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## Crop Diversification and Its Role in Strengthening Food Security in India

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**Abstract:** In a country where agriculture is the primary economic activity, the contentious question that arises is whether or not to pursue crop specialisation or diversification in order to make the most efficient use of resources and to demonstrate economies of scale. According to the findings of a number of studies, crop diversity has a substantial impact on food security and offers a wide range of food options. These food options include grains, a variety of proteins and minerals, as well as a wide range of vegetables and fruits. According to the findings of the study, there were no significant connections between the diversification of crop types and the assurance of adequate nutrition. On the other hand, there are a few states, such as Haryana and Punjab, that demonstrate a high level of diversification in addition to developing a study paper on food security. Diversification is present in some states, such as Maharashtra and Gujarat, although these states do not have a considerable level of food security.

**Key words:** Specialisation, Diversification, Food Security, Income, Purchasing power

### Introduction

Over the past few decades, the agricultural industry of India has been undergoing a significant transformation, shifting from a traditional cropping pattern to a high-value cropping pattern. Additionally, the economy has undergone a shift in the pattern of consumption, which has shifted away from conventional grains and towards vegetables and fruits that are richer in nutrients. It is vital that India engage in agricultural diversification in order to guarantee faster production growth, a high level of farm revenue, the generation of employment opportunities, and sustainable development. In his research, Von Braun made the observation that diversification may be utilised as a tool to boost the income of farmers, to expand employment opportunities, to reduce poverty, and to improve the conservation of natural resources in order to preserve ecological balance. In recent years, the agricultural sector has been confronted with a number of challenges, including the reduction of agricultural land holdings as a result of urbanisation, the rise in population, and the alteration of consumer food habits. As a result of all of these challenges, farmers are working hard to incorporate additional high-value crops into their cropping pattern. A very unequal and unsteady route has been followed by the agricultural sector in India, and there have been observed regional inequalities in the growth pattern. The growth performance of the agricultural sector in India is inconsistent. For the purpose of formulating specialised agricultural strategies, it is essential to determine the extent of the probe diversification that occurs at the administrative level. A variety of agricultural diversification strategies have been used in a variety of states to varying degrees. As a result, it is necessary to do research on the cropping pattern that is also present at the state level. Additionally, it is essential to determine the factors that determine crop diversification as well as the limitations that it imposes.

## A conceptual framework of Food Security and Diversification in Cropping Pattern

Increasing the variety of crops that are grown could have an effect on the availability of food, such as the development of livestock and vegetable products that contain organic nutrients that can be extracted from them. There is a direct and beneficial connection between crop diversification and food security, according to research that have been conducted on the threat. The cultivation of high-value crops in order to provide farmers with a substantial portion of revenue, which in turn increases the purchasing power of households, allowing them to purchase more food and ensuring that food is affordable. One of the ramifications of crop diversity is that it can improve farm income, provide food security, and help address challenges related to poverty. According to Joshi (2013), the diversification of cropping patterns towards high-remunerative crops has a significant impact on the purchase power of farmers as well as the affordability of agricultural products.

### Methodology

The study makes use of secondary data in order to investigate the extent of crop diversification and the impact that it has on the protection of food supplies in India. The data is secondary and collected from a variety of sources, including agricultural censuses, economic surveys, the handbook of statistics on the Indian economy published by the Reserve Bank of India (RBI), and statistical abstracts. Through the utilisation of the Simpson diversity index, proper diversification has been verified. Here, D represents the Simpson index, and p represents the proportional percentage of each crop's gross cropped area.

$$D = 1 - \sum_{i=1}^N (p_i)^2$$

The index is a representation of values that range from zero to one. A number of zero for the index implies that there is total specialisation of the cropping pattern, while a value of one suggests that there is perfect diversification and complete specialisation.

**Food security index:** The three aspects of food security are utilised in the research process to measure food security. The availability of food is indicated by the per capita readiness of food in various states of India, which comes under the first component, which is the accessibility of food. The second component is the cost-effectiveness of food. In order to determine whether or not food is affordable, an indicator that was used was the percentage of households that were above the poverty line. The third component, which is the usability of food, is evaluated for its contribution to food security by employing measures that measure the percentage of families that have access to adequate sanitation facilities.

Individual Component Index =  $d_i = \frac{\text{Actual} - \text{Minimum}}{\text{Maximum} - \text{Minimum}}$  (i = 1, 2, 3.... n) where Actual is equal to true value of component i, Minimum is equal lower limit for component i, Maximum is equal to upper limit of component i. Food security index is calculated with the use of Euclidian distance formula as follows:

$$IFS = \sqrt{\frac{(1-d_1)^2 + (1-d_2)^2 + (1-d_3)^2}{3}}$$

Value of IFS lies between zero to one. Zero means there is most insecure region in terms of

