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Change in Cropping Pattern in India: A Four Decades Analysis

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Abstract

Over the past four decades, India's cropping pattern has experienced profound structural changes, with crop diversification emerging as a defining feature. These transformations, spanning the period 1980–81 to 2023–24, have been driven by a combination of economic reforms, climatic variability, technological advancements, and policy interventions. A marked shift has occurred from a cereal-centric production system toward a more diversified agricultural base that increasingly includes horticultural crops, pulses, oilseeds, and other commercial crops. The study highlights the role of government initiatives, innovations in agricultural technology, and changing climatic conditions in shaping these dynamics. To investigate the determinants of diversification, explanatory variables such as percentage of irrigated area (PIA), road density (RD), agricultural credit (AC), and fertilizer use per hectare (FUPH) are examined. These infrastructural and technological factors together explain the evolving trajectory of cropping patterns across India.

Keywords: Cropping pattern, crop diversification, agricultural credit, road density.

INTRODUCTION

Agriculture is one of the most important sectors of the Indian economy, providing both food and jobs while contributing to the country's GDP. In the past forty years, the types of crops grown in India have changed a lot. These changes have been shaped by new farming technologies introduced during the Green Revolution, government policies, open markets, changing weather patterns, and consumer demand. In West Bengal, these shifts are especially noticeable because of the state's climate, soil, and social conditions.

Crop diversification growing a wider variety of crops instead of relying only on a few has become very important for India's growth. Changing the mix of crops is often seen as a sign of progress in farming. Since the 1960s, farmers across India have been moving away from food-grain crops toward non-food crops like vegetables and cash crops (Pandey & Sharma, 1996; Vyas, 1996). By the 1980s, crops such as potatoes, oilseeds, and sugarcane expanded rapidly in terms of the land area cultivated (Chand *et al.,* 2008). India attained self-sufficiency in food grain production by the late 1970s, marking a major milestone in its agricultural development. However, this achievement also prompted a policy shift towards diversification, leading to a gradual decline in the area under cereal cultivation after 1983–84. From the early 1990s onward, diversification towards horticulture gained significant momentum.

The *West Bengal Human Development Report* (2004) highlights a steady trend of crop diversification in the state since 1985. In line with the all-India pattern, West Bengal also experienced a marked shift towards horticultural crops from the early 1990s. Between 1990–91 and 2005–06, fruits and vegetables accounted for about 13 percent of the cultivated area in West Bengal second only to Orissa, where the share was 15.37 percent. Moreover, in both Orissa and West Bengal, the share of fruits and vegetables in the total value of agricultural output reached nearly 46 percent during this period (Chand *et al.,* 2008).

Over the past few decades, India's cropping pattern has undergone a profound transformation. Although the net sown area has remained almost constant, rising food demand driven by population growth and rapid urbanization has placed immense

pressure on agricultural land. This has encouraged more intensive cropping and a gradual shift away from traditional food grains towards commercially lucrative crops. The evidence clearly reflects a structural transformation of Indian agriculture, where the historical dominance of cereals has diminished in favour of high-value crops such as oilseeds, potatoes, fruits, and vegetables.

Objectives:

1. To study the changes in cropping patterns in India over the past forty years.
2. To construct and analyse the Crop Diversification Index for India during this period.
3. To identify and examine the key factors economic, institutional, and socially responsible for the shifts in cropping patterns across the last four decades.

Hypotheses:

1. Cropping patterns and crop diversification in India have undergone significant changes over time.
2. Economic, institutional, and social factors have played a significant role in shaping the changes in cropping patterns in India over the past forty years.

DATABASE AND METHODOLOGY

The present study aims to examine the cropping pattern and crop diversification in India through a comparative analysis. The research is entirely based on secondary data, which has been systematically collected, organized, and analysed to draw meaningful conclusions.

The required data on cropping patterns has been obtained from a variety of official sources, including the *Statistical Abstract of India*, *Handbook of Statistics of Indian States*, publications of the *National Horticultural Board*, reports of the *Ministry of Agriculture, Government of India*, and the *Census of India*.

