram, ground nut, jowar and mesta. This indicated that there was greater shift in

[++] M.Sc. Scholar;
[#] Scientist;
[†] Professor and Head;
**Corresponding author: E-mail: sarithakotla001@gmail.com;*

cropping pattern in Telangana State. The selection of crops holds immense potential to elevate agriculture to the forefront of property growth, and it should be a focal point in research and extension programmes.

Keywords: Cropping pattern; Markov chain analysis; transitional probability matrix; shift; diversification.

1. INTRODUCTION

The Indian economy is largely dependent on agriculture. In India, agriculture is a source of income for more than 70 per cent of rural households. 60 percent of the population is employed in agriculture, which contributes 19.9 per cent to GDP (2020–2021) [1-4]. In 1950–1951, there were 51 million tonnes produced whereas in 2020–2021 308.65 million tonnes were produced. The total area in Telangana State used to grow food grains is 3.38 million hectares (2020–21) [5]. Gross sown area (GSA) in Telangana increased from 5.45 million hectares in 2014–15 to 8.75 million hectares in 2020–21. Both the overall cropped area and the irrigated area have expanded considerably for different crops in Telangana [6-9]. The gross sown area of paddy in Yasangi had increased from 43.42 per cent in 2014-15, to 76 per cent in 2020-21 [10,11,12]. Hence, in Telangana there were significant changes in cropping pattern. This study will help to promote crop diversification based on the changes in cropping pattern.

2. MATERIALS AND METHODS

Markov chain analysis: Using the LINDO software, transitional probabilities were computed based on a linear programming (LP) technique to evaluate the dynamism in the direction of cropland from 2000-01 to 2020-21. Different crops grown in Telangana state were taken into account to determine the shift in cropping patterns. A transitional probability matrix (P) is created via Markov chain analysis, and its elements (P_{ij}) represent the likelihood (share) of a crop moving from the i^{th} crop to the j^{th} crop over time. Following equation is an algebraic way to describe this:

$$E_t = \Sigma [E_t - 1] P_{ij} + e_t$$

$$i = 1,..., n$$

Where,

E_t = area under crop for the j^{th} crop group in year't';
E_t-1 = area under crop for the i^{th} crop group in year't-1';
P_{ij} = probability of shift in area under i^{th} crop to j^{th} crop
e_t = error-term statistically independent of E_t-1;
n = number of crops.

The transitional probabilities P_{ij} arranged in (m × n) matrix have the following properties:

$$\Sigma P_{ij} = 1 \text{ and } 0 \leq P_{ij} \leq 1$$

$$i = 1,..., n$$

The transitional probability matrix (T) based on LP framework will be estimated using Minimization of Mean Absolute Deviation (MAD).

$$\text{Min, } OP^* + I e$$

Subjected to

$$X P^* + V = Y$$

$$GP^* = 1$$

$$P^* > 0$$

Where,

P^* = vector of the probabilities P_{ij};
O = vector of zeros;
I = appropriately dimensional vectors;
e = vector of absolute errors;
Y = proportion of area to each crops;
X = block diagonal matrix of lagged values of Y;
V = vector of errors;
G = grouping matrix to add the row elements of P arranged in P* to unity.

3. RESULTS AND DISCUSSION

The transition probability matrix accurately represented the consistency of the crop's acreage share and the direction of change over time. The crops grow steadily less stable as the diagonal components go closer to zero, and steadily more stable as they get closer to one. The components of the ith row of the Transitional Probability Matrix indicate the percentages of the ith crop's acreage from the previous period that are expected to be lost to other crops in the

Table 1. Transitional probability matrix for shift in cropping pattern for period 2000-01 to 2020-21

