Concentration and Diversification of Crops in Ambedkar Nagar District of Uttar Pradesh, India

ABSTRACT

People have relied on agriculture as their primary source of income all over the world. More than half of the population of India depends on agriculture for employment and livelihood. Uttar Pradesh is the largest producer of food grains because of its fertile Gangetic plains, canal irrigation, and government and private tube wells. Social, economic, political, and technological factors also decide crop production in different parts of the state. In this study, calculation and analysis of crop concentration and crop diversification in Ambedkar Nagar district have been done for 2000 and 2018 to investigate the changing relations between land, humans, and the environment. Crop concentration is calculated using Jasbir Singh's method, whereas crop diversification is calculated using the Gibbs and Martin method. Crop concentrations of crops like rice, wheat, and pulses are increasing, while crop concentrations of sugarcane are decreasing. Crop concentration in Ambedkar Nagar district shows changing trends from 2000 to 2018, crop diversification also follows the same pattern. The high crop concentration of food crops and the high crop diversification index show that agriculture is still the primary occupation and source of income and livelihood in the district.

Keywords: crop concentration, crop diversification, economy, food crops, livelihood.

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1. INTRODUCTION

Agriculture is the backbone of the Indian economy. The people of India heavily depend on agriculture and allied activities. Even today, as secondary and tertiary sectors are growing, the importance of Indian agriculture and the dependency of the population on this sector have been maintained from independence until now. In the initial years of independence, agriculture contributed more than 50% of the Indian GDP, but now, agriculture and its allied sectors contribute 17.80% of the GDP/GVA for the year 2019–20 (at current prices) [14]. India's 54.6% workforce is still engaged in agriculture and allied activities [15]. The nature of Indian agriculture is closely related to high crop concentration and a high degree of crop diversification. This is because of the growing population and the continuous decline in size of land holdings, fragmentation of farms, etc., so the farmers' needs are well met by high

crop concentration and diversification. Both concentration and diversification are helpful for proper agricultural land use.

Crop diversification simply refers to growing a variety of crops in the agricultural field at a given point in time. In general, crop diversification, a process that takes into account the different returns from value-added crops with competing marketing prospects, is the addition of new crops or growing techniques to agricultural production on a specific field. Pingali and Rosegrant (1995) [9] have defined crop diversification as "change in product choice of input based on market forces and the principle of profit maximization." Diversification means raising a variety of crops. Crops are diversified in the field due to the erratic nature of rainfall and insufficient irrigation [13]. This diversification suits the needs and resource endowments of small landholders [6]. It mainly depends on physio-climatic, social, economic, and technological factors. Crop diversification has the opposite effect of crop specialisation. Small landholder farmers try to grow several crops in their fields in an agricultural year. According to Saikia and Bhagyalakhi (2017) [11], agricultural diversification is a process in which farmers change their farm activities or crop patterns from low- to high-value commodities or farm enterprises. The crop diversification formula given by Bhatia, 1965, Jasbir Singh 1976, Gibbs, and Martin, 1962 [1, 12, 4], and many others. The greater the number of crops, the greater the competition, and the higher the magnitude of diversification [2]. In Indian conditions, crop diversification is a common phenomenon because the farmers try to satisfy most of the family's demands on their own land, resulting in crop diversification [8]. There is obvious competition among crops for space. It is obvious that the larger the number of crops in a combination, the greater the degree of diversification [7].