Correlation and Regression Analysis

To study the interrelationship among variables, both correlation and regression techniques have been employed. A correlation matrix, based on the Pearson correlation coefficient, has been constructed to identify the degree of association between variables. Regression analysis has further been applied as the primary tool to estimate the relationship between dependent and independent variables, thereby providing a more accurate assessment of the underlying dynamics· Crop Diversification Index (CDI)

To measure the extent of crop diversification, the Herfindahl Index (HI) has been utilized (Pattayanayak, 2006). The index is calculated by summing the squares of the acreage proportion of each crop in the total cropped area. Mathematically, it is expressed as:

$$\mathbf{HHI} = \sum_{i=1}^{n} (P_i^2)$$

Where:

- N = total number of crops
- P_i = proportion of the area under the *i-th* crop in the total cropped area

Originally introduced by Theil (1967) to measure regional industrial concentration, the Herfindahl Index in agriculture reflects the degree of concentration in cropping patterns. A value of 1 indicates complete concentration (i.e., monocropping), while a value approaching 0 denotes perfect diversification.

Transformed Herfindahl Index (Crop Diversification Index)

Since the HI measures concentration, it is transformed into a Crop Diversification Index (CDI) by subtracting the HI from 1:

$$\mathbf{CDI = 1\text{-}HI\text{-}}\sum_{i=1}^{n} (P_i^2)$$

This transformation ensures clarity when comparing indices. The CDI increases as diversification rises, reaching a maximum when multiple crops are cultivated, and assumes a value of 0 under complete concentration (i.e., when only one crop is grown).

DISCUSSION AND RESULTS

Changing Cropping Pattern in India (1980–81 to 2023–24)

India's agricultural landscape has witnessed a remarkable transformation in cropping patterns over the past four decades. Although the net cultivated area has remained largely stable, rising food demand driven by rapid population growth, urbanization, and changing consumption habits has exerted considerable pressure on agricultural resources. This has led to more intensive cropping practices and a gradual shift from traditional food grains to commercially lucrative crops. The evidence reflects a structural realignment in Indian agriculture, shaped by evolving market forces, improved irrigation facilities, technological progress, and policy initiatives aimed at promoting diversification.

Decline of Traditional Crops

Traditionally, food grains occupied the largest share of India's agricultural output. However, their relative share in cultivated area has steadily declined. Rice, once the dominant crop (including Aus, Aman, and Boro varieties), fell from 24.52% in 1980–81 to 21.74% in 2023–24. This contraction is linked to high dependence on monsoon rainfall, stagnating yield growth, and the expansion of more remunerative crops. Wheat, despite significant technological gains, has recorded only a modest rise in area from 13.78% in 1980–81 to 14.52% in 2023–24. The limited increase may be explained by regional constraints, competition from alternative crops, and changing dietary preferences favouring diversification. Pulses, a vital source of dietary protein, declined from 14.16% in 1980–81 to 12.68% in 2023–24. Although recent policy measures, such as enhanced Minimum Support Prices (MSPs) and focused research efforts, aim to boost pulse production, they

continue to remain less attractive for farmers compared to cash and high-value crops.

Expansion of High-Value and Commercial Crops

In contrast to the declining trend of traditional food grains, high-value and commercial crops have witnessed remarkable growth in recent decades. Oilseeds, for instance, expanded from 12.14% of the cropped area in 1980–81 to 14.35% in 2023–24. This increase is largely driven by rising domestic demand for edible oils, attractive price incentives, and the introduction of higher-yielding varieties. Government initiatives particularly the National Mission on Edible Oils have further reinforced this upward trend by promoting self-sufficiency in oilseed production.

Potato cultivation presents an even more striking example, with its share of cropped area rising from just 0.51% in 1980–81 to 9.78% in 2023–24. This rapid expansion has been facilitated by improvements in cold storage facilities, stronger market linkages, and growing consumer demand, particularly from urban centres and the processed food sector. Similarly, fruits and vegetables among the most profitable agricultural segments have expanded significantly, rising from 4.79% in 1990–91 to 8.65% in 2023–24. This growth reflects shifting consumer preferences toward diversified diets, improved export prospects, and better supply-chain infrastructure.

