# Trends in Food Grains Production in India with Special Reference to Tamil Nadu During 2011 to 2024

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**Abstract**

*Food grains form the backbone of India's food security system. As staple foods for the majority of the population, crops such as rice, wheat, maize, pulses, and coarse cereals are not merely agricultural outputs but essential components of social and economic stability. In a country with a rapidly growing population, ensuring adequate and stable food grain production is both an economic necessity and a developmental priority. The proposed research paper deeply discussed with the trends of food grains production in Tamil Nadu to analyze the trends and growth patterns of food grain production in Tamil Nadu over the study period, with reference to major crops such as rice, wheat, pulses, and coarse cereals and examine regional variations in food grain production by comparing global, national, and Tamil Nadu level data, and to assess their implications for food security and policy measures to improve the food grains production in Tamil Nadu respectively.*

*Keywords: Food Grains, Agriculture, Tamil Nadu, Fertilizer, Paddy, Food Security etc*

## 1. Introduction

Agriculture has been the foundation of the Indian economy since ancient times and continues to play a pivotal role in the country's socio-economic development. Despite rapid industrialization and the expansion of the service sector, agriculture remains the primary source of livelihood for a large proportion of India's population. The sector contributes significantly to national income, employment generation, poverty reduction, and food

security. Within agriculture, food grain production holds paramount importance as it ensures the availability of essential food items required to sustain the country's vast population.

Food grains form the backbone of India's food security system. As staple foods for the majority of the population, crops such as rice, wheat, maize, pulses, and coarse cereals are not merely agricultural outputs but essential components of social and economic stability. In a country with a rapidly growing population, ensuring adequate and stable food grain production is both an economic necessity and a developmental priority.

India is one of the largest producers of food grains in the world. Since Independence, the country has made remarkable progress in increasing food grain output. During the initial post-independence period, India faced severe food shortages, low productivity, and heavy dependence on imports. The introduction of the Green Revolution in the mid-1960s marked a turning point in Indian agriculture. The adoption of High Yielding Variety (HYV) seeds, expansion of irrigation facilities, increased use of fertilizers and pesticides, and modernization of farming techniques significantly boosted productivity, especially in rice and wheat. As a result, India gradually transformed from a food-deficit nation into a largely self-sufficient one.

**Global Scenario of Food Grain Production**

Food grain production is a critical component of the global agricultural system and plays a vital role in ensuring food security across nations. Cereals such as rice, wheat, and maize constitute the staple food for a large share of the world's population. With continuous population growth, urbanization, and changing consumption patterns, the demand for food grains has been steadily increasing worldwide. Major food grain–producing countries such as China, India, the United States, and Brazil significantly influence global food supply and price trends. Globally, food grain production has benefited from technological advancements, mechanization, improved seed varieties, and modern irrigation systems. However, production remains uneven across regions due to differences in natural resources, technology adoption, and policy support. Climate change, extreme weather events, land degradation, and water scarcity have emerged as major challenges affecting global food grain production. These issues highlight the importance of sustainable agricultural practices and effective policy interventions at the international level.

The world has witnessed steady growth in rice and wheat production, reflecting their importance as primary food grains. Technological improvements such as high-yielding varieties, better irrigation facilities, and mechanization have contributed significantly to increased output. At the same time, coarse cereals and pulses have gained importance due to growing awareness of nutritional security and climate-resilient agriculture. However, their production remains sensitive to climatic variability, particularly in rain-fed regions.

