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An Analytical Study on Crop Diversification in Indian Agriculture

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Abstract

This study examines the patterns of crop diversification in India with a focus on major crops identified in the Annual Agricultural Report (2021–22) released by the Department of Agriculture and Farmers' Welfare. The crops covered include food grains, oilseeds, sugarcane, cotton, jute, and mesta. The analysis observes both the share of these crops in the gross cropped area and their contribution to total production. Trends of increase or decline in area and output were analyzed to understand the overall direction of crop diversification. Findings indicate that diversification, measured in terms of area and production, has been gradually increasing. The Herfindahl–Hirschman Index (HHI) was employed to evaluate the extent of concentration and diversification across crops.

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INTRODUCTION

Agriculture continues to be a cornerstone of the Indian economy, providing livelihoods to nearly half of the population and contributing substantially to national food security. Historically, India has been celebrated for its rich variety of crops and spices, which were not only consumed domestically but also exported globally. The country's agricultural dominance once earned it the title of the "golden bird." Traditional theories, such as Adam Smith's concept of specialization, emphasized focusing on specific crops for efficiency and trade benefits. However, in today's rapidly changing agricultural and economic landscape, over-specialization exposes farmers to significant risks, including market price volatility, climatic uncertainties, and pest outbreaks. Diversification, therefore, becomes an important strategy for resilience. Crop diversification refers to the practice of cultivating a wider range of crops, often including high-value crops alongside traditional staples. In India, this practice reduces production risks, enhances farm incomes, and supports sustainable use of resources. For example, cultivating a mix of cereals, pulses, oilseeds, and commercial crops allows farmers to offset losses from adverse climatic events or price crashes in a single crop. Additionally, diversification reduces pressure on natural resources by promoting crop rotation, which maintains soil fertility and checks groundwater depletion.

The current agricultural scenario highlights the growing relevance of diversification due to multiple factors. Climate change has increased the frequency of droughts, floods, and irregular monsoons, making mono-cropping less viable. Government initiatives, such as the National Mission on Sustainable Agriculture (NMSA) and crop insurance schemes like PMFBY, encourage farmers to diversify their production systems. Moreover, consumer preferences are shifting toward nutritional security, organic produce, and horticultural crops, creating new market opportunities. Given India's fifteen agro-climatic zones with unique soil and climatic features, the scope for diversified farming is vast. This study evaluates the recent trends of crop diversification among major crops in India, drawing on agricultural data from 2018–19 to 2020–21, as reported in the Annual Agricultural Report (2021–22).

REVIEW OF LITERATURE:

Joshi et al. (2004) Joshi, Gulati, Birthal, and Tewari analyzed crop diversification trends in India, emphasizing the growing shift from cereals to high-value crops like fruits, vegetables, and oilseeds. They argued that diversification was influenced by urbanization, rising incomes, and changing dietary preferences. The study highlighted that diversification not only contributed to farm income but also improved nutritional security. However, it also pointed out challenges such as inadequate infrastructure and weak market linkages.

Rao et al. (2006) [15] Rao and colleagues examined the regional variation in diversification patterns across Indian states. Using the Herfindahl Index, they found that states with better irrigation facilities and market access showed higher levels of diversification. The study also emphasized that rainfall-dependent states were more vulnerable to mono-cropping, while diversified regions ensured stability in farm income.

Chand et al. (2011) Chand, Prasanna, and Singh studied long-term agricultural trends in India, showing that diversification toward horticultural crops had accelerated since the 1990s. They linked this shift to liberalization policies, export opportunities, and government support for horticulture. The authors cautioned that this pattern, while beneficial economically, required sustainable water and land use strategies.

Birthal et al. (2015) Birthal and co-authors assessed crop diversification as a strategy for risk management. They concluded that small and marginal farmers adopted diversification to mitigate income shocks from climate variability. The study stressed that diversification played a key role in reducing vulnerability, but it required institutional support in the form of crop insurance, irrigation, and extension services.

Kumar & Sharma (2017) Kumar and Sharma examined crop diversification in Northern India, particularly Punjab and Haryana. They found that overdependence on rice–wheat systems had caused ecological stress, including groundwater depletion and declining soil fertility. Their analysis suggested that diversification toward pulses, oilseeds, and vegetables was crucial for ecological sustainability.

Rani & Pal (2019) Rani and Pal highlighted the role of government schemes in promoting crop diversification. They observed that subsidies for pulses, oilseeds, and horticultural crops encouraged farmers to move away from traditional cereal-dominated systems. However, they noted that policy measures often failed to address local agro-climatic conditions, limiting their effectiveness.