Changes in Fiber and Plantation Crops

Plantation crops reveal a mixed picture. Tea, a longstanding pillar of India's agricultural economy, has remained broadly stable, with its share fluctuating between 1.2% and 1.5% over the years. In contrast, jute a once-dominant fiber crop has suffered a steep decline, shrinking from 0.61% of the cropped area in 1980–81 to only 0.38% in 2023–24. The primary reasons include the widespread availability of cheaper synthetic substitutes and changing industrial demand. Other fiber crops such as mesta and cotton have nearly disappeared from the cropping pattern altogether, reflecting similar pressures from synthetic alternatives and shifting market dynamics.

Table 1: Percentage Share of Gross Cropped Area under Different Crops in India, 1980-81 to 2023-24

Crop	1980-81	1990-91	2000-01	2005-06	2010-11	2023-24
Rice	24.52	24.6	26.61	24.7	22.95	21.74
Total Pulses	14.16	14.21	12.11	12.67	14.15	12.68
Wheat	13.78	13.93	15.32	14.98	15.77	14.52
Total Foodgrains	73.59	73.67	72.02	68.81	67.82	60.45
Total Oilseeds	12.14	13.91	13..55	15.76	13.47	14.35
Total Fibers	0.61	0.58	0.62	0.53	0.49	0.38
Potato	0.51	0.6	0.72	0.79	1.01	9.78
Total Fruits & Vegetables		4.79	5.4	7.11	7.94	8.65

Source: Author's analysis based on secondary data from *Hand book of Statistics Indian State (RBI)*

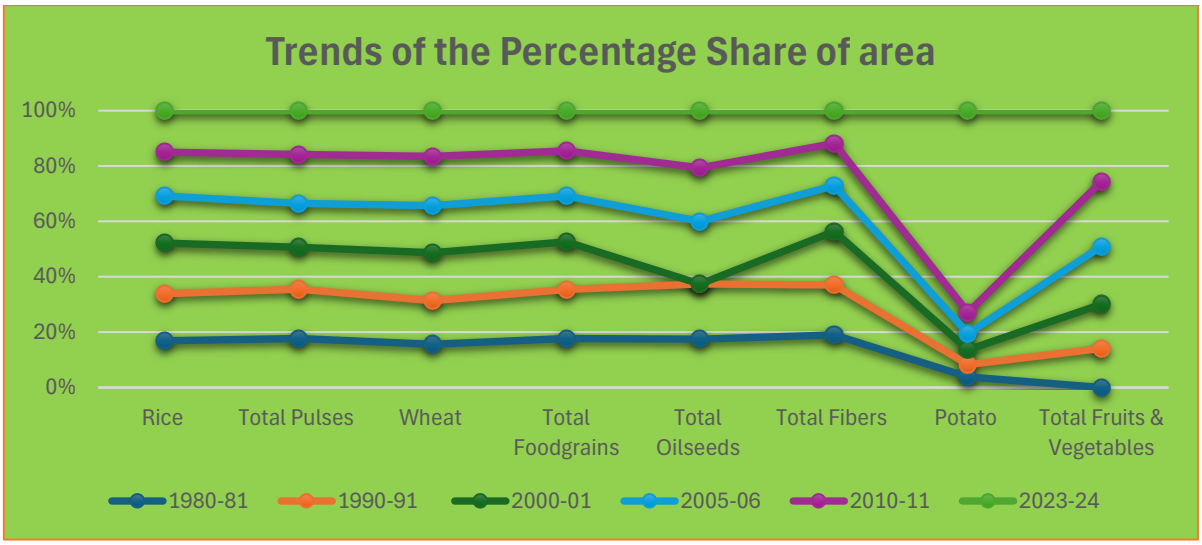

Figure 1: Trends of the Percentage Share of Gross Cropped Area under Different Crops in India, 1980-81 to 2023-24
Source: Author's analysis based on secondary data from *Hand book of Statistics Indian State (RBI)*

Crop Diversification in India:

Crop diversification is an important indicator of agricultural development, reflecting shifts in cropping patterns over time. Analysing diversification trends provides valuable insights into the adaptability of agriculture to economic, climatic, and policy-driven changes.