**Global Trends in Agricultural and Food Grain Production (Million Tonnes)**

| World | 2011 | 2013 | 2015 | 2017 | 2019 | 2021 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|
| Rice | 715 | 745 | 760-765 | 752.6 | 758.1 | 792.5 | 805.4 | 811.5 |
| Wheat | 697 | 729 | 728.3 | 756.5 | 730.92 | 773.09 | 789.17 | 784.91 |
| Pulses | 70-75 | 73-75 | 80 | 90-92 | 88-90 | 88-90 | 96-97 | 96 |
| Coarse cereals | 1164 | 1266 | 1301 | 1353 | 1433 | 1505 | 1532 | 1509 |
| Oil seeds | 454.88 | 503.77 | 524.67 | 583.42 | 582.33 | 611.16 | 627.44 | 671.23 |
| Cotton | 22.5 | 24.0 | 24.8 | 25.6 | 25.2 | 25.2 | 25.97 | 25.6 |
| Sugarcane | 1790 | 1902 | 1875 | 1835 | 1958 | 1859 | 2026 | 2050 |
| Raw jute and mesta | 3.13 | 2.85 | 2.60 | 2.94 | 2.58 | 2.97 | 0.31 | 0.40 |

Source: Foreign Agricultural Service (FAS)

**Rice and Wheat Production**

Rice and wheat, the two most important staple food grains globally, show a consistent upward trend during the study period. World rice production increased from 715 million tonnes in 2011 to 811.5 million tonnes in 2024, demonstrating sustained growth despite minor declines in certain years due to adverse weather conditions. Similarly, wheat production rose from 697 million tonnes to 784.91 million tonnes, reflecting improvements in yield, expansion of cultivated area in major producing countries, and technological progress. The steady growth of these crops underlines their crucial role in ensuring global food security.

**Pulses Production**

Global pulses production increased gradually from around 70–75 million tonnes in 2011 to about 96 million tonnes in 2024. Although the growth rate of pulses is slower compared to cereals, the overall increase indicates rising awareness of nutritional security and growing demand for plant-based protein. However, noticeable fluctuations in production reflect the vulnerability of pulses cultivation to climatic conditions and limited technological adoption in many regions

**Coarse Cereals Production**

Coarse cereals recorded one of the strongest growth trends among all commodities. Production increased from 1164 million tonnes in 2011 to 1509 million tonnes in 2024. This significant rise is largely attributed to increasing demand for maize and other coarse grains for livestock feed, biofuel production, and industrial use. Despite minor declines in some years, the long-term trend remains positive.

**Oilseeds Production**

Oilseeds production showed substantial growth over the period, increasing from 454.88 million tonnes in 2011 to 671.23 million tonnes in 2024. The expansion reflects rising global demand for edible oils, industrial oils, and biofuels. Although production fluctuated in some years due to price volatility and climatic factors, the overall trend indicates increasing importance of oilseeds in the global agricultural economy.

**Cotton Production**

World cotton production increased moderately from 22.5 million tonnes in 2011 to around 25.6 million tonnes in 2024. The trend suggests relatively stable growth, supported by steady demand from the textile industry. Minor fluctuations can be attributed to changes in acreage, competition from synthetic fibers, and environmental concerns affecting cotton cultivation

**Sugarcane Production**

Sugarcane production recorded a strong upward trend, rising from 1790 million tonnes in 2011 to 2050 million tonnes in 2024**.** Despite periodic declines caused by weather conditions and price cycles, sugarcane remains one of the most extensively produced crops globally. Growth is mainly driven by increasing demand for sugar, ethanol, and other by-products.

**Raw Jute and Mesta Production**

Production of raw jute and mesta showed considerable fluctuations during the study period. While output declined in the initial years, a gradual recovery is observed in recent years, reaching 4.0 million tonnes by 2024. These variations reflect changes in global demand for natural fibers, competition from synthetic alternatives, and concentration of production in limited region.

**Comparative Analysis of Food Grain Production Across Major Countries**

| Country | 2011(mt) | 2016(mt) | 2020(mt) | 2024(mt) | Grain focus |
|---|---|---|---|---|---|
| China | 550 | 650 | 680 | 638 | Wheat, Rice, Maize |
| India | 230 | 280 | 320 | 369 | Rice & wheat |
| United states | 340 | 360 | 350 | 377(corn) | Maize & wheat |
| Brazil | 80 | 100 | 110 | 120 | Maize |
| Russia | 85 | 95 | 105 | 115 | Wheat & cereals |
| Argentina | 35 | 45 | 59 | 57 | Maize& wheat |

Source: Foreign Agricultural Service (FAS)

**Trends in Agricultural Production in Tamil Nadu**

Agricultural production in Tamil Nadu during the period 2011–2024 has shown considerable fluctuations, largely due to variations in monsoon rainfall and the state's heavy dependence on surface and groundwater irrigation. Unlike many other states, Tamil Nadu's agriculture is highly sensitive to water availability, which has significantly influenced crop production trends over the years.

