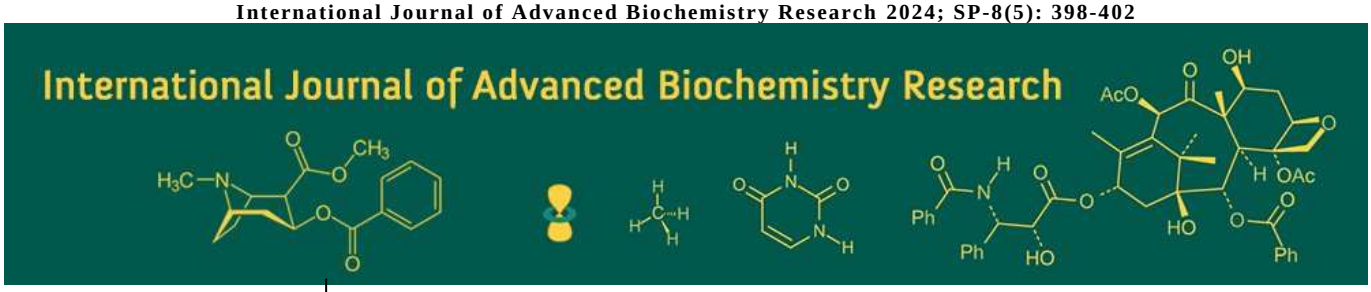


ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(5): 398-402
www.biochemjournal.com
Received: 15-03-2024
Accepted: 23-04-2024

Akash Tiwari
Department of Agricultural Economics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. VK Choudhary
Department of Agricultural Economics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. Ravi Shrey
Department of Agricultural Economics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Akash Tiwari
Department of Agricultural Economics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Nature and extent of the crop diversification kharif season in northern hills of Chhattisgarh

Akash Tiwari, Dr. VK Choudhary and Dr. Ravi Shrey

DOI: https://doi.org/10.33545/26174693.2024.v8.i5Sf.1224

Abstract
The present study has examined the trend in crop concentration and diversification and advantageous crops in different districts of Northern hills of Chhattisgarh based on the secondary data of 20 years *i.e.*, from 2001 to 2020. Simpson Diversity Index have been estimated to study crop diversification. Crop diversification represents the growing of a variety of agricultural crops that are commercially viable and locally acceptable. It means moving away from growing a single crop to a number of crops. It is an agricultural development concept towards intensification and utilization of land in cultivating multiple crops. So, in this section an attempt is made to analyse the nature and extent of crop diversification at districts and state level. At districts and state level index for different crop groups *viz.* overall crops (kharif crops), Paddy, Pigeon pea, Maize, Black gram, Sesamum, Groundnut and Niger are measured and quantified using Simpson Diversification Index at secondary data from 2001 to 2020. For analyses of Herfindhal Index (HHI) and Simpson's Diversification Index (SI), the whole study period (2001 to 2020) has been classified into 7 sub-periods, considering a periodicity of 3 years. Above study revealed that the SI seems to be gradually decreasing very slowly, over the periods, from 0.2385 to 0.1935; while HI is gradually increasing with the same pace from 0.7425 to 0.7954. A decline of 6% of diversity was experienced during study period, leading to harmful effect on the farmer's economy.

Keywords: Crop concentration, diversification indices, advantageous crop, Herfindahl index

Introduction
Agricultural diversification is an important mechanism for economic growth. To meet the challenges of a globalizing market in agriculture as well as the growing and changing needs of the population. Agriculture remains the main pillar of Indian economy, in spite of concerted efforts towards industrialization in the last decades. Agriculture contributes a high share of gross domestic product by sectors in India. India with only 2.3 per cent of world's total land area supports around 18 per cent of human and 15 per cent of livestock population in the world. The final outcome from agriculture depends on the efficiency of resource use and genuine technological progress in the sector with an appropriate cropping pattern. Cropping pattern denotes the distribution of area under different crops in different seasons expressed in percentage of total crop area. A change in cropping pattern implies a change in proportion of area under different crops. The change in cropping pattern occurs periodically depending upon the market forces and agro climatic conditions. These changes bring about a chain of effects on different aspects of farming and its economy along with some changes in social and economic aspects of farming families. Systematic understanding of changes in cropping pattern over the years is very important, for the farmers to get better returns, for the entrepreneurs to decide the optimal locations and capacities of new agro-based plants, for the policy makers to check the over or under production some farm products, thus ensuring the required overall balance.