This study examines the nature of crop diversification in West Bengal in comparison to India as

a whole by constructing a Crop Diversification Index (CDI) and assessing the share of non-foodgrain area across different time periods. Previous studies have highlighted the significance of this shift. For instance, Birthal *et al.,* (2007) emphasized the role of smallholders in driving agricultural diversification towards high-value crops, while Bhattacharyya (2008) noted that West Bengal has gradually moved towards commodities such as fruits, vegetables, and flowers.

The Crop Diversification Index measures the extent of diversification in land use, where a higher value suggests cultivation of a wider range of crops instead of concentration on a few dominant ones. For India, the index showed a consistent upward trend, rising from 0.80 in 1995–96 to 0.82 in 2010–11, and further to 0.84 in 2021–22. This indicates steady progress towards diversification.

In South Asia more broadly, diversification in favour of high-value commodities has been driven by rising per capita income, changes in food consumption patterns, rapid urbanization, and improved infrastructure such as roads. However, as noted by Joshi et al. (2003), the pace of agricultural diversification remained relatively slow across most South Asian countries.

A parallel indicator of diversification is the percentage of total cultivated land under non-foodgrain crops (such as oilseeds, fiber crops, sugarcane, and horticultural crops) as opposed to foodgrains (rice, wheat, and pulses). In India, this share increased significantly, rising from 29.16% in 1995–96 to 35.75% in 2021–22, reflecting a structural shift towards more diverse cropping practices.

To further assess these trends, statistical measures were employed. The average Crop Diversification Index for India stood at 0.8239, with a standard deviation of 0.013. Similarly, the mean share of non-foodgrain area was 31.75%, with a coefficient of variation (CV) of 0.080, indicating noticeable fluctuations in the pace and extent of agricultural diversification.

Table 2: Crop Diversification Index and Percentage of Area under Non-foodgrains in India, 1995-96 to 2021-22

Years	Percentage of Area under Non foodgrains	Crop diversification index
1995-96	29.16	0.8079
1996-97	29.06	0.8076
1997-98	28.59	0.809
1998-99	28.99	0.8134
1999-00	28.4	0.8107
2000-01	27.95	0.8073
2001-02	28.39	0.8126
2002-03	28.72	0.8141
2003-04	28.13	0.8108
2004-05	31.1	0.8142
2005-06	31.19	0.8134
2006-07	30.92	0.8178
2007-08	31.64	0.8206
2008-09	32.01	0.8195
2009-10	32.32	0.8237
2010-11	32.17	0.8266
2011-12	33.24	0.8328
2012-13	34.2	0.8324
2013-14	33.92	0.832
2014-15	33.87	0.8368
2015-16	34.54	0.8289
2016-17	34.8	0.8421
2017-18	33.67	0.8377
2018-19	34.45	0.8423
2019-20	34.85	0.8411
2020-21	35.17	0.8443
2021-22	35.75	0.8478
Mean	**31.75**	**8239**
SD	**2.59**	**0.013**
CV	**0.08**	**0.0001**

Sources: Author's analysis based on secondary data Statistical Appendix India & Hand book of Statistics Indian State (RBI)