Rice production, which occupies a major share of the cropped area, experienced sharp year-to-year variations. Periods of drought and reduced reservoir storage led to declines in output, while favorable rainfall and improved irrigation support resulted in recovery in subsequent years. This pattern highlights the vulnerability of rice cultivation to climatic uncertainty in the state.

Sugarcane production in Tamil Nadu has exhibited a declining tendency in recent years, mainly due to water scarcity, delayed payments to farmers, and competition from alternative crops. Overall, the trend analysis indicates that agricultural production in Tamil Nadu is marked by instability rather than sustained growth, emphasizing the need for effective water management, climate-resilient farming practices, and policy interventions to ensure long-term agricultural sustainability in the state.

**Trends in Agricultural Production in Tamil Nadu**

| Tamil Nadu | 2011-13 | 2013-15 | 2015-17 | 2017-18 | 2019-20 | 2021-22 | 2023-24 |
|---|---|---|---|---|---|---|---|
| Rice | 7458.7 | 5349.8 | 7517.1 | 6638.9 | 7171.1 | 7906.6 | 6799 |
| Coarse cereals | 2323.8 | 2819.7 | 3406.6 | 3518.4 | 3493.2 | 3592.4 | 3515.0 |
| Pulses | 369.3 | 613.8 | 554.8 | 556.3 | 605.4 | 499.0 | 386.0 |
| Oilseeds | 1113.7 | 964.2 | 932.2 | 1038.0 | 1075.0 | 1082.8 | 916.7 |
| Cotton | 450.0 | 408.0 | 396.0 | 445.0 | 418.0 | 301.9 | 251.8 |
| Sugarcane | 38575.7 | 32454.1 | 25494.1 | 17154.0 | 14119.1 | 16166.4 | 15927.5 |

Source: Directorate of Economics & Statistics (DES)

The data reveals that agricultural production in Tamil Nadu during the period 2011–2024 is marked by significant year-to-year fluctuations, largely due to the state's dependence on monsoon rainfall and irrigation from reservoirs. Rice production, the major food crop of the state, shows sharp variations, declining steeply during drought years such as 2012–13 and 2016–17, and recovering in years with better rainfall and water availability. This highlights the vulnerability of rice cultivation to climatic conditions.

Coarse cereals display moderate growth over the study period, reflecting efforts to promote less water-intensive crops and millets. However, their production also fluctuates, indicating continued dependence on rainfall. Pulses production shows improvement in some years but lacks consistency, pointing to limited area expansion and yield instability. Oilseeds and cotton exhibit unstable trends influenced by market prices, input costs, and climatic stress.

Sugarcane production shows a clear declining trend, especially after 2013–14, due to severe water scarcity, reduced canal irrigation, and shifts in cropping patterns. The absence of

wheat, raw jute, and mesta production indicates agro-climatic unsuitability of Tamil Nadu for these crops. Overall, the data suggests that while Tamil Nadu has diversified its crop production, water scarcity and climate variability remain major constraints, emphasizing the need for sustainable water management and climate-resilient agricultural practices.

Agriculture continues to play a vital role in the economy of Tamil Nadu, providing livelihood support to a large proportion of the population and contributing significantly to food security and agro-based industries. The state's agriculture is characterized by a diversified cropping pattern comprising food crops, commercial crops, and plantation crops, with production largely influenced by monsoon rainfall, irrigation availability, and policy interventions.