The term "crop concentration" simply refers to the variation in crop density in a given area at a given time. The terrain, temperature, moisture, and soil environment of a region have a significant impact on the concentration of a crop. The concentration of a crop in a geographical area largely depends on regional economic, socio-political, and technological factors [10]. It has a tendency to have a high concentration in areas of ideal agro climatic conditions, and the density declines as the geographical conditions become less conducive [5]. There is an ideal, optimum, and lowest temperature for each crop. It tends to be concentrated heavily in locations with the best agro-climatic conditions, and its density decreases as the terrain becomes less favourable. The crop concentration aids in identifying the region where a specific crop grows well even with the use of few inputs, and as a result, it has substantial planning implications for the growth of agriculture. The concentration of a crop in a given geographical area largely depends on the region’s geographical, economic,

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political, social, and technological factors [10]. Crop concentration measures the density of individual crops in an area at a given point in time. In the field of crop concentration, pioneering work has been done by Florence, 1948, Bhatia,1965, Jasbir Singh, 1976, and others [3, 1, 12]. Several scholars have applied the location quotient method to determine the degree of crop concentration in a particular study area, which is the most common method for the analysis of crop concentration. Crop concentration and diversification contributed to high production for the Indian people and economy.

Primary objective of the present study is to investigate, and calculate the crop concentration and crop diversification in Ambedkar Nagar District and also to analyse the effect of both in the District and conclude about the changing nature of agriculture.

1.1 Study Area

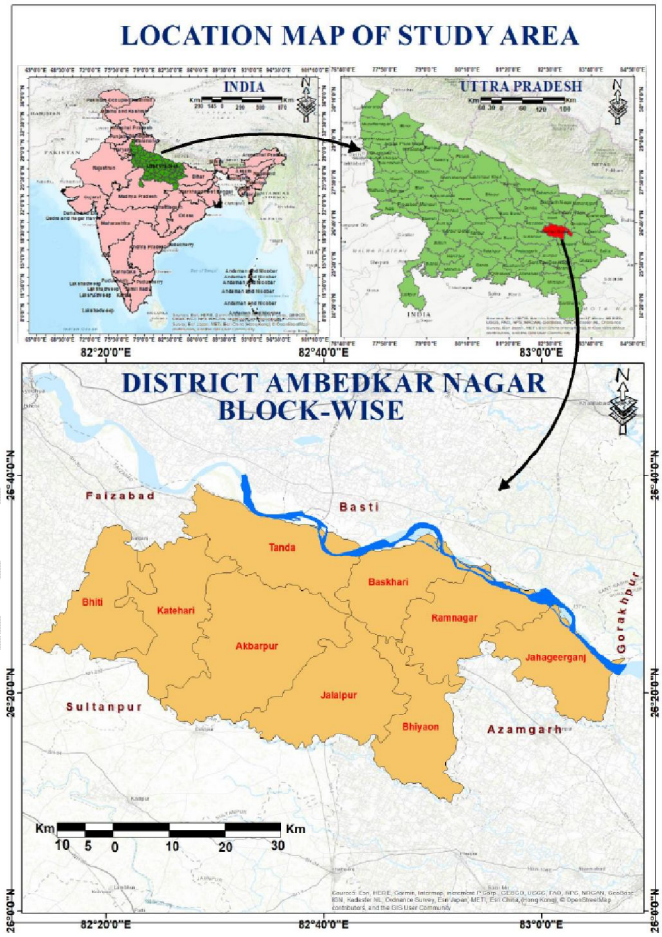

Fig. 1. Location Map of Study Area

Source: NATMO (National Atlas and Thematic Mapping Oranisation)

Ambedkar Nagar district is situated in the eastern part of Uttar Pradesh. The district is located between the latitudes of 26° 09' and 26° 40' North and 82° 12' to 83° 09' East longitudes (Fig.1). The geographical area of the district is 2350 sq. km. Akbarpur, the district headquarter, is also a tehsil and a block. There are 2397888 people living in the district, according to the 2011 census [15].

2. METHODOLOGY

The current study is based primarily on secondary data that was gathered from a variety of sources, including the district statistics magazine, district survey report, and district census guidebook. In this study crop concentration is calculated using Jasbir Singh's method whereas crop diversification is calculated using the Gibbs and Martin method.