Singh et al. (2021) Singh, Mehta, and Sahoo evaluated recent diversification patterns using NSSO data. They found that diversification had increased modestly in the past decade, particularly toward fruits, vegetables, and commercial crops. The authors emphasized that climate change and market demand were major drivers of this trend. They also recommended that diversification strategies should integrate sustainability concerns, including efficient water management and soil health.

OBJECTIVES OF THE STUDY

The present study seeks to analyze the pattern of crop diversification in India with special reference to the major crops reported in the Annual Agricultural Report (2021–22). Specifically, the study focuses on the fiscal years 2018–19, 2019–20, and 2020–21 to identify changes in area allocation and production shares. The detailed objectives are:

1. To examine the trend of crop diversification in India during 2018–19 with respect to both gross cropped area and gross production of major crops.
2. To analyze the shift in crop diversification patterns during 2019–20 and assess changes in crop concentration and distribution across food grains, oilseeds, sugarcane, cotton, jute, and Mesta.
3. To evaluate the trend of crop diversification during 2020–21 and compare it with the previous two years to identify emerging patterns of stability, growth, or decline.

Hypothesis

The present study tests the following hypothesis:

- **H_0 (Null Hypothesis):** The trend of diversification in major crops grown in India during 2018–19 to 2020–21 is neutral (no significant increase or decrease).
- **H_1 (Alternative Hypothesis):** The trend of diversification in major crops grown in India during 2018–19 to 2020–21 shows significant variation (increase or decrease).

RESEARCH METHODOLOGY

This study uses secondary data from the Annual Report on Agriculture and Allied Sectors 2021–22, covering fiscal years 2018–19, 2019–20, and 2020–21, to analyze crop diversification trends in India. The Herfindahl–Hirschman Index (HHI) was used to measure area-wise and production-wise diversification. Comparing these indicators helped identify trends in land allocation and production diversification. Observation and trend analysis were used to study year-wise changes in cropping patterns, including rainfall variation, policy measures, and price fluctuations. This comprehensive view of crop diversification trends is presented.

Analysis

India cultivates a wide range of crops, among which paddy, wheat, coarse cereals, pulses, oilseeds, sugarcane, cotton, jute,

and mesta are considered the major crops in the *Annual Report on Agriculture and Allied Sectors*. Among these, paddy, wheat, coarse cereals, and pulses are grouped as food crops.

Table 2.1: Area of Main Crops

Area (In Lakh Hectare)				
Sr. No.	**Crop**	**2018-2019**	**2019-2020**	**2020-2021**
1	Food Crops	1247.77	1269.95	1293.43
2	Oilseeds	247.94	271.39	287.88
3	Sugarcane	50.61	46.03	48.57
4	Cotton	126.14	134.77	130.07
5	Jute &Mesta	7.05	6.73	6.63
6	GCA	1679.51	1728.87	1766.58

Source: Annual Report (2021-22) in Agriculture by DAFW (Department of Agriculture and Welfare)

The table 2.1 presents gross cropped area (GCA) of India's major crops for the fiscal years 2018–19, 2019–20, and 2020–21. The crops included are food crops (paddy, wheat, coarse cereals, pulses), oilseeds, sugarcane, cotton, and jute & mesta. Table 2 shows the percentage share of each crop in the total GCA during the same period. The data clearly indicates that food crops dominate India's cropping pattern, occupying the largest share of cultivated land. Their share, however, shows a gradual decline from 74.29% in 2018–19 to 73.22% in 2020–21. This downward movement, though marginal, suggests a slow reduction in the relative importance of food crops in the total cropped area. In contrast, oilseeds display a consistent upward trend, with their share rising from 14.76% in 2018–19 to 16.30% in 2020–21. This reflects increasing farmer preference for oilseed cultivation, possibly driven by growing demand, higher market prices, and supportive government policies. For sugarcane and cotton, no consistent trend is visible. The area under sugarcane fell in 2019–20 but recovered in 2020–21, while cotton area expanded in 2019–20 and then contracted slightly in 2020–21. These fluctuations may be linked to rainfall variability, cyclical market demand, and price movements in cash crops. Jute and mesta show a steady decline, from 0.42% in 2018–19 to 0.37% in 2020–21, indicating the diminishing role of these crops in India's agriculture. Overall, the analysis suggests that while food crops still dominate, there is a gradual reallocation of area toward oilseeds. The slight increase in total GCA also indicates that the expansion of these main crops has partly come at the expense of other minor crops not covered in the table. Thus, India's cropping structure shows early signs of diversification, though the heavy dependence on food crops remains a concern.