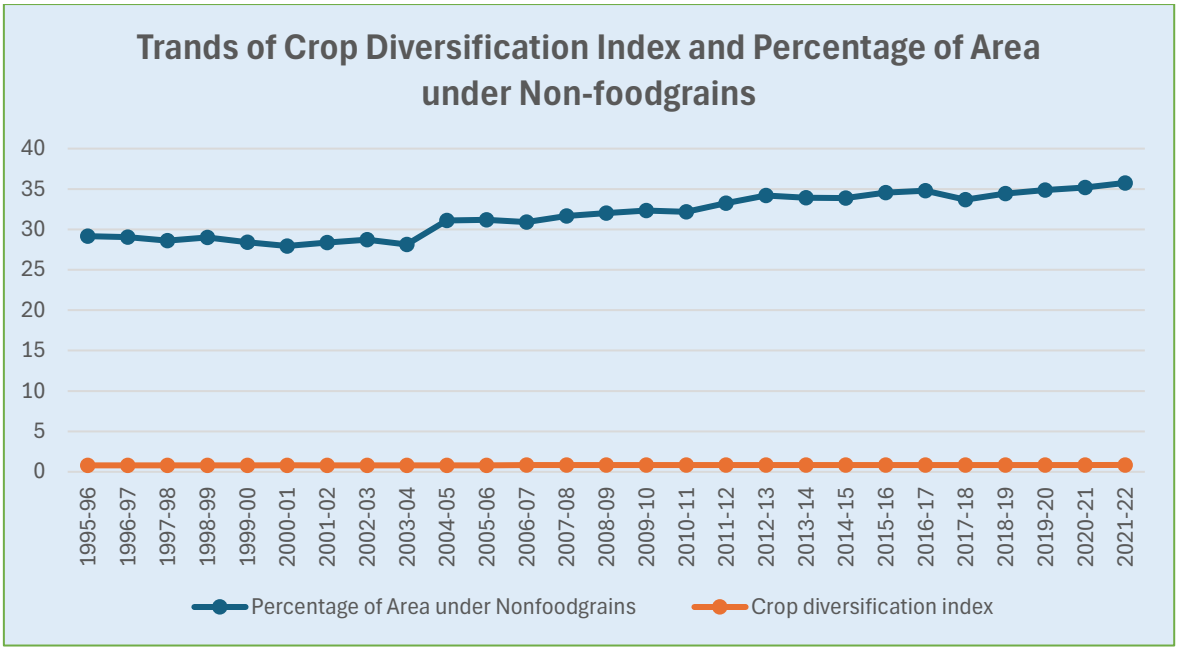

Figure 2: Trands of Crop Diversification Index and Percentage of Area under Non-foodgrains in India, 1995-96 to 2021-22

Sources: Author's analysis based on secondary data Statistical Appendix India & Hand book of Statistics Indian State (RBI)

The Crop Diversification Index (DI) in India has recorded a CAGR of 0.18%, reflecting a notable upward trend. Meanwhile, the share of land under non-foodgrains has expanded at a faster CAGR of 0.76%, surpassing the overall national growth rate. This pattern highlights a significant transition away from conventional foodgrain cultivation towards cash crops, horticultural produce, and other high-value agricultural commodities.

Table 3: Compound Annual Growth Rate (CAGR) of DI and Percentage of Non foodgrains area, 1995-96 to 2021-22

State/Country	Variable	CAGR	Level of Significant
India	Crop diversification index	0.18	1 per cent
	% of non-foodgrains area	0.76	1 per cent

Factors Influencing Crop Diversification:

The development of agriculture in India, both across regions and over time, depends fundamentally on the availability of basic infrastructure. Among these, irrigation plays a crucial role in enhancing agricultural productivity. To understand the factors driving diversification toward high-value crops, several explanatory variables have been analysed. Large-scale irrigation systems, particularly canals constructed over the years, have enabled farmers to shift cultivation toward more profitable crops such as potato, oilseeds, and summer paddy crops that rely heavily on assured irrigation. Using measures such as the Simpson Index and the concentration of non-food crops, researchers have examined the influence of variables including income levels, land distribution, irrigation intensity, institutional credit, road density, urbanization, and market penetration (Jha *et al.,* 2009).

Infrastructure and Crop Diversification:

The progress of Indian agriculture has been closely tied to the expansion and improvement of basic infrastructure across regions and over time. Among these, irrigation has emerged as the most critical driver of productivity growth. The establishment of an extensive canal network and other large-scale irrigation facilities have significantly reshaped the agricultural landscape. Reliable irrigation has allowed farmers to diversify into high-value and more profitable crops such as potatoes and oilseeds, and to undertake summer paddy cultivation, which depends entirely on assured water supply.