The present study analyses the crop-wise agricultural production in Tamil Nadu over a period of thirteen years from 2011–12 to 2023–24. The dataset includes major crops such as rice, coarse cereals, pulses, oilseeds, cotton, and sugarcane, which together represent the core of the state's agricultural output. Crops like wheat and raw jute & mesta are not produced in the state due to agro-climatic limitations and hence are excluded from active analysis.

Rice occupies a predominant position in Tamil Nadu's agricultural economy, as reflected by its consistently higher production levels compared to other food crops. However, the data reveal substantial inter-year fluctuations, particularly the sharp decline in production during 2016–17, highlighting the vulnerability of rice cultivation to drought conditions and water scarcity. Coarse cereals show a relatively improving trend in recent years, indicating a gradual shift towards climate-resilient and dryland crops.

Pulses and oilseeds exhibit considerable variability in production across the study period, reflecting issues related to low productivity, dependence on rainfall, and market price instability. Cotton production shows an uneven pattern with an overall declining tendency, pointing towards increasing cultivation costs and farmers' shift to alternative crops. Sugarcane, a major commercial and water-intensive crop, records a significant downward trend over time, largely due to water stress, delayed payments by sugar mills, and changes in cropping preferences.

Overall, the data underscore the structural challenges and emerging transitions in Tamil Nadu agriculture, including climate variability, resource constraints, and policy-induced changes. Analyzing these long-term production trends is essential for understanding the performance of different crops and for formulating effective agricultural policies aimed at sustainability, income stability, and food security in the state.

**Statement of Problem**

Tamil Nadu food grain production has expanded considerably over the decades; however, this quantitative growth has not been uniform or sustainable across regions and crops**.** Persistent regional disparities, dependence on monsoon rainfall, declining soil fertility, and increasing pressure on land and water resources have resulted in uneven productivity levels. These structural imbalances raise concerns regarding the long-term sustainability of food grain production and its ability to meet the nutritional requirements of a growing population.

The production of major food grains in Tamil Nadu is characterized by significant instability and vulnerability to climatic and economic factors**.** Frequent occurrences of droughts, floods, and temperature fluctuations, combined with rising input costs, price volatility, and limited access to institutional support, have adversely affected production efficiency and farmers' income. Such instability undermines agricultural growth and weakens the resilience of the food grain sector.

Despite the introduction of technological innovations and government policy interventions, productivity gaps continue to exist in India's food grain sector**.** Uneven adoption of modern farming techniques, inefficient resource utilization, and environmental degradation constrain output growth. These challenges necessitate a comprehensive economic analysis of food grain production to identify constraints, assess performance, and suggest policy measures for ensuring sustainable and inclusive agricultural development.

**Objectives of the study**

The aims of the current study are as follow:

1. To analyze the trends and growth patterns of food grain production in Tamil Nadu over the study period, with reference to major crops such as rice, wheat, pulses, and coarse cereals.

2. To examine regional variations in food grain production by comparing global, national, and Tamil Nadu level data, and to assess their implications for food security.
3. To identify the economic, climatic, and policy-related factors influencing food grain production in Tamil nadu and to suggest measures for sustainable agricultural development

**Scope of the study**

The scope of the present study is confined to an economic analysis of food grain production in Tamil nadu for the period from 2011 to 2024. The study focuses on major food grain crops such as rice, wheat, pulses, and coarse cereals**,** along with selected commercial crops relevant to agricultural performance. It includes a comparative analysis at the global, national, and Tamil Nadu levels to understand regional variations in production trends. The study primarily relies on secondary data collected from government publications and official statistical sources. The analysis is limited to production trends and growth patterns and does not cover farm-level microeconomic behavior or primary survey data.

**Review of Literature**

**D.G. Mogale Icon Tiwari (2019)** the study examined institutions such as the Food Corporation of India, logistics providers, and state government agencies in developing a sustainable food grain supply chain. It emphasized balancing economic efficiency and environmental protection by considering transportation, warehouse capacity, and logistics constraints. Using multi-objective optimization methods, the study found that proper warehouse planning in production and consumption regions can reduce costs and emissions, providing useful guidance for policymakers to improve supply chain efficiency and sustainability.