Formula used are:

A. According to Jasbir Singh Method, 1976

$$Crop\ Concentration\ Index = \frac{Area\ of\ particular\ crop\ in\ the\ unit}{Total\ cropped\ area\ in\ the\ unit\ area} \div \frac{Area\ of\ particular\ crop\ in\ the\ region}{Total\ cropped\ area\ in\ the\ region}$$

(in this "Location Quotient Method of Crop Concentration" high value represent the high concentration and the low value shows the low crop concentration).

B. According to Gibbs and Martin Method, 1962

$$Crop\ Diversification\ Index = 1 - \sum X^2 / (\sum X)^2$$

(in Gibbs and Martin method, crop diversification index value ranges from 0 to 1.
'1' shows the higher index value means higher crop diversity and '0' shows the less diversity).

3. RESULTS AND DISCUSSION

3.1 Crop Concentration and Diversification in the Year 2000

The crop concentration is calculated blockwise for the main crops like rice, wheat, pulses, and sugarcane. Table 1 and Fig. 2 shows the high concentration of rice in four blocks, more than one of which was in Katehari, Akbarpur, Tanda, and Ramnagar in the year 2000. In the

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same year, Jahaheerganj had the lowest rice crop concentration. Bhiyaon, Jalalpur, Bhaskhari, and Bhiti, also have crop concentrations less than one.

In the year 2000, five blocks performed better in wheat crop concentration, which was more than one, in blocks Jahageerganj, Jalalpur, Ramnagar, Baskhari, and Bhiyaon. The four blocks that perform less than one wheat crop concentration are Bhiti, Tanda, Akbarpur, and Katehari (Table 1 and Fig. 2)..

According to the Table 1 and Fig. 2 in the year 2000, four blocks had pulse production more than one crop concentration, which are Bhiti, Tanda, Jahageerganj, and Bhiyaon blocks. The crop concentration of pulses lower than one was found in five blocks, namely, Ramnagar, Katehari, Akbarpur, Jalalpur, and Baskhari.

A high sugarcane crop concentration of more than one was found in five blocks in 2000. Bhiyaon had the highest crop concentration, followed by Jahageerganj, Bhiti, Jalalpur, and Ramnagar, respectively. Four blocks had low crops, i.e., less than one in Baskhari, Tanda, Katehari, and Akbarpur blocks, respectively, in 2000 (Table 1 and Fig. 2).

The given Table 4, 5 and Fig. 4 show the higher crop diversification in the Ambedkar Nagar district, covering all 9 blocks in the year 2000. As per the data highest crop diversification was in Bhiti block (0.688) and lowest in Katehari block (0.636).

Table 1. Crop Concentration Index in Ambedkar Nagar District, 2000 (in%)

Blocks	Rice	Wheat	Pulses	Sugarcane
Bhiti	0.98	0.92	1.19	1.26
Katehari	1.08	0.99	0.92	0.68
Akbarpur	1.07	0.97	0.97	0.74
Tanda	1.03	0.96	1.08	0.58
Baskhari	0.97	1.02	0.99	0.81
Ramnagar	1.02	1.03	0.81	1.06
Jahageerganj	0.80	1.12	1.06	1.44
Jalalpur	0.97	1.05	0.98	1.19
Bhiyaon	0.94	1.00	1.06	1.72
District	**40.47**	**41.34**	**5.52**	**3.92**