Review of Literature
Meena *et al.* (2015) [8] This paper aims to measure crop diversification for a uniform data set of 35 year for two districts of Rajasthan state of India namely Kota and Jaisalmer. Herfindahl indexes, Simpson index and Index of maximum proportion were used to measure the crop diversification in the districts for comparative study. Results of the study shows complete diversification was found in the Kota district in all period through all index and likewise in Jaisalmer district crop specialization was found in first and second period through all indices,

Moderate diversification was found in third and fourth period through all indices and finally complete diversification was found in firth period through all three indices in Jaisalmer district. Lama (2016) [6] examines the extent of crop diversification and its impact on farm income in Arunachal Pradesh based on the analysis of both primary and secondary data. Simpson Index of Diversification (SID) was used and showed a high and growing degree of crop diversification in the State. Sen *et al.* (2017) [16] examined crop diversification by using Simpson Index for Diversification (SID) clearly indicates that Indian agriculture has shifted from a cereals-based production pattern to other high-value-based production patterns. Empirical analysis with farm level primary survey in Banka and Bhagalpur districts of Bihar for the year 2016-17 revealed that diversification of farms by adopting ancillary; horticulture and other HVCs like mushrooms, etc. will increase farm income. Mithiya *et al.* (2018) [10] investigated the pattern and trend of crop diversification in different districts in west Bengal based on secondary data. The study focused on 17 major districts of west Bengal during the period of 1990-91 to 2013-14. Simpson index was used to estimate the diversification pattern and reported that all the districts of west Bengal and the state as a whole revealed that the crop sector in west Bengal in general has been diversifying towards HVCs from the traditional ones. However, there was considerable variation in terms of the intensity of diversification across districts. Few districts showed no tendency towards diversification. Vani and Pavithra (2021) [15] Crop pattern and diversification has been systematically analysed in the Chikkaballapur district of Karnataka. The area under cultivation in Chikkaballapur district changed over the time. Over the decade there is a significant change in crop pattern and district adopted more vegetables, fruits and oil seed crops compared to the commercial crops, spices, flowers and others. The present study has analysed the crop pattern and crop diversification at the taluk level and under different agro-climatic conditions. In the district the trends and determinants and factors influencing crop diversification in the area has been studied with Herfindahl index, Simpson's index, Entropy index and Gini index indicating that there is a shift in crop diversification in Chikkaballapur district.

Methodology

Nature and Source of Data

The study covers a period from 2001 to 2020. The data from 2001 to 2020 is analyzed at a periodic interval of 2-3 years basis. The reason for studying the span of this Period is availability of meaningful data from reliable sources. The data were collected from various government publications like, Ministry of Commerce & Industry"- Government of India, Agri Indiastat, DAC & FW, Directorate of Economics & Statistics, FAO (Food and Agricultural Organization) Stat.

There are quite a few measures of diversification; important ones include Herfindal Index, Simpson Diversity Index, Ogive Index, Entropy and Modified Entropy Index. Each method has some special features and some limitations. Considering the objective of this study of assessing the extent of diversity the Simpson Diversity Index, Herfindhal index of diversification has been used. The nature of crop diversification is examined through changes in allocation of land towards the cultivation of different crops grown over the year. Different diversity indices have been used to measure the degree of diversification taking place in the Northern hills of Chhattisgarh.