Table 2.2: Herfindahl–Hirschman Index of Gross Cropped Area in Major Crops of India

Sr. No.	**Crop**	**Share in %**			**Square of Share (S^2)**		
		2018-19	**2019-20**	**2020-21**	**2018-19**	**2019-20**	**2020-21**
1	Food Crops	74.29	73.45	73.22	5519.0041	5394.9025	5361.1684
2	Oilseeds	14.76	15.7	16.3	217.8576	246.49	265.69
3	Sugarcane	3.02	2.67	2.75	9.1204	7.1289	7.5625
4	Cotton	7.51	7.79	7.36	56.4001	60.6841	54.1696
5	Jute & Mesta	0.42	0.39	0.37	0.1764	0.1521	0.1369
6	SUM	100	100	100	5802.5586	5709.3576	5688.7274

***Source*:** Calculated

The Table 2.2 show the presents Herfindahl Hirschman Index (HHI) values for major crops in India for three consecutive fiscal years, 2018–19, 2019–20, and 2020–21. The HHI values stand at 5802.56, 5709.36, and 5688.73, respectively. Since an HHI value above 2,500 indicates a less diversified cropping structure, it is evident that the gross cropped area (GCA) of major crops in India continues to remain highly concentrated, reflecting dependence on a few dominant crop categories. Food crops alone account for more than 73% of the GCA across all three years, showing a persistent reliance on cereals and pulses. Although their share has marginally declined (from 74.29% in 2018–19 to 73.22% in 2020–21), the dominance of food crops continues to define the agricultural landscape. In contrast, oilseeds have shown a gradual increase in area share from 14.76% to 16.30%, suggesting a slow but steady diversification toward high-value and edible oil-oriented crops. Cotton and sugarcane, representing commercial crops, exhibit minor fluctuations in their share, with cotton declining from 7.51% to 7.36%, while sugarcane has remained relatively stable around 3%. Jute and mesta, on the other hand, have consistently held a marginal position of less than 0.5%, signifying their diminishing role in the overall cropping system. Overall, the HHI trend shows a slight downward movement, indicating a gradual yet limited diversification of India's agriculture. This suggests that farmers are slowly moving toward alternative crops, though food crops still dominate the agricultural economy. The high concentration reflects both food security priorities and structural challenges in crop diversification. Policy interventions encouraging oilseeds, pulses, and high-value crops could help balance agricultural growth with income stability and environmental sustainability.

Table 2.3: Production of Main Crops

Sr. No.	**Crop**	**Produce (In Million Ton)**		
		2018-2019	**2019-2020**	**2020-2021**
1	Food Crops	285.21	297.50	308.65
2	Oilseeds	31.52	33.22	36.10
3	Sugarcane	405.42	370.50	399.25
4	Cotton	28.04	36.07	35.38
5	Jute &Mesta	9.82	9.88	9.56
6	GP	760.01	747.17	788.94

Source*: Annual Report (2021-22) in Agriculture by DAFW (Department of Agriculture and Farmer Welfare*)

Table 2.3 highlights the production patterns of major crops in India between 2018–19 and 2020–21. The figures indicate a consistent rise in food grain production, increasing from 285.21 million tonnes in 2018–19 to 308.65 million tonnes in 2020–21. This steady growth reflects improvements in farming practices, better input use, and the government's continued focus on food self-sufficiency. Oilseeds also registered a progressive increase, from 31.52 to 36.10 million tonnes, suggesting a gradual shift towards high-value crops in response to growing demand for edible oils. Sugarcane output showed instability, falling from 405.42 million tonnes in 2018–19 to 370.50 million tonnes in 2019–20, before recovering to 399.25 million tonnes in 2020–21. Such fluctuations can be linked to water availability, rainfall variations, and biofuel policy initiatives. Cotton recorded a remarkable rise in 2019–20 (36.07 million tonnes) from 28.04

million tonnes in 2018–19 but declined slightly in 2020–21 (35.38 million tonnes), influenced by climatic conditions and market uncertainties. On the other hand, jute and mesta remained almost unchanged across the years, indicating limited diversification in fibre crops. The overall Gross Production (GP) showed a decline in 2019–20 (747.17 million tonnes) compared to the previous year, but a significant recovery was seen in 2020–21 with 788.94 million tonnes. These results underline the resilience of Indian agriculture and point towards crop diversification as a balancing factor that helps maintain agricultural growth even amidst climatic and policy challenges.