Source: Computed by the author

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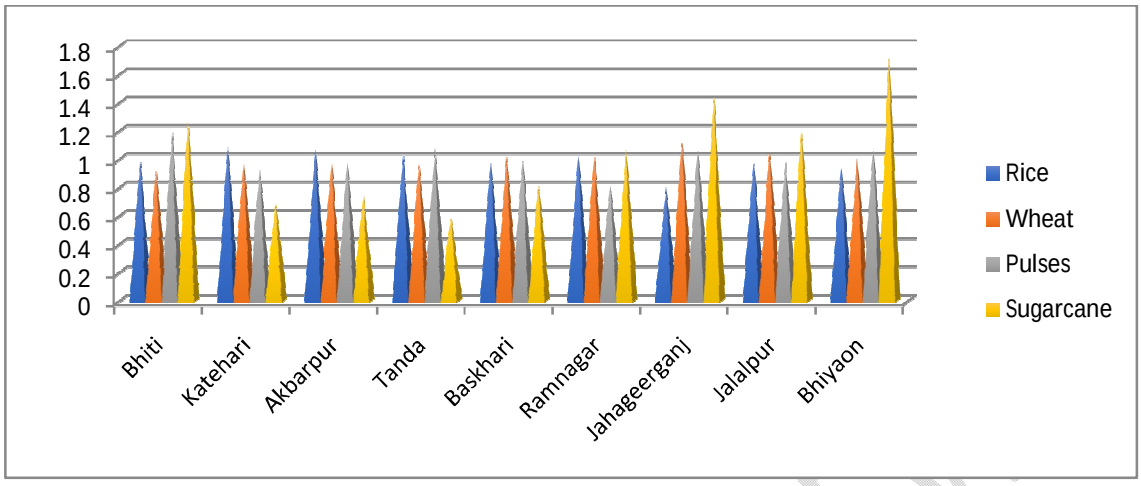

Fig. 2. Trends of crop concentration, 2000

3.2 Crop Concentration And Diversification in the Year 2018

In the year 2018, Bhaskhari showed the highest rice crop concentration, which is more than one; Tanda, Jahageerganj, Ramnagar and Jalalpur performed well and had more than one rice crop concentration, respectively (i.e., in five blocks). The Bhiyaon block has the lowest crop concentration, with other blocks performing less than one rice crop concentration are Bhiti, Katehari, and Akbarpur respectively (Table 2 and Fig. 3).

In 2018, seven blocks had more than one wheat crop concentration: Akbarpur, Bashkari, Bhiyaon, Jahageerganj, Ramnagar, Katehari, and Tanda. Only two blocks performed less than one crop concentration, i.e., Bhiti and Jalalpur blocks (Table 2 and Fig. 3).

In 2018, the crop concentration of pulses was more than one in six blocks, namely, Bhiti, Tanda, Bhiyaon, Katehari, Akbarpur, and Baskhari. In 2018, the crop concentration was less than one was in Jahageerganj, Ramnagar, and Jalalpur blocks (Table 2 & Fig. 3).

In 2018, the highest sugarcane crop concentration was found in three blocks, namely, Bhiyaon, followed by Bhiti, Jalalpur, and Akbarpur, i.e., sugarcane crop concentration was more than one in four blocks. But low crop concentration, i.e., lower than one, was in five blocks in the year 2018, namely Baskhari, Katehari, Ramnagar, Tanda, and Jahageerganj (Table 2 and Fig. 3).

All nine blocks of the Ambedkar Nagar district in 2018 show the same trend of high crop diversification, i.e., more than 0.6 but at the individual block level few changes are also

visible. The highest crop diversity was in Bhiti (0.87) and lowest in Jahageerganj (0.629) (Table 4, 5 and Fig. 4).

Table 2. Crop Concentration Index in Ambedkar Nagar district, 2018 (in%)

Block	Rice	Wheat	Pulses	Sugarcane
Bhiti	0.93	0.92	1.75	1.48
Katehari	0.99	1.00	1.28	0.75
Akbarpur	0.99	1.03	1.17	1.03
Tanda	1.03	1.00	1.33	0.95
Baskhari	1.04	1.03	1.07	0.57
Ramnagar	1.02	1.00	0.76	0.90
Jahageerganj	1.03	1.01	0.73	0.99
Jalalpur	1.02	0.99	0.90	1.17
Bhiyaon	0.85	1.03	1.31	1.97
District	42.23	41.78	3.69	3.88