Selection of districts, blocks, villages and respondents: Chhattisgarh state consist of 33 districts, out of those 5 districts from northern hills *i.e.*, Jashpur, Surguja, Surajpur, Balrampur and Korea has been selected. Blocks has been selected @ 2% selection criteria out of total blocks and the villages has been selected randomly. Total number of respondents are 120 out of total number of farm families. Selection of blocks, villages and respondents has been represented in the following tables:

Table 1: Selection of Blocks and respondents in Northern hills

Districts	Block (area based)	No. of villages (area based)	Village selection (criteria @ 2%)	Total no. of farmers	Selected respondents (criteria @ 5%)	No. of respondents from blocks
Surajpur	Surajpur	120	3	320	15	
	Pratappur	111	2	220	11	26
Jashpur	Patthalgaon	106	2	250	15	
	Kansabel	61	1	100	05	20
Surguja	Sitapur	51	1	120	06	
	Ambikapur	125	3	300	15	21
Balrampur	Balrampur	124	3	325	17	
	Ramanujganj	112	2	230	12	29
Korea	Baikunthpur	126	3	250	14	
	Khadganva	92	2	170	10	24
Total		918	22	2299		120

Simpson Diversification Index (S.D.I): Considering the objective of assessing the extent of crop in crop, we used Simpson Index. Superiority of Simpson Diversification Index over the other above indices it's that in case of Herfindahl and Ogive Index, Index does not provide the minimum Value *i.e.*, gives zero for smaller number of N, in Entropy index. It does not give the standard scale of diversification, as upper value of index can exceed one, when number of total crops is higher than the value of logarithm's base, and it is less than one when the number of crops is lower than the base of logarithm. In case of Modifieds Entropy Index, diversification is measured for only given crops, or it is not sensitive to change in the number of crops. Therefore, Simpson diversification index is used for current study. The index provides a clear dispersion of commodities in a geographical region. The index ranges between 0 and 1. If there exists complete specialization, then index moves towards 0. The index is easy to compute and interpret, as follows:

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

Where:
n = number of individuals of each crop
N = Total number of Crops

Herfindahl Index (HI): It was for the first time used by Theil in 1967. Herfindahl Index is computed by taking sum of squares of acreage proportion of each crop in the total cropped area. The Herfindahl index takes a value one when there is a complete specialization and approaches to zero as N gets large, *i.e.,* if diversification is perfect. The major limitation of the index is that it cannot assume the theoretical minimum, *i.e.,* zero for smaller value. Mathematically, the index is given as below:

$$HI = \{\sum_{i=1}^{n} Pi^2\}/\mathbf{N}$$

Where,
N is the total number of crops and
Pi represents area proportion of the i^{th} crop in total cropped area.

Results and Discussion

Crop Diversification in Chhattisgarh during kharif season

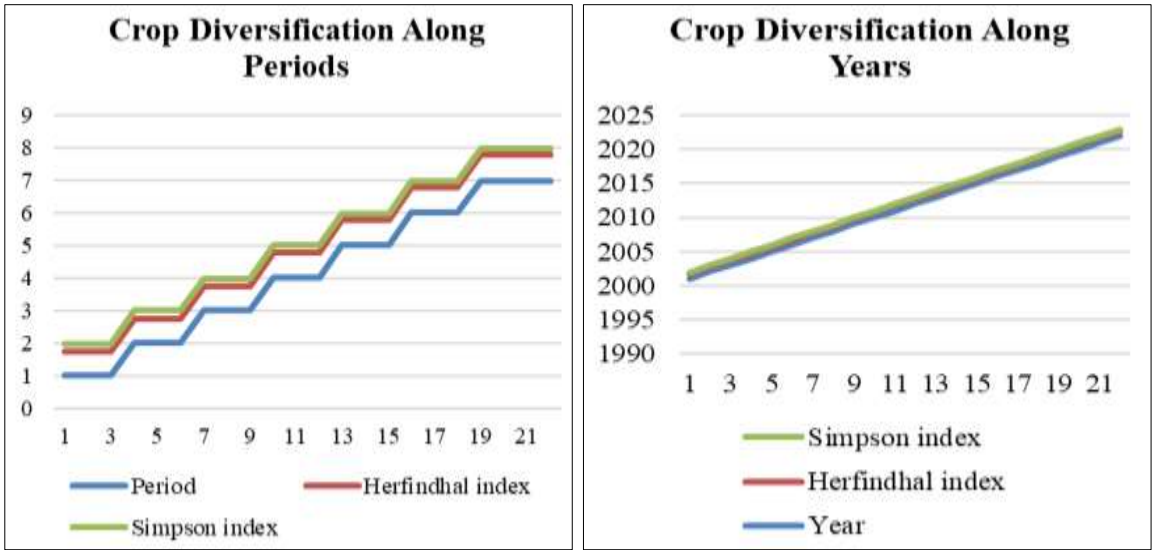
Out of the above mentioned eight crops how much crop area were shifted to other crop annually were computed using HI and SI. These indices were also obtained for these crops for the 7 periods as defined above considering a periodicity of seven years. These periodic and annual indices have been helped in understanding the pattern of crop diversification in Chhattisgarh State during Kharif season.