To analyse the main factors influencing crop diversification in India, researchers consider a set of explanatory variables. These include infrastructural indicators like the percentage of irrigated area (PIA), road density (RD), and agricultural credit (AC), along with technological indicators such as fertilizer use per hectare (FUPH). Together, these variables have played a vital role in driving changes in cropping patterns across the country.

Irrigation and Crop Diversification:

Irrigation plays a crucial role in driving crop diversification in India. The development and expansion

of irrigation infrastructure have enabled farmers to move beyond traditional cereal-based cultivation towards more profitable cropping patterns. With reliable water availability from canals and other irrigation sources, farmers are increasingly able to adopt high-value crops, leading to higher farm incomes and enhanced agricultural productivity.

Role of Chemical Fertilizers to changing Cropping Pattern:

The application of chemical fertilizers has been instrumental in enhancing agricultural productivity and promoting diversification over time. Between 1995–96 and 2023–24, fertilizer use per hectare rose markedly from 102 kg to 175 kg. This sharp increase has improved soil fertility, boosted crop yields, and facilitated a shift toward nutrient-intensive and high-value crops. By providing essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K), fertilizers stimulate plant growth, strengthen resistance against pests and diseases, and improve overall crop performance. Consequently, farmers have been able to utilize land more efficiently, diversify cropping patterns, and respond to the rising demand for food, fiber, and biofuels. Moreover, the widespread adoption of chemical fertilizers has played a vital role in strengthening global food security by ensuring consistent and expanded agricultural production.

Road Density and Agricultural Growth:

Road density (RD) is a significant determinant of cropping patterns in India. Representing the total length of roads per unit of geographical area, road density enhances market accessibility, lowers transportation costs, and facilitates the efficient movement of agricultural inputs and outputs. A clear relationship exists between road density and crop diversification, as improved connectivity incentivizes farmers to grow perishable and high-value crops that rely on timely supply chain management. Over time, India has witnessed substantial growth in road infrastructure, which has played a pivotal role in transforming agriculture by improving market access, ensuring prompt delivery of inputs, and promoting the commercialization of farming.

Agricultural Credit and Crop Diversification:

The availability of agricultural credit has been instrumental in promoting crop diversification in India. Access to credit empowers farmers by providing the necessary financial resources to adopt modern agricultural practices, high-yield crop varieties, mechanization, and improved irrigation techniques. Institutional credit, in particular, alleviates financial constraints, enabling farmers to embrace innovative and diversified cropping patterns that enhance both productivity and profitability. A strong positive correlation exists between agricultural credit and the diversification index (DI) in India. With reliable credit, farmers are more willing to take calculated risks, reducing dependence on traditional staple crops and exploring more lucrative and resilient alternatives. This transition not only boosts farm incomes but also strengthens the agricultural sector by mitigating risks associated with mono-cropping and climate variability.

Over the years, agricultural credit in India has expanded remarkably. The total disbursement of agricultural credit has increased significantly, reflecting growing institutional support for farmers and underscoring the role of credit accessibility in transforming the agrarian landscape. With improved financial backing, farmers are increasingly able to integrate high-value crops into their production systems.

This study examines the extent to which fluctuations in the Diversification Index (DI) can be explained by variations in key economic and infrastructural factors, specifically fertilizer use per hectare (FUPH), road density (RD), agricultural credit (AC), and the percentage of gross irrigated area (PGIA). As shown in Table 5, between 1995–96 and 2023–24, these factors collectively account for 71% of the total variation in DI. The coefficient of FUPH is statistically significant at the 10% level, while RD and AC exhibit even higher significance at the 1% level. The overall model demonstrates strong explanatory power, with an F-value of 60.23, confirming its robustness and reliability.

