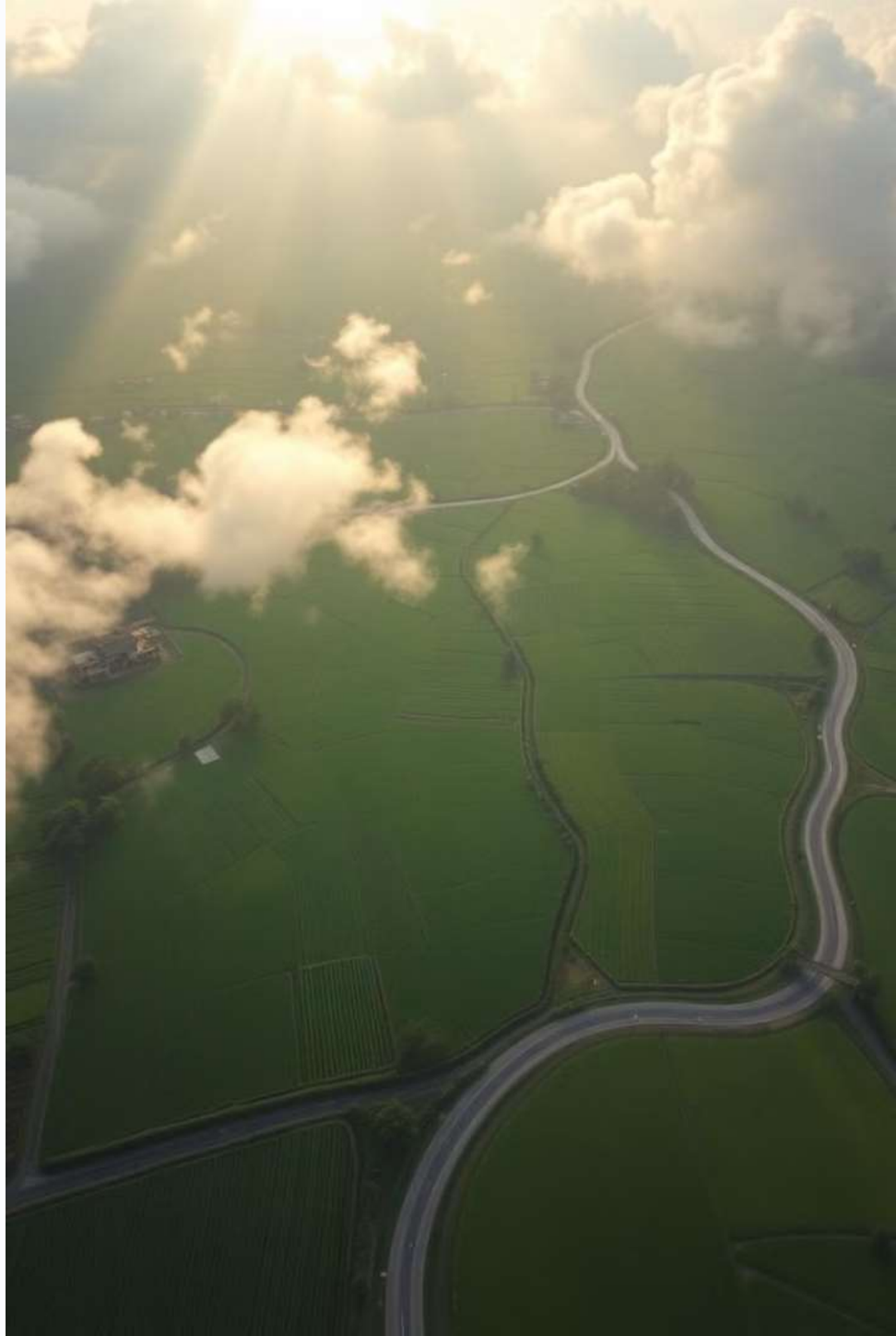
Crop Production Analysis in India

India's agricultural sector is a vital part of the country's economy, contributing around 17-18% to its Gross Domestic Product (GDP) and providing employment to over 50% of the population. This comprehensive analysis delves into the diverse crop production landscape of India, highlighting key insights and metrics that influence crop yields and productivity.