Source: Computed by the author

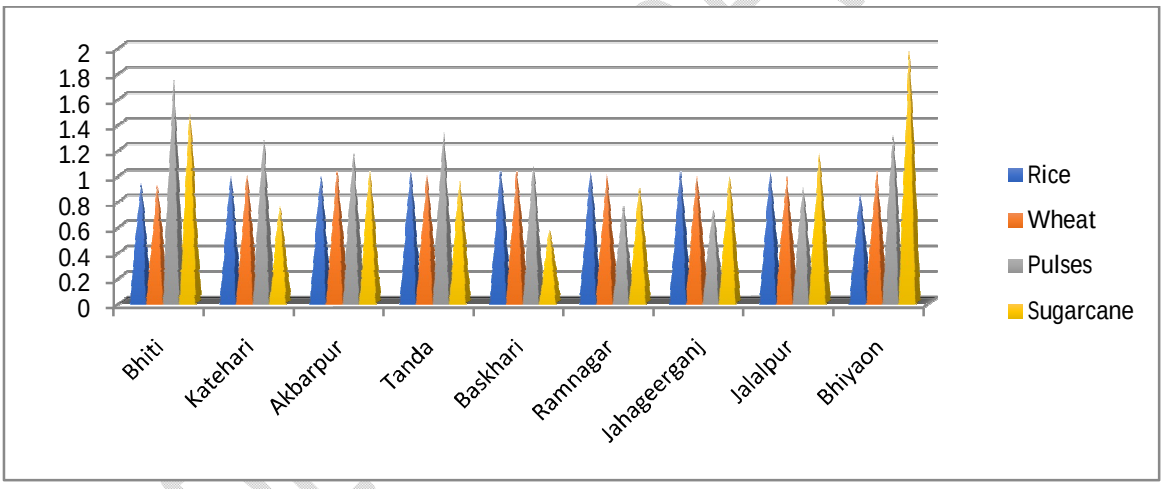

Fig. 3. Trends of crop concentration, 2018

Table 3. Calculation of Gibbs and Martin Index for Crop Diversification, 2000

Blocks	Rice	Wheat	Pulses	Sugarcane	Vegetable	Potato	Total	Percentage $1-\sum X^2/(\sum X)^2$
Bhiti	1585.632	1446.281	43.033	24.304	13.690	2.433	3115.375	0.688
Katehari	1917.564	1687.566	25.806	7.128	5.198	1.537	3644.802	0.636
Akbarpur	1877.489	1598.400	28.515	8.352	5.760	3.385	3521.903	0.648
Tanda	1735.556	1580.858	35.640	5.107	11.155	4.708	3373.026	0.663
Baskhari	1545.276	1774.094	29.593	10.176	4.840	7.236	3371.216	0.663
Ramnagar	1709.823	1800.305	20.160	17.222	1.440	3.276	3552.226	0.645
Jahageerganj	1051.056	2126.132	34.105	31.696	6.002	1.822	3250.816	0.675

Jalalpur	1542.918	1867.968	29.376	21.808	3.385	4.622	3470.080	0.653
Bhiyaon	1621.673	1701.563	34.222	41.860	3.062	3.496	3405.878	0.659

Source: Computed by the author

Table 4. Value of Gibbs and Martin Index in Ambedkar Nagar

Blocks	Year (2000)	Year (2018)
Bhiti	0.688	0.687
Katehari	0.636	0.644
Akbarpur	0.648	0.636
Tanda	0.663	0.630
Baskhari	0.663	0.619
Ramnagar	0.645	0.637
Jahageerganj	0.675	0.629
Jalalpur	0.653	0.640
Bhiyaon	0.659	0.679

Source: Computed by the author

Table 5. Range of Gibbs and Martin Index

Categories	Range of Gibbs and Martin Index	No. of Blocks
Low	<0.40	0
Medium	0.40-0.60	0
High	>0.60	9