Table 2: Crop diversification in Chhattisgarh during Kharif season

Period	Herfindhal index	Simpson index	Year	Herfindhal index	Simpson index
1	0.7425	0.2385	2001	0.7412	0.2386
1	0.7425	0.2385	2002	0.7481	0.2319
1	0.7425	0.2385	2003	0.7477	0.2323
2	0.7520	0.2450	2004	0.7514	0.2445
2	0.7520	0.2450	2005	0.7535	0.2407
2	0.7520	0.2450	2006	0.7545	0.2435
3	0.7610	0.2310	2007	0.7608	0.2308
3	0.7610	0.2310	2008	0.7611	0.2315
3	0.7610	0.2310	2009	0.7620	0.2335
4	0.7695	0.2276	2010	0.7635	0.2216
4	0.7695	0.2276	2011	0.7622	0.2285
4	0.7695	0.2276	2012	0.7665	0.2245
5	0.7725	0.2185	2013	0.7710	0.2143
5	0.7725	0.2185	2014	0.7732	0.2165
5	0.7725	0.2185	2015	0.7720	0.2133
6	0.7835	0.2070	2016	0.7802	0.2040
6	0.7835	0.2070	2017	0.7812	0.2011
6	0.7835	0.2070	2018	0.7830	0.2046
7	0.7954	0.1935	2019	0.7909	0.1925
7	0.7954	0.1935	2020	0.7915	0.1936

The Table 2 and Fig.4.61 (a) show the performance of periodic as well as annual HI and SI in Chhattisgarh from 2001-20, with a periodicity 2-3 years. From Fig 1, it is found that the SI seems to be gradually decreasing very slowly, from 2001 to 2020, over the periods, from 0.2385 to 0.1935; while HI is gradually increasing with the same pace from 0.7425 to 0.7954, SI indicates that the crop diversification was highest (almost 24%) during Period-1, *i.e.,*, 2001-03, whereafter it has gone down to the level of almost 18%. So, in nutshell a decline of 6% of diversity was experienced from 2001-2020, leading to harmful effect on the farmer's economy.
To see the annual pattern of the HI and SI, one may refer to Table 2 and Fig. 1 (b) which show the similar pattern of decreasing (increasing) SI (HHI), except in the year 2006 and 2015 when it has greater increase (decrease) in SI (HHI).

Crop diversification in Northern Hills during Kharif season: HHI and AGSI indices were obtained for the eight crops annually and for the 7 periods considering a periodicity of three years, except the last period which had only one year, by averaging the relevant areas over the corresponding years. These periodic and annual indices will help in understanding the pattern of crop diversification in Northern Hills during Kharif season.
The Table 3 and Fig. 2 (a) show the performance of periodic as well as annual HI and SI in Northern hills of Chhattisgarh from 2001-20, with a periodicity 2-3 years. From Fig. 2, it is found that the SI seems to be gradually decreasing very slowly, from 2001 to 2020, over the periods, from 0.4063 to 0.6333; while HI is gradually increasing with the same pace from 0.5737 to 0.6450, SI indicates that the crop diversification was highest (almost 41%) during Period-1, *i.e.*, 2001-03, where after it has gone down to the level of almost 35%. So, in nutshell a decline of 6% of diversity was experienced from 2001-2020, leading to harmful effect on the farmer's economy.