Economic Contribution and Diversity

Economic Contribution

Agriculture contributes around 17-18% to India's GDP and is a primary source of livelihood for over 50% of the population.

Diverse Crop Production

India is a leading global producer of crops such as rice, wheat, pulses, sugarcane, cotton, and spices, taking advantage of its diverse agro-climatic zones.

Green Revolution Impact

The Green Revolution in the 1960s-70s significantly increased food grain production, with wheat production rising from 10 million tonnes to over 110 million tonnes.

Horticulture, Dairy, and Exports

Horticulture and Dairy

India is a leading producer of fruits, vegetables, and milk, with annual production exceeding 320 million tonnes for horticulture and 210 million tonnes for dairy.

Agricultural Exports

India's agricultural exports contribute significantly to its foreign exchange, valued at around $50 billion in 2022-2023, with major items including rice, spices, sugar, and tea.

Government Initiatives and Challenges

1 Government Initiatives

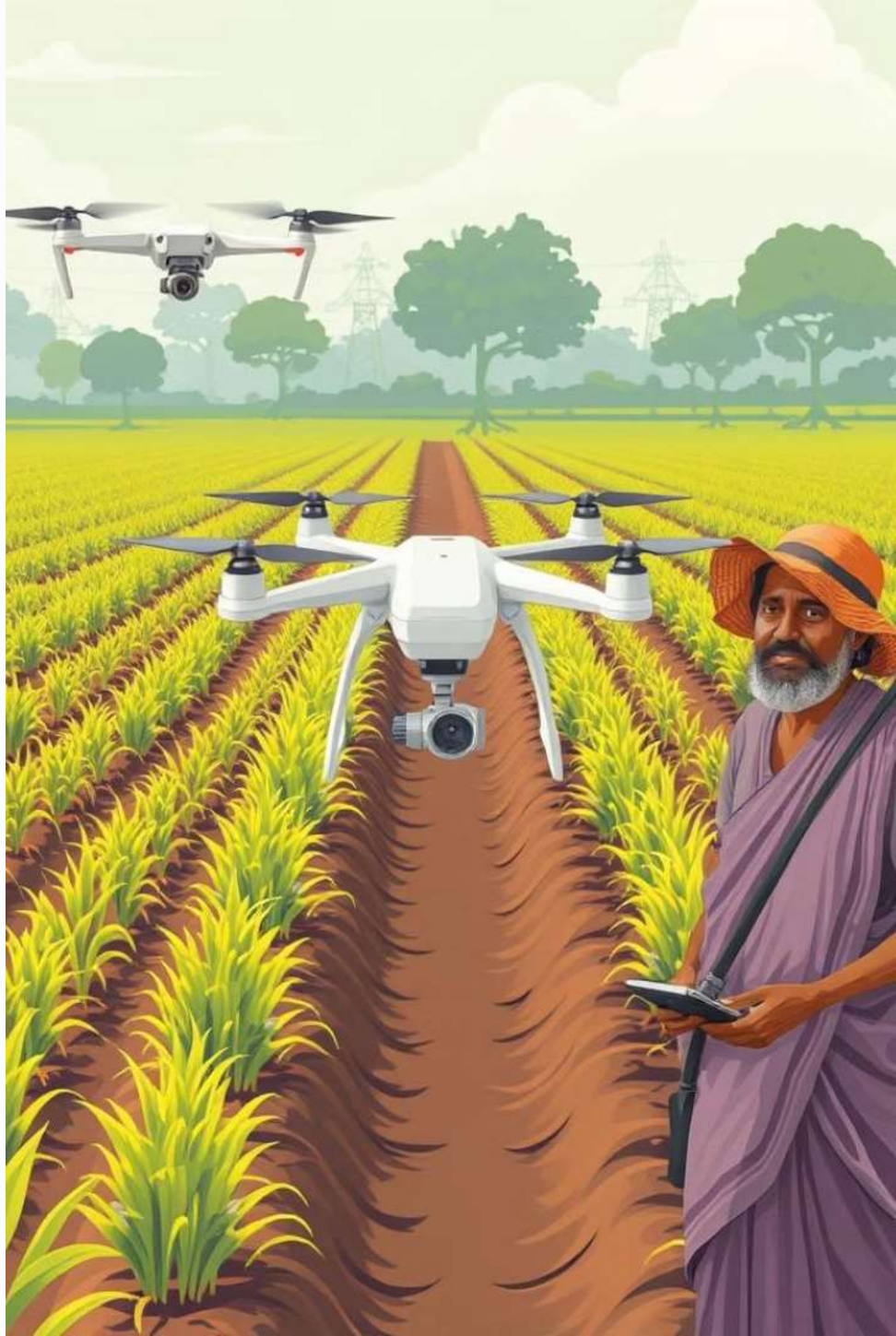
The government has launched programs like PMFBY (crop insurance), PM-KISAN (income support), and e-NAM (digital agricultural markets) to support farmers and improve productivity.