**Bogala madhu (2025)** the study highlights that modern technologies in food grain processing and storage are essential to reduce post-harvest losses and improve food security. It emphasizes the role of mechanization, smart technologies, and improved storage methods in maintaining grain quality, while noting that high costs and weak infrastructure limit adoption, creating a need for supportive policies and research.

**Results and Discussion**

The total food grain production in India is 245 million tonnes, indicating a strong level of agricultural output. Among the two major cropping seasons, the Kharif season contributes slightly more with 126.24 million tonnes compared to 118.76 million tonnes in the Rabi season. Rice emerges as the leading crop with a production of 102 million tonnes, largely cultivated during the Kharif season, while wheat ranks second with 84 million tonnes and is mainly produced in the Rabi season. In addition to these major crops, coarse cereals contribute 42 million tonnes and pulses account for 17 million tonnes of the total production. Overall, the data highlights that seasonal conditions and cropping patterns play a significant role in determining food grain production in India.

The data indicates that rice exports from India have shown a generally increasing trend from 2011–12 to 2023–24, rising significantly from 7.1 million tonnes to a peak of 21.3 million tonnes in 2021–22. Although there is a slight decline in exports during 2022–23 and 2023–24, the export levels remain considerably higher than in the earlier years, reflecting sustained growth over the period. Rice imports have remained consistently low throughout the years, which clearly shows that India does not depend on imports to meet its domestic demand. As a result, the net trade balance has been positive in all the years, indicating that exports have continuously exceeded imports. Overall, the findings highlight that India holds a strong position as a major net exporter of rice in the global market, and rice trade plays a significant role in strengthening the country's agricultural economy.

The data shows that total food grain production in India increased significantly from 259.3 million tonnes in 2011 to 356.7 million tonnes in 2024, registering a growth of 37.6 percentage, which reflects strong progress in the agricultural sector. Uttar Pradesh remains the highest producer of food grains, with its production rising from 50.1 million tonnes to 66.8 million tonnes during the period. Among the states, Telangana recorded the highest percentage growth at 129.2 percentage, followed by Madhya Pradesh with 58.7 percentage and Rajasthan with 56.9 percentage, indicating remarkable improvement in agricultural performance in these regions. In contrast, states like Goa and Sikkim show almost no significant change in their production levels over the years.Overall, the findings highlight a positive growth trend in food grain production across most states, suggesting enhanced agricultural productivity, better farming practices, and overall development in India's agricultural sector.

The data indicates that Uttar Pradesh is the leading producer of food grains in India during 2023–24, with a production of 602.86 lakh tonnes, maintaining its top position due to favorable agricultural conditions and extensive cultivation area. Madhya Pradesh ranks second with 414.68 lakh tonnes, reflecting notable progress in agricultural development, while Punjab holds the third position with 325.44 lakh tonnes, continuing its strong contribution to food grain production. Bihar and Telangana also emerge as important contributors, producing 212.01 lakh tonnes and 202.76 lakh tonnes respectively, showing their significant role in the overall agricultural output. In addition, all other states and union territories together account for a substantial share of 1565.20 lakh tonnes, indicating that food grain production is widely distributed across the country. Overall, the total food grain production of 3322.95 lakh tonnes in 2023–24 highlights the strong performance of the agricultural sector and emphasizes the crucial role played by different states in ensuring food security and supporting the Indian economy.