In addition to analysing DI, the study investigates the determinants of changes in the percentage of area under non-food grains (PNFA). Specifically, it assesses the contribution of RD, AC, and the percentage of irrigated area (PIA) to PNFA variations. As presented in Table 6, between 1995–96 and 2023–24, these factors collectively explain 58% of the variation in PNFA. The coefficients of RD and AC are statistically significant at the 5% level, indicating their notable influence on land-use diversification. The overall model is also significant at the 5% level, with an F-value of 8.69, highlighting a moderate yet meaningful relationship between the explanatory variables and PNFA trends.

These findings underscore the critical role of infrastructure, investment, and mechanization in shaping agricultural diversification and land-use patterns. The strong influence of FUPH and PGIA on DI indicates that technological advancement and financial support are key drivers of diversified agricultural activities. Similarly, the impact of RD, AC, and PIA on PNFA highlights the importance of infrastructure, credit, and irrigation in influencing cropping patterns and land allocation.

Table 4: Percentage of Irrigated Area, Fertilizer Use Per Hectare, Agricultural Credit and Road Density in Relation to Diversification Index in India 1995-96 to 2023-24

Variables	Coefficients	Standard Error	t-Value	P-Value
Intercept	0.6744	0.0217	15.02	0.000***
Percentage of Gross Irrigated area (PGIA)	0.001	0.0004	2.45	0.021**
Fertilizer use per hectare(kg/Ha) (FUPH)	0.0001	0.0002	1.74	0.095**
Road density (km/sq.km) (RD)	0.0184	0.0031	4.23	0.000***
Agricultural Credit (Rs, in billion) (AC)	0.0002	0.0001	2.47	0.008***
Adj R-squared	0.7			
R Square	0.71			
Significant F-Value	60.23	Number of obs = 29		

Table 5: Percentage of Irrigated Area, Fertilizer Use Per Hectare, Agricultural Credit and Road Density in Relation to Percentage of non-foodgrains area (NFA) in India1995-96 to 2023-24

Variables	Coefficients	Standard Error	t-Value	P-Value
Intercept	17.624	8.707	2.25	0.035**
Percentage of Gross Irrigated area (PGIA)	0.273	0.152	1.78	0.092*
Fertilizer use per hectare(kg/Ha) (FUPH)	0.045	0.060	0.79	0.444
Road density (km/sq.km) (RD)	2.325	1.196	2.09	0.050**
Agricultural Credit (Rs, in billion) (AC)	0.002	0.077	1.89	0.054*
Adj R-squared	0.53			
R Square	0.58			
Significant F-Value	8.69	Number of obs = 29		

*** Indicates coefficient significant at 1 percent level,
** Indicate coefficient significant at 5 percent level,
*Indicates coefficient significant at 10 percent level.

CONCLUSION

This paper investigates the evolving cropping patterns within India's agricultural landscape. The study employs the Transformed Herfindahl Index to analyse crop diversification and track changes over time. Over the past four decades, crops such as Boro rice, potato, and oilseeds particularly mustard have gained prominence among farmers. Interestingly, some earlier cropping trends have resurged in the past decade. The findings indicate a structural transformation in Indian agriculture, characterized by a decline in the dominance of traditional food grains and a rise in high-value crops such as oilseeds, potatoes, and fruits & vegetables. The increasing cultivation of Boro rice, the expansion of oilseed production, and the growth of horticulture reflect responses to changing market dynamics, improved irrigation, and policy interventions. Conversely, the decline in wheat, pulses, and fiber crops highlights areas requiring further research and support to achieve balanced agricultural development.

The Transformed Herfindahl Index, which measures the extent of crop diversification, shows a consistent increase across India, indicating a broader variety of crops being cultivated rather than reliance on a few dominant ones. This transformation has been strongly influenced by infrastructural and technological advancements, including the expansion of irrigation systems, greater use of chemical fertilizers, improved road connectivity, and enhanced access to agricultural credit. These developments have enabled farmers to diversify into high-value crops, thereby boosting rural incomes and contributing to overall economic growth. Looking ahead, sustained investment in rural infrastructure, adoption of sustainable agricultural practices, and robust financial support mechanisms will be essential to ensure the long-term resilience and viability of India's agricultural sector.

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