2 Challenges

India faces challenges such as fragmented land holdings, water scarcity, and soil degradation, which the government is addressing through sustainable farming practices and technology adoption.

3 Sustainability and Modernization

Efforts are underway to promote organic agriculture, precision farming, and the use of renewable energy in agriculture to ensure long-term sustainability.



```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

df = pd.read_csv("Crop Production data.csv")
print(df.shape)

print(df.isnull().sum())
df2 = df.copy()

df2['Production'] = df2['Production'].fillna(df2['Production'].mean())

print(df2.isnull().sum())

print(df2.duplicated().sum())
df2 = df2.drop_duplicates()

df2['State_Name'] = df2['State_Name'].str.strip().str.title()
df2['District_Name'] = df2['District_Name'].str.strip().str.title()
df2['Season'] = df2['Season'].str.strip().str.title()
df2['Crop'] = df2['Crop'].str.strip().str.title()

df2['Area'] = df2['Area'].astype(int)
df2['Crop_Year'] = df2['Crop_Year'].astype(int)
df2['Production'] = df2['Production'].astype(int)
df2['Season'] = df2['Season'].astype('category')

x = (df2 == 0).any()
print(x)

df2 = df2[(df2['Area'] > 0) & (df2['Production'] > 0)]

Q1_area = df2['Area'].quantile(0.25)
Q3_area = df2['Area'].quantile(0.75)
IQR_area = Q3_area - Q1_area

# Calculate the IQR for Area and Production
Q1_area = df2['Area'].quantile(0.25)
Q3_area = df2['Area'].quantile(0.75)
IQR_area = Q3_area - Q1_area

Q1_production = df2['Production'].quantile(0.25)
Q3_production = df2['Production'].quantile(0.75)
IQR_production = Q3_production - Q1_production

# Define outlier boundaries for 'Area' and 'Production'
lower_bound_area = Q1_area - 1.5 * IQR_area
upper_bound_area = Q3_area + 1.5 * IQR_area

lower_bound_production = Q1_production - 1.5 * IQR_production
upper_bound_production = Q3_production + 1.5 * IQR_production

# Remove outliers
df2 = df2[(df2['Area'] >= lower_bound_area) & (df2['Area'] <= upper_bound_area) &
     (df2['Production'] >= lower_bound_production) &
     (df2['Production'] <= upper_bound_production)]


df2.to_csv("Crop_Production_Data_Cleaned.csv", index=False)
```

Data Collection and Analysis

1

Data Collection

The dataset was obtained from the unified mentor portal as an Excel workbook, containing 246,092 rows of data with information on crop production across India's states and districts from 1997 to 2015.

2

Data Cleaning and Analysis

The data was cleaned and analyzed using tools like Pandas, Seaborn, and Matplotlib, with steps including filling missing values, removing duplicates, and identifying outliers.

3

Data Visualization

The cleaned data was then visualized using Power BI, creating various charts, maps, and dashboards to uncover insights and trends in India's crop production.

Key Insights and Trends

Crop Diversity

India's diverse agro-climatic zones support the cultivation of a wide range of crops, from cereals and pulses to fruits, vegetables, and spices, making it a global leader in several agricultural commodities.