Table 2.4: Crop Production Concentration Measured by HHI (2018–2021)

Sr. No.	Crop	Share in %			Square of Share (S^2)		
		2018-19	2019-20	2020-21	2018-19	2019-20	2020-21
1	Food Crops	37.53	39.82	39.12	1408.5009	1585.6324	1530.3744
2	Oilseeds	4.15	4.45	4.58	17.2225	19.8025	20.9764
3	Sugarcane	53.34	49.58	50.61	2845.1556	2458.1764	2561.3721
4	Cotton	3.69	4.83	4.48	13.6161	23.3289	20.0704
5	Jute & Mesta	1.29	1.32	1.21	1.6641	1.7424	1.4641
6	SUM	100	100	100	4286.1592	4088.6826	4134.2574

***Source*:** Calculated

Table 2.4 shows the Herfindahl-Hirschman Index (HHI) is used here to examine the level of crop concentration in India's agricultural production across the period 2018–19 to 2020–21. A higher HHI value suggests greater concentration towards a particular crop, while lower values reflect diversification. From the table, sugarcane consistently records the largest production share, ranging between 49.58% and 53.34%, making it the most dominant crop in terms of production. Its squared share contributes significantly to the overall HHI, with values above 2450, thereby influencing the aggregate index. Food crops are the next major contributor, accounting for nearly 38–40% of production, and their squared share also remains substantial, adding more than 1400–1585 points to the index. Oilseeds, cotton, and jute & mesta, though important, together contribute less than 10% to the total production share, showing limited impact on the concentration index. The total HHI values are 4286.16 in 2018–19, 4088.68 in 2019–20, and 4134.26 in 2020–21. These values are relatively high, reflecting moderate-to-high concentration in production, largely driven by sugarcane and food crops. However, the slight decline in HHI during 2019–20 indicates a marginal shift towards diversification, although the trend reverses again in 2020–21. Overall, the analysis shows that India's agricultural production is still highly concentrated around a few dominant crops, particularly sugarcane and food crops, leaving limited scope for crop diversification in terms of production structure.

FINDINGS

1. **Food crops dominate production**: Food grain output increased steadily from 285.21 million tons in 2018-19 to 308.65 million tons in 2020-21, showing strong policy support and productivity gains.
2. **Oilseeds show positive growth:** Expansion in oilseed production reflects diversification efforts and demand-driven cultivation, but growth remains moderate compared to food crops.
3. **Commercial crops are volatile:** Sugarcane, cotton, and jute exhibit fluctuating trends, indicating their vulnerability to climatic conditions, water availability, and market instability.
4. **High crop concentration:** HHI values above 4000 confirm over-dependence on a few crops, especially sugarcane and food grains, limiting diversification.
5. **Sustainability concerns:** Reliance on water-intensive crops (like sugarcane) raises ecological risks, threatening soil fertility, groundwater levels, and long-term agricultural sustainability.

Suggestions

1. **Promote diversified cropping systems:** Encourage cultivation of pulses, oilseeds, fruits, and vegetables to reduce dependency on food grains and sugarcane.
2. **Strengthen market and MSP support:** Extend Minimum Support Price (MSP) and procurement facilities to non-cereal crops to make diversification economically attractive.
3. **Adopt climate-smart agriculture:** Promote drought-resistant, less water-intensive crops through research, extension services, and farmer awareness programs.
4. **Enhance infrastructure and value chains:** Invest in storage, processing, and marketing facilities for diversified crops to reduce post-harvest losses and improve farmer incomes.
5. **Region-specific policies:** Frame diversification strategies based on agro-climatic zones to optimize resource use and balance food, commercial, and ecological needs.

CONCLUSION

The study on the current scenario of crop diversification in India highlights both the progress achieved and the challenges that persist in the agricultural sector. The production trends between 2018-19 and 2020-21 reveal that while food crops and oilseeds have registered steady growth, commercial crops such as sugarcane, cotton, and jute display fluctuations. Food crops remain the backbone of Indian agriculture, with production rising from 285.21 million tons in 2018-19 to 308.65 million tons in 2020-21, reflecting improved productivity and government support. Oilseeds too witnessed a positive trajectory, driven by policy incentives and technological adoption. However, sugarcane production has been inconsistent, largely influenced by climatic conditions and market dynamics. Cotton and jute, though significant, contribute relatively smaller shares to total production. The Herfindahl-Hirschman Index (HHI) analysis of crop production underscores the dominance of sugarcane and food crops in India's agricultural structure. With HHI values consistently above 4000, the concentration is notably high, indicating limited diversification. Though there are marginal shifts in shares across years, the overall structure suggests dependence on a few major crops, which raises concerns about ecological balance, income risks, and long-term sustainability. From a policy perspective, crop diversification is essential not

only for stabilizing farm incomes but also for ensuring food security, reducing regional imbalances, and promoting sustainable use of resources. Shifts toward oilseeds, pulses, fruits, and vegetables could help reduce reliance on water-intensive crops like sugarcane while simultaneously boosting nutrition security. Strengthening market linkages, improving MSP coverage, and expanding technological support are vital for promoting such diversification. In conclusion, India's agriculture is at a crucial juncture: while growth in food production has been commendable, future strategies must emphasize balanced diversification to address economic, environmental, and nutritional challenges. Only then can agriculture serve as a resilient foundation for sustainable development.

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