The data shows the trend of All-India total production from 2011 to 2024. The production level fluctuates during the initial years and shows a clear increasing trend in the later period. During 2011, production was 32.48 million tonnes, which slightly declined to 29.80 million tonnes in 2012. A moderate recovery was observed in 2013 and 2014, reaching 32.75 million tonnes. However, production experienced a noticeable decline between 2015 and 2016, falling to the lowest level of 25.25 million tonnes, possibly due to unfavorable climatic conditions such as poor rainfall. From 2017 onwards, production began to recover steadily. The output remained stable around 31 million tonnes during 2017–2019, followed by a consistent growth phase. Production increased significantly from 33.22 million tonnes in 2020 to 37.96 million tonnes in 2022, indicating improvements in agricultural practices, irrigation facilities, and favorable weather conditions. The highest production was recorded in 2023 with 41.35 million tonnes, reflecting strong agricultural performance. Although there was a slight decline to 39.60 million tonnes in 2024, the overall trend during the study period shows a positive growth in production at the national level in India. Overall, the data indicates long-term growth with short-term fluctuations, suggesting gradual improvement in agricultural productivity and production stability over time.

The data presents the trend in total coarse cereals production from 2011 to 2024 in India, measured in million tonnes. The overall pattern indicates fluctuations in the early years followed by a steady growth trend in recent years. In 2011, coarse cereals production stood at

39.8 million tonnes, which slightly declined to 38.5 million tonnes in 2012. Production then increased significantly to 43.8 million tonnes in 2013, showing improvement in cultivation and favorable agricultural conditions. A small decline occurred again in 2015, returning to 38.5 million tonnes, indicating short-term production instability. From 2016 onwards, production showed a strong upward movement. Output increased to 47.0 million tonnes in 2017, though a minor fall was observed in 2018. Although production slightly decreased in 2023, it reached the highest level of 62.1 million tonnes in 2024, indicating strong growth in coarse cereal production. Overall, the data shows a positive long-term trend with minor fluctuations, suggesting increasing importance of coarse cereals in India's agricultural production and food security system

The data shows that the production of coarse cereals in India experienced fluctuations during the initial years, declining from 18.24 MT in 2011 to 17.09 MT in 2012, followed by a gradual increase up to 19.26 MT in 2014. However, production again declined during 2015 and 2016, reaching 17.15 MT and 16.35 MT respectively, likely due to unfavorable climatic conditions. A significant improvement is observed from 2017 onwards, with production rising sharply to 23.13 MT and further increasing to 25.42 MT in 2018. Although there was a slight decline in 2019, production recovered in 2020 and continued to grow in the following years. The production reached its peak at 27.30 MT in 2022, indicating strong growth in this period. However, a slight decline is observed in the subsequent years, with production decreasing to 26.06 MT in 2023 and 24.49 MT in 2024.Overall, the findings indicate that despite periodic fluctuations, the production of coarse cereals in India has shown an increasing trend over time, reflecting improvements in agricultural practices and the rising importance of millets and other coarse cereals in the country.

The data shows that Uttar Pradesh is the largest producer of food grains in India during 2023–24, with a production of 602.86, securing the first rank. Madhya Pradesh occupies the second position with 414.68, indicating strong agricultural performance, while Punjab ranks third with 325.44, reflecting its high productivity in major crops like wheat and rice. Bihar and Telangana also make significant contributions, with production levels of 212.01 and 202.76 respectively, highlighting their important role in the overall food grain output. In addition, all other states and union territories together account for a substantial production of 1565.20, forming a major share of the total. Overall, the total food grain production of 3322.95 during 2023–24 indicates a strong agricultural base, and the findings

reveal that a few leading states contribute a large portion of the country's total production, emphasizing their importance in ensuring food security in India.

The data indicates that wheat production in India has shown an overall increasing trend from 2011 to 2024, despite some fluctuations during certain years. Production increased from 86.9 MT in 2011 to 94.9 MT in 2012, followed by a slight decline in 2013, and then improved again to 95.9 MT in 2014.A minor decline is observed during 2015 and 2016, when production dropped to 86.9 MT and 87.0 MT respectively. However, from 2017 onwards, wheat production exhibited steady growth, rising to 98.5 MT in 2017 and 99.9 MT in 2018, and crossing the 100 MT mark in 2019 with 103.6 MT. The upward trend continued in the following years, reaching 107.9 MT in 2020 and 109.6 MT in 2021. Although there was a slight decline to 104.0 MT in 2022, production recovered again, increasing to 110.6 MT in 2023 and attaining the highest level of 113.3 MT in 2024.Overall, the findings reveal that wheat production in India has improved significantly over the years, reflecting advancements in agricultural practices, better irrigation facilities, and the use of improved seeds and modern technology.