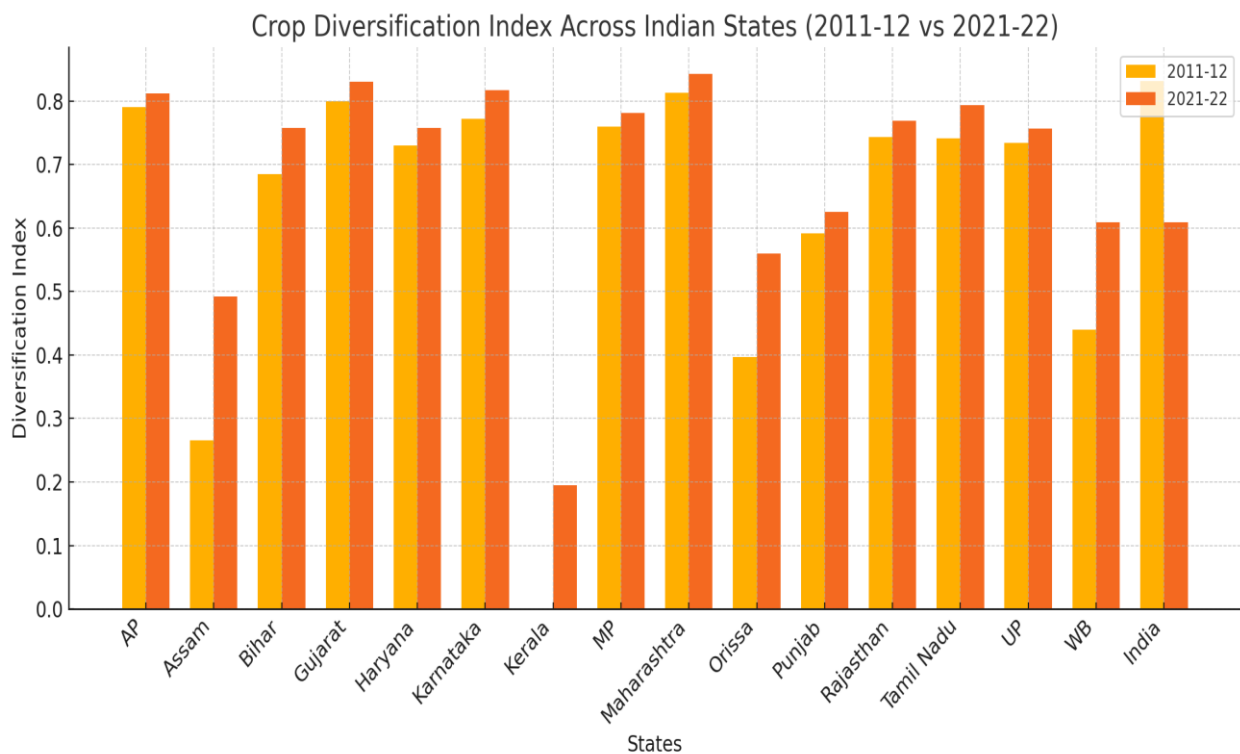
food security and one means most secure region.

**Table no. 1: - Year Wise Simpson Index of Major States**

State	Diversification Index (2011-12)	Diversification Index (2021-22)
AP	0.791	0.812
Assam	0.266	0.492
Bihar	0.685	0.758
Gujarat	0.800	0.830
Haryana	0.730	0.758
Karnataka	0.772	0.817
Kerala	0.000	0.195
MP	0.760	0.781
Maharashtra	0.813	0.843
Orissa	0.397	0.560
Punjab	0.592	0.625
Rajasthan	0.743	0.769
Tamil Nadu	0.741	0.794
UP	0.734	0.757
WB	0.44	0.609
India	0.832	0.609

Source: Agriculture Statistics at a Glance 2021.