Regional Variations

The analysis revealed significant variations in crop production across different states and districts, highlighting the need for targeted interventions and policies to address regional disparities.

Productivity Trends

The data showed both positive and negative trends in crop yields over the years, underscoring the importance of factors like weather, technology adoption, and government support in influencing agricultural productivity.

Export Potential

India's strong position as a major producer of various crops, coupled with its growing agricultural exports, suggests significant untapped potential to further boost the country's global market share and foreign exchange earnings.

Informing Decision-Making

1

Data-Driven Insights

The comprehensive analysis of crop production data provides valuable insights that can inform decision-making at the policy, industry, and farm levels.

2

Targeted Interventions

The insights can help identify areas for targeted interventions, such as improving infrastructure, promoting technology adoption, and addressing regional disparities in productivity.

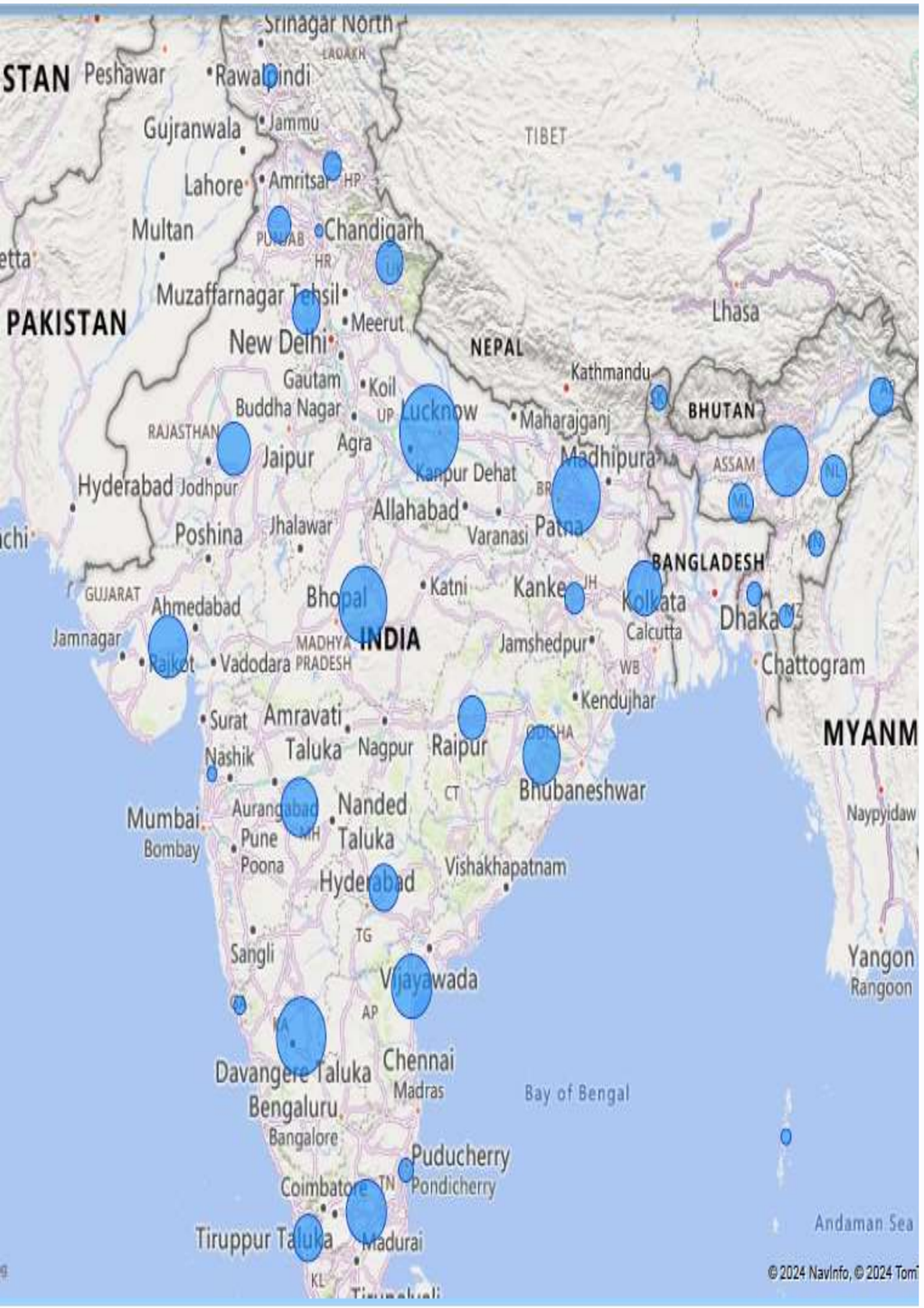
3

Sustainable Growth