Source: Based on Gibbs and Martin Index (GMI), 1962

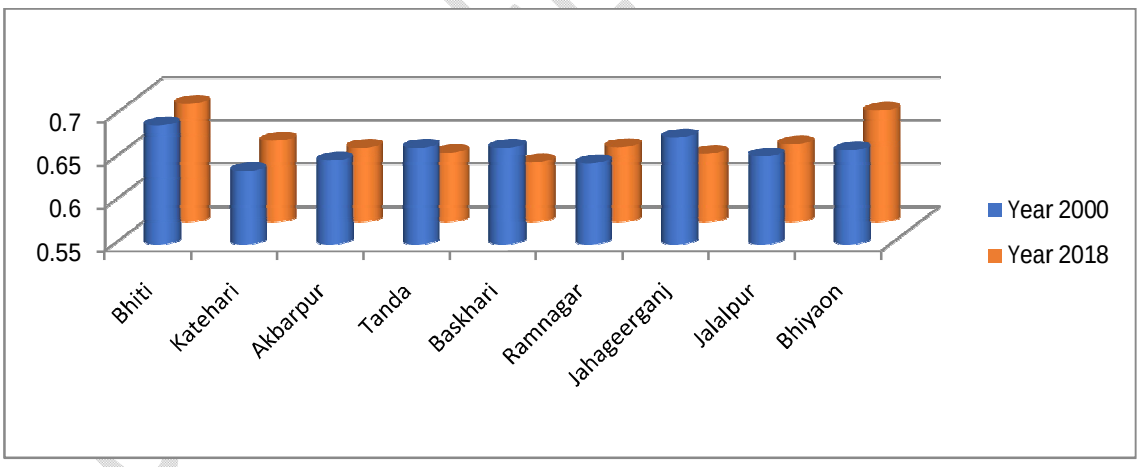

Fig. 4. Values of Gibbs and Martin Index (GMI)

3.3. Analysis of Crop Concentration and Diversification (2000-2018)

From the above results and discussion, it is clear that in 2000, high crop concentrations (i.e., more than one) of rice were found in only four blocks, which increased to five blocks in 2018. Crop concentrations (more than one) of wheat increased from five blocks in 2000 to seven blocks in 2018. The same is the case

with pulse, as crop concentration of pulse was higher than one in four blocks in 2000, which increased to six blocks in 2018. While the sugarcane crop concentration was higher than one in five blocks in 2000, it was reduced to only four blocks in 2018.

It simply means the farmer in Ambedkar Nagar district tries to grow several crops in his fields. Generally, higher diversification shows the poor development of agricultural technology and various other components like erratic weather, a lack of labour, fertilisers, etc. Data depict that the concentration of sugarcane is reducing while rice, wheat, and pulses, i.e., food crops, are increasing in 2018.

On the other side, crop diversification of all crops remained high in both 2000 and 2018, (i.e., more than 0.6) but at the individual block level, crop diversification in blocks Katehari and Bhiyaon has increased while decreasing in blocks Bhiti, Akabarpur, Tanda, Baskhari, Ramnagar, Jahageerganj, and Jalalpur from 2000 t0 2018. It simply means the farmer in Ambedkar Nagar district still tries to grow several crops in his fields. Crops like rice and wheat are covering more area, while areas under maize, barley, mustared, and other coarse cereals are reducing. Generally, higher diversification shows the poor development of agricultural technology and various other components like erratic weather, a lack of labour, fertilisers, etc.

4. Conclusion

The analysis of crop concentration in Ambedkar Nagar district reflects the result that rice, wheat, and pulses were the most concentrated crops in the district in 2018, while the crop concentration of sugarcane decreased from 2000 to 2018. Thus, it may be concluded that the economy of the population revolves mainly around food crops like rice, wheat, and pulse crops. The high level of crop diversification in both 2000 and 2018 shows very little crop specialisation in the study area, but at the individual block level changes are clearly visible which means that livelihood farming is still dominant in the Ambedkar Nagar district and a very few signs of crop specialization may be also traced and that still people practice agriculture mainly to sustain their lives and fulfil their daily food needs.

Hige crop diversification in the district is happening due to the insufficient and erratic nature of rainfall, the changing nature of agro-climatic conditions, the lack of finance to the farmers, poor agricultural tools, technology, and infrastructure, etc.

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