**Figure no. 1: - Year Wise Simpson Index of Major States**



NOTE: AP = Andhra Pradesh, MP= Madhya Pradesh, UP- Uttar Pradesh

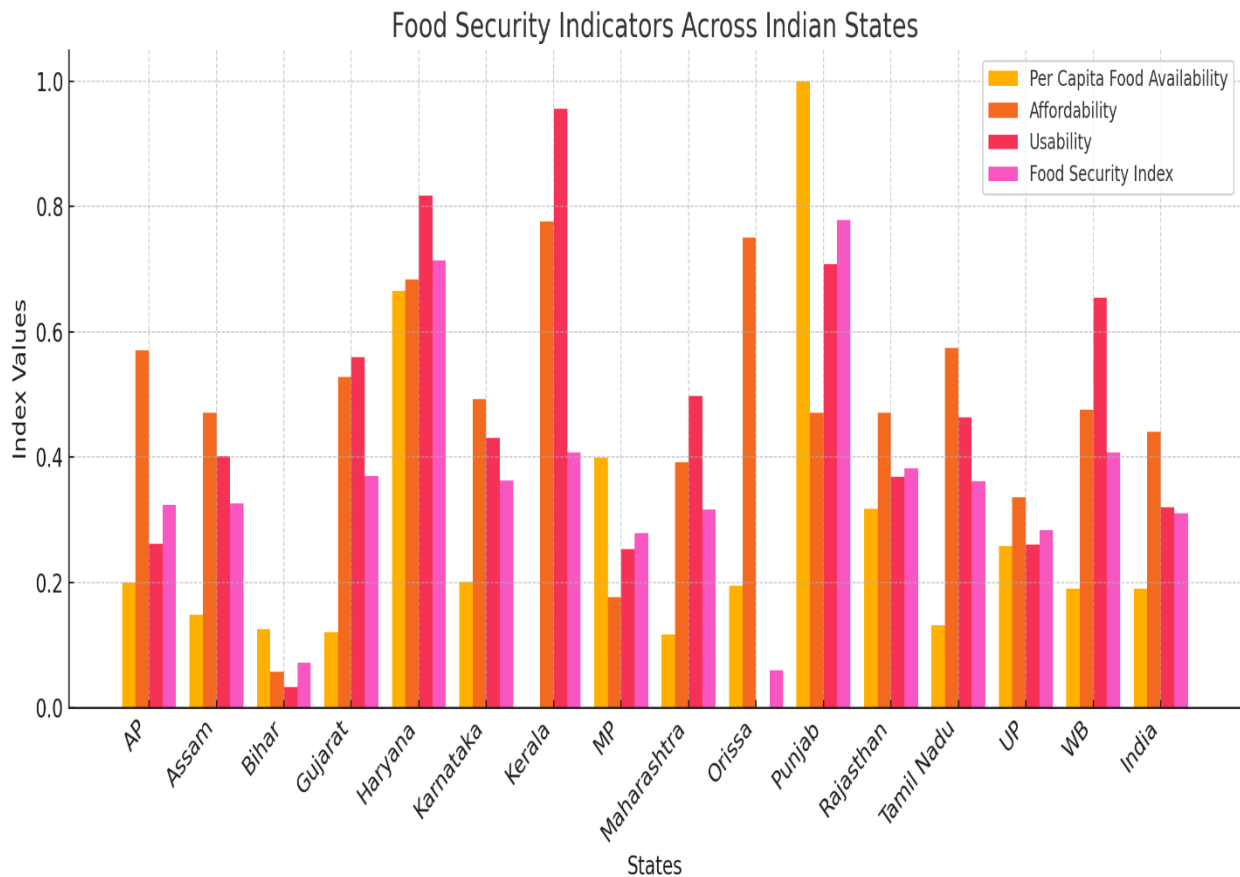
Fig 1 This article provides a straightforward explanation of the relationship between the diversity index and food security among the primary states of the nation. The data presented in the figure makes it abundantly evident that crop diversification is not the only factor that determines the degree of food security. There are just a few states, such as Punjab and Haryana, that have demonstrated a favourable influence of crop diversification on the issue of food security. This indicates that the level of food security in these states is higher, and that growing levels of crop diversification are contributing to this. Therefore, the visual evidence demonstrates that there has been an empirical relationship between the two in question. The value of the Pearson correlation coefficient is - 0.05332, which is a negative value. It can be deduced from the value of r that there is an inverse relationship between the diversification of crop types and the assurance of food supply.

**Table no. 2: - Food Security Index of States**

States	Per capita food availability	Affordability	Usability	Index of Food Security
Andhra Pradesh	0.2	0.570	0.262	0.324
Assam	0.149	0.471	0.402	0.326
Bihar	0.125	0.057	0.033	0.0715
Gujarat	0.121	0.528	0.56	0.370
Haryana	0.665	0.683	0.817	0.714
Karnataka	0.201	0.493	0.430	0.362
Kerala	0.000	0.776	0.956	0.407
Madhya Pradesh	0.399	0.177	0.253	0.278
Maharashtra	0.117	0.392	0.498	0.316
Orissa	0.195	0.75	0	0.060
Punjab	1	0.471	0.708	0.778
Rajasthan	0.318	0.471	0.369	0.382
Tamil Nadu	0.132	0.574	0.464	0.361
Uttar Pradesh	0.258	0.336	0.260	0.284
West Bengal	0.19	0.475	0.654	0.408
India	0.19	0.44	0.32	0.31

Source: Authors work based on Manual of statistics, Economic survey and Department of drinking water and Public health, baseline survey.

**Figure no. 2: - Food Security Index of States**



The information shown in Table 2 illustrates that a composite index of food security at the state level is comprised of three various aspects of food security: availability, affordability, and usability. There are significant agricultural states such as Punjab and Haryana that exhibit a high value of index, which is 0.778 and 0.714 respectively. This value is significantly higher than the value of the country index. Assam, Bihar, Orissa, and Madhya Pradesh are examples of states that are significantly different from the national average. The states of Andhra Pradesh, Karnataka, and Maharashtra have a poor level of food security, despite having a higher level of diversification in their agricultural production. In light of this, it may be concluded that the level of relationship between these two indexes is limited.

**Conclusion**

The purpose of this study is to investigate the connections that exist between crop variety and improved food security. The conclusion that can be drawn from this is that there is a significant amount of diversity in the value of the indexes. Certain states, such as Punjab and Haryana, have greater values for both indices. However, Maharashtra and Orissa have a higher level of agricultural diversification, while having a lower level of food security. According to the findings, there is not a substantial amount of data that supports the idea that there is a connection between these two variables. However, there is a statistically significant positive association between food security and agricultural diversity in certain states. a method by which farmers can use crop diversification as a means of ensuring that their crops' nutritional needs are met.

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