Crops	Rice	Maize	Cotton	Bajra	Black gram	Castor	Chillies	Cow gram	Green gram	Ground nut	Horse gram	Jowar	Mesta	Others
Rice	0.314	0.019	0	0	0	0	0	0.203	0	0	0	0	0.078	0.384
Maize	0	0	0	0	0	0.047	0	0.952	0	0	0	0	0	0
Cotton	0.155	0.008	0.188	0.131	0	0.015	0.330	0.053	0.101	0.017	0	0	0	0
Bajra	0	0	0.732	0.264	0	0.003	0	0	0	0	0	0	0	0
Black gram	0	0	0	0	0.808	0	0	0	0	0	0.058	0	0.133	0
Castor	0	0.183	0.382	0	0	0.433	0	0	0	0	0	0	0	0
Chillies	0	0	0.223	0	0	0	0	0	0	0	0	0	0	0.777
Cow gram	0	0	0	0	0	0	0	0.745	0	0	0	0	0.023	0.231
Green gram	0.351	0.014	0	0.635	0	0	0	0	0	0	0	0	0	0
Ground nut	0	0	0	0.383	0	0	0	0	0.016	0.600	0	0	0	0
Horse gram	0	0	0	0	0	0	0	0	0	0	0.521	0	0.479	0
Jowar	0.018	0	0	0.025	0.054	0	0.131	0	0.004	0	0	0.768	0	0
Mesta	0	0	0	0	0	0	0	0	0	0	0.030	0	0.146	0.824
Others	0.013	0	0.024	0	0.025	0	0.068	0.021	0	0.230	0	0.005	0.045	0.797

current period. The ith column's element provides the percentage of the ith crop's area that is projected to increase during the next several months.

According to the results of the transitional probability matrix (Table 1) for several crops in the state of Telangana from 2000–01 to 2020–21, maize, chillies, and green gram had zero per cent retention, whereas castor (4.7%) and cow gram (95.2%) gained maize's lost acreage.Green gram was replaced by rice (35.1%), maize (1.4%), and bajra (63.5%), while cotton (22.3%) and other crops (77.7%) replaced the land that had produced chillies.

The findings show that other crops held onto a percent of 79.7, while rice (1.3%), cotton (2.4%), black gram (2.5%), chillies (6.8%), cow gram (2.1%), ground nut (23%), jowar (0.5%), and mesta (4.5%) replaced the remaining land. between 2000-01 and 2020-21. This suggested that Telangana State's cropping pattern has seen an increased shift. The fact that maize (1.9%), cow gram (20.3%), mesta (7.8%), and others (38.4%) replaced rice in the remaining area, which had been 31.4 percent, showed that Telangana's cropping pattern is shifting towards diversity.

4. CONCLUSION

Based on the present work, the selection of crops holds immense potential to elevate agriculture to the forefront of property growth, and it can be a focal point in research and extension programmes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Rejula K, Singh R. An analysis of changing land use pattern and cropping pattern in a scenario of increasing food insecurity in Kerala state. Economic Affairs. 2015; 60(1):123.
2. Vincent A, Manivasagam S. A Study on the shift in cropping pattern from agriculture to horticulture in Coimbatore district, Tamil Nadu, India. Asian Journal of Agricultural Extension Economics and Sociolology. 2019;35(4):1-10.
3. Nagpure S, Deshmukh R, Sharma PK, Ingole DN. Pattern of crop concentration and crop diversification–An economic analysis. Maharashtra Journal of Agricultural Economics. 2017;20(2):128-132.
4. Lakshmi SBR, Devi IB. Crop shifts in coastal region of Andhra Pradesh: A Markov chain approach. Agricultural Situation in India. 2012;69(7):363-367.
5. Available:https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%2020at%20a%20Glance%20-%202021%20(English%20version).pdf
6. Devi DR, Reddy RU, Madavi B, Ravi P, Sadvi P. Dynamics of cropping pattern in Karimnagar District of Telangana–A Markov chain approach. Asian Journal Agricultural Extension Economics and Sociolology. 2019;37(4):1-5.
7. Amirthalingam N, Devi KS. An economic analysis of crop diversification and dynamics of changes in the cropping pattern in Villupuram district of Tamil Nadu. International Journal of Research and Analytical Reviews. 2018;5(4):243-248.
8. Reddy AR, Bante RP, Dhunde AD, Blaise D. Dynamics of cropping pattern in cotton growing districts of Maharashtra. Economic Affairs. 2021;66(4):563-568.
9. Ragamalika V, Rajeswari S, Aparna B, Ravindra Reddy B. Crop shifts in Rayalaseema region of Andhra Pradesh: A Markov chain approach. Andhra Pradesh Journal of Agricultural Sciences. 2021;1-9.
10. Available:https://www.telangana.gov.in/PDFDocuments/Telangana-Socio-Economic-Outlook-2022.pdf
11. Lakshmi SBR, Devi IB. Crop shifts in coastal region of Andhra Pradesh: A Markov chain approach. Agricultural Situation in India. 2012;69(7):363-367.
12. Rao D, Parwez S. Dynamics of cropping pattern in sorghum growing states of India. Indian Journal of Agricultural Economics. 2005;60(902-2016-67449).

© 2023 Saritha et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104175