The data shows that rice production in India has followed a generally increasing trend from 2011 to 2024, despite minor fluctuations in certain years. Production remained almost stable in the initial period, with slight declines observed in 2012, 2014, and 2015, likely due to variations in climatic conditions such as irregular rainfall. A clear upward trend is evident from 2016 onwards, when production began to rise steadily from 109.7 million tonnes and continued to increase consistently in the following years. The growth became more significant after 2018, with production reaching 118.9 million tonnes in 2019 and further increasing to 124.4 million tonnes in 2020.The rising trend continued strongly in subsequent years, with production reaching 129.5 million tonnes in 2021 and 135.8 million tonnes in 2022. By 2023, production increased to 137.8 million tonnes, and it is estimated to reach the highest level of about 145.0 million tonnes in 2024.Overall, the findings indicate that rice production in India has improved significantly over the years, increasing from 105.3 million tonnes in 2011 to around 145.0 illion tonnes in 2024. This reflects enhanced agricultural productivity supported by better irrigation, improved seed varieties, modern farming techniques, and effective government policies, highlighting the importance of rice as a major food crop in India.

The data reveals a clear declining trend in both storage losses and transit losses of food grain stocks in India from 2011–12 to 2022–23. Storage losses decreased significantly from around 0.50 percentage to 0.16 percentage, while transit losses also showed a steady reduction over the same period. This continuous decline indicates improvements in storage facilities, better handling practices, and more efficient transportation systems. It also reflects the effectiveness of government initiatives such as modernization of warehouses, improved logistics, and better management of food grain stocks in reducing wastage.However, a slight increase in storage loss is observed in 2023–24, rising to 0.22 percentage, while transit loss remains stable at 0.16 percentage. This increase may be due to temporary factors such as climatic conditions or higher stock levels.Overall, the findings highlight that India has made significant progress in minimizing post-harvest losses, thereby improving the efficiency of the food grain management system and supporting food security in the country.

The data shows that both the Cost (C2) of production and the Minimum Support Price (MSP) have increased steadily over the selected years, indicating a rise in the cost of cultivation as well as government support to farmers. In all the years considered, MSP is fixed higher than the cost of production, ensuring that farmers receive a minimum profit and protection from market price fluctuations.The increase in cost from ₹1050 in 2011–12 to ₹2150 in 2024–25 reflects higher input expenses such as seeds, fertilizers, labour, and irrigation. At the same time, the corresponding increase in MSP from ₹1120 to ₹2400 shows that the government has taken measures to compensate farmers for rising costs.Overall, the findings indicate that the government has consistently maintained a positive margin between production cost and MSP, which helps in safeguarding farmers' income, encouraging agricultural production, and supporting the growth of the agricultural sector.

**Suggestions and Policy Measures to improve Food Grains Production in India**

1. Improve irrigation facilities in low-producing states to reduce dependence on rainfall.
2. Promote modern farming techniques and high-yielding seed varieties among farmers.
3. Provide better access to fertilizers, credit, and agricultural technology.
4. Strengthen government support through fair MSP and effective procurement systems.
5. Encourage crop diversification and sustainable farming practices.
6. Conduct farmer training and awareness programs to improve productivity.

## Conclusion

The analysis of food grain production in India shows that certain states like Uttar Pradesh, Punjab, and Madhya Pradesh contribute significantly to the country's agricultural output due to favorable soil, climate, and better irrigation facilities. Steady improvements in irrigation, government support, and modern farming techniques have helped increase production over the years. However, there is still scope to enhance productivity in other states through better infrastructure, technology adoption, and farmer awareness programs. Overall, a focused approach can ensure balanced growth in food grain production and strengthen India's food security.

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