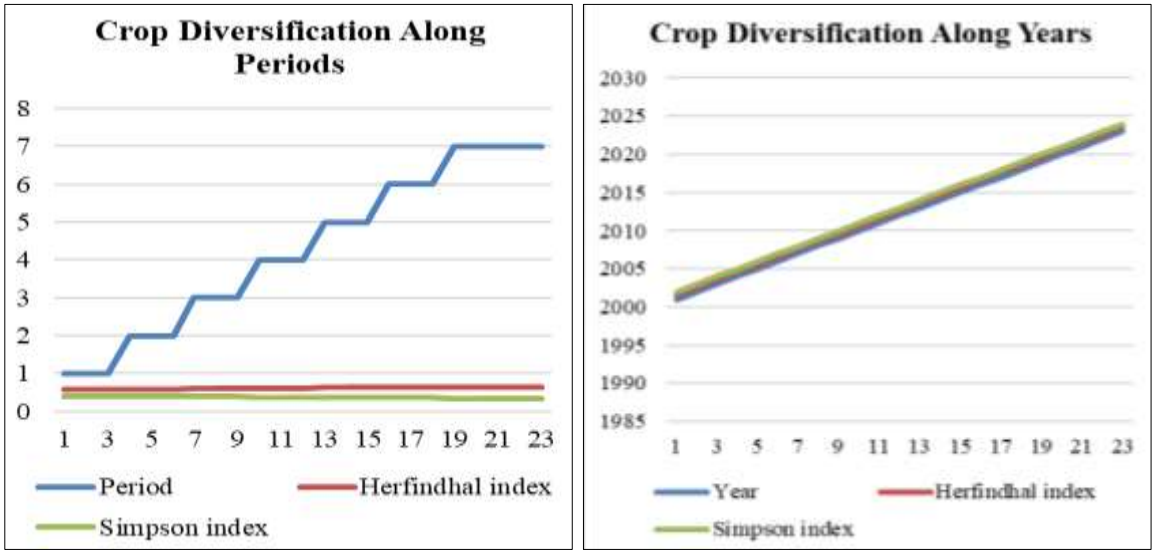


A B

Fig 1: Crop diversification in Chhattisgarh during Kharif season

Table 3: Crop diversification in Northern hills during Kharif season

Period	Herfindhal index	Simpson index	Year	Herfindhal index	Simpson index
1	0.5737	0.4063	2001	0.5685	0.4125
1	0.5737	0.4063	2002	0.5685	0.4146
1	0.5737	0.4063	2003	0.5685	0.4122
2	0.5864	0.3931	2004	0.5729	0.4046
2	0.5864	0.3931	2005	0.5729	0.4046
2	0.5864	0.3931	2006	0.5729	0.4035
3	0.5969	0.3875	2007	0.5824	0.3945
3	0.5969	0.3875	2008	0.5869	0.3945
3	0.5969	0.3875	2009	0.5869	0.3985
4	0.6115	0.3748	2010	0.6021	0.3844
4	0.6115	0.3748	2011	0.6032	0.3866
4	0.6115	0.3748	2012	0.6033	0.3825
5	0.6242	0.3644	2013	0.6145	0.3756
5	0.6242	0.3644	2014	0.6174	0.3784
5	0.6242	0.3644	2015	0.6165	0.3745
6	0.6359	0.3590	2016	0.6255	0.3633
6	0.6359	0.3590	2017	0.6245	0.3644
6	0.6359	0.3590	2018	0.6245	0.3685
7	0.6450	0.3485	2019	0.6358	0.3516
7	0.6450	0.3485	2020	0.6345	0.3553