By leveraging the data-driven insights, stakeholders can develop strategies to enhance agricultural productivity, promote sustainable farming practices, and strengthen India's position in the global agricultural market.

Insights Generated

Comprehensive analysis of crop production, area sown, and regional trends in India.



Crop Production Overview

Total Crop Production

238M units across all regions

Total Area Sown

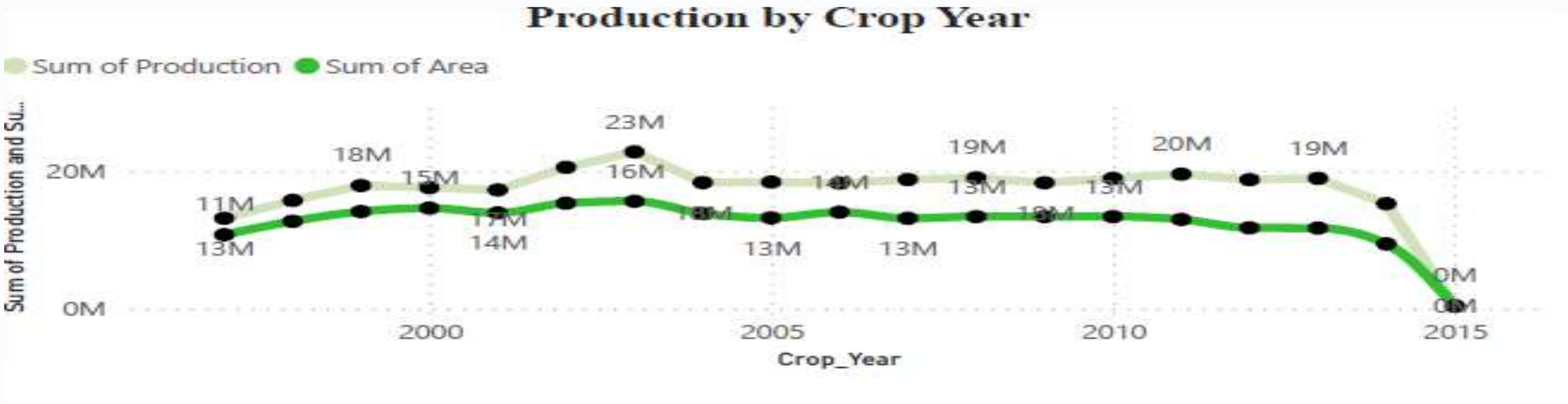
328M units across all regions

Total Districts

646 districts across India

Total Crops Grown

105 crops cultivated in India



Yearly Trends

1 **Highest Production**

Year 2003

2 **Lowest Production**

Year 2015

3 **Highest Area Sown**

Year 2003

4 **Lowest Area Sown**

Year 2015

Crops, States & District With Highest Production Volume

Top Crops

1. Maize
2. Rice
3. Potato
4. Onion
5. Sugarcane

Top District

1. Prakasam, AP
2. Visakapatanam, AP
3. Chitradurga, KR
4. West Garo Hills, Meghalaya
5. Spsr Nellore, AP

Top Regions

1. Uttar Pradesh
2. Karnataka
3. Bihar
4. Madhya Pradesh
5. Assam

Seasonal Trends

1

Highest Production

Kharif Season

2

Lowest Production

Winter Season

3

Highest Area Sown

Kharif Season

4

Lowest Area Sown

Winter Season

Regional Crop Production Patterns

1 Highest Producing Region

Uttar Pradesh