A PROBE INTO SHIFTS IN CROPPING PATTERN IN TELANGANA STATE – A MARKOV CHAIN APPROACH

ABSTRACT: For a better understanding of the agricultural development strategy, it is essential to assess changes in cropping pattern across several regions. The present study was undertaken to examine the shift in cropping pattern in Telangana state. The data was collected from Directorate of Economics and Statistics, Government of Telangana from the period 2000-01 to 2020-21 and it was analysed with the help of Markov chain approach. The major findings from the study revealed that none of the crops retained its area in Telangana, but the area under each crop was continuously shifting from one crop to another crop throughout the period. 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 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.

Key words: Cropping pattern, markov chain analysis, transitional probability matrix, shift, diversification

INTRODUCTION

Agriculture plays a key role in the Indian Economy. Over 70 per cent of the rural households in India depend on agriculture. Agriculture contributes to 19.9 per cent of GDP (2020-21) and provides employment to 60 per cent of the population. The food grain production has increased from 51 million tonnes in 1950-51 to 308.65 million tonnes during 2020-21. (Agricultural Statistics at a Glance 2021). In Telangana state total area under food grain production is 3.38 million hectares (2020-21) (Agricultural Statistics at a Glance 2021). In Telangana overall cropping area and irrigated area have increased significantly, the Gross Sown Area(GSA) has increased from 5.45 million hectares in 2014-15 to 8.75 million hectares in 2020-21. The gross sown area of paddy increased from 43.42 per cent in 2014-15, to 76 per cent in 2020-21(Telangana-Socio-Economic-Outlook- 2022). Hence, in Telangana there were significant changes in cropping pattern.

MATERIAL 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, including paddy, cotton, maize, red gram, sorghum, oil seed crops 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;

Comment [U1]: In addition to this, if the available statistics obtained from the state of Telangana are given, the statement will be stronger

Comment [U2]: Mention in percent of total cultivable land also

Comment [U3]: Why? For foodgrains only or for total number of crops?

Comment [U4]: At which season and instead of which crop area and why?

Comment [U5]: After that, what is the specific objective(s) of this paper needs to be written.

Comment [U6]: Sampling method for selection of crops needs to be clearly stated. Is it random sampling or purposive sampling? And why?

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.

RESULTS AND DISCUSSION

The stability of the acreage share of the crop and their direction of change over some time was captured by the transition probability matrix. As the diagonal elements approach zero, the crops become less and less stable and as they approach one, they become more and more stable over some time. The elements in the i^{th} row of the Transitional Probability Matrix give the proportions of the previous period's acreage of i^{th} crop which is likely to lose to other crops in the current period. The element of i^{th} column gives the proportion of the area of i^{th} crop which is likely to gain in the current period.

The results of the transitional probability matrix(table 1) for different crops in Telangana state for the time period 2000-01 to 2020-21 indicated that maize, chillies, green gram had zero per cent of retention while maize has lost its area to castor (4.7%), cow gram (95.2%).Chillies area was replaced by cotton (22.2%) and by other crops (77.7%) while green gram was replaced by rice (35%), maize (1.3%) and bajra (63%).

Comment [U7]: Do not matches with the figure of Table 1

Comment [U8]: All these figures do not match with the figures of Table 1

CONCLUSIONS

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

Comment [U9]: This table should be given before the conclusion

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**

The results indicate that other crops has retained the area to a per cent of 79.7 and the remaining area was replaced by rice (1.3%), cotton (2.3%), black gram (2.5%), chillies (6.6%), cow gram (2%), ground nut (5%), jowar (1%), mesta (4.4%). for the period 2000-01 to 2020-21. This indicated that there was greater shift in cropping pattern in Telangana State. Rice had retained 31.4 per cent and the remaining area was replaced by maize (1.9%), cow gram (20.2%), mesta (7.8%), others (38.4%) indicated that the cropping pattern moves towards diversification in Telangana.

FUTURE SCOPE

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.

REFERENCES

https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%2020at%20a%20Glance%20-%202021%20(English%20version).pdf.

https://www.telangana.gov.in/PDFDocuments/Telangana-Socio-Economic-Outlook-2022.pdf.

Devi, D. R., Reddy, R. U., Madavi, B., Ravi, P and Sadvi, P. 2019. Dynamics of cropping pattern in Karimnagar District of Telangana–A Markov chain approach. *Asian Journal Agricultural Extension Economics and Socio*logy, *37*(4): 1-5.

Amirthalingam, N and Devi, K. S. 2018. 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*, *5*(4): 243-248.

Reddy, A. R., Bante, R. P., Dhunde, A. D and Blaise, D. 2021. Dynamics of Cropping Pattern in Cotton Growing Districts of Maharashtra. *Economic Affairs*, *66*(4): 563-568.

Ragamalika, V., Rajeswari, S., Aparna, B and Ravindra Reddy, B. 2021. Crop Shifts in Rayalaseema Region of Andhra Pradesh: A Markov Chain Approach. *Andhra Pradesh Journal of Agricultural Sciences*: 1-9.

Comment [U10]: This paragraph is a part of RESULTS AND DISCUSSION

Comment [U11]: Do not matches with the figure of Table 1

Comment [U12]: Do not matches with the figure of Table 1

Comment [U13]: Do not matches with the figure of Table 1

Comment [U14]: Do not matches with the figure of Table 1

Comment [U15]: Do not matches with the figure of Table 1

Comment [U16]: Do not matches with the figure of Table 1

Comment [U17]: Do not matches with the figure of Table 1

Comment [U18]: FUTURE SCOPE can be considered as conclusion of this study.