A B

Fig. 2: Crop diversification in Northern hills during Kharif season

Conclusion

Agricultural diversification is an important mechanism for economic growth. The state of Chhattisgarh overall shows a high level of diversification as measured by these Indices but the process as analyzed on time series basis is somewhat stagnant. The study clearly revealed that performance of periodic as well as annual HI and SI in Chhattisgarh from 2001-20, with a periodicity 2-3 years. It is found that the SI seems to be gradually decreasing very slowly, over the periods, while HI is gradually increasing with the same pace in Chhattisgarh state. In case of Northern hills of Chhattisgarh, it is found that the SI seems to be gradually decreasing very slowly, from 2001 to 2020, from 0.4063 to 0.6333; while HI is gradually increasing with the same pace from 0.5737 to 0.6450. Talking about diversity at the state level data shows that SI indicates that the crop diversification was highest (almost 24%) during Period-1, *i.e.,,* 2001-03, whereafter it has gone down to the level of almost 18%. So, in nutshell a decline of 6% of diversity was experienced from 2001-2020, leading to harmful effect on the farmer's economy. Similarly for Northern hills of Chhattisgarh SI indicates that the crop diversification was highest (almost 41%) during Period-1, *i.e.,* 2001-03, whereafter it has gone down to the level of almost 35%. So, in nutshell a decline of 6% of diversity was experienced from 2001-2020, leading to harmful effect on the farmer's economy.

References

1. Acharya SP, Basavaraja H, Kunnal LB, Mahajanashetti SB, Bhat ARS. Growth in area, production and productivity of major crops in Karnataka. Karnataka Journal of Agricultural Science. 2012;25(4):431-436.
2. Anonymous. Pocket Book on Agricultural Statistics Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India; c2016. p. 26-32, 66-73.
3. Anonymous. Assistant Director of Agriculture, Govt. of Chhattisgarh; c2020.
4. Anonymous. District Statistical Book of Chhattisgarh, Govt. of Chhattisgarh; c2021.
5. Anupama J, Sahu RM, Yogita K. Decomposition analysis of major cereal crops in different agroclimatic regions of Chhattisgarh. International Journal of Chemical Studies. 2019;7(6):2198-200.
6. Lama M. Crop Diversification and Farm Income in the Hills of North East India: A Case of Arunachal Pradesh. International Journal of Food, Agriculture and Veterinary Sciences. 2016;6(2):15-21.
7. Mahesh P, Deepa NR. Trend Analysis of Area, Production and Productivity of Rice in Kerala in the Context of Food Security. International Journal of Agricultural Research and Review. 2016;4(8):539-546.
8. Meena MD, Lal G, Meena SS. Market arrivals and price behavior of coriander seeds in Rajasthan, India. International Journal of Seed Spices. 2020;10(1):27-38.
9. Mishra VK. Impact of Globalization on the Area, Production and Yield of the Food grains in India. Third International Conference on Science, Technology and Management. 2016;74(6):36-43.
10. Mithiya D, Mandal K, Dutta L. Trend, pattern and determinants of crop diversification of small holders in West Bengal: A district-wise panel data analysis. Journal of Development and Agricultural Economics. 2018;10(4):110-119.
11. Narmadha, Kandeepan. Performance of Major Millet Crops in Tamil Nadu: An Economic analysis. Indian Journal of Economics and Research. 2017;6(5):351-360.
12. Puneet D. Time series modelling for forecasting of food grain production and productivity of India. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):476-82.
13. Ruchi. Food grains in India: Growth, instability and decomposition analysis. International Journal of Multidisciplinary Research and Development. 2017;4(6):304-308.
14. Sharma A. Trends in Area, Production and Productivity of Food Grain Crops: An Overview. Economic Affairs. 2013;58(1):1.
15. Vani NR. Trends and determinants of crop diversification in Chikkaballapur District of Karnataka: An Economic Analysis. Journal of Research in Agriculture and Animal Science. 2021;16-21.
16. Sen S, Ganguly S. Opportunities, barriers and issues with renewable energy development–A discussion. Renewable and sustainable energy reviews. 2017 Mar 1;69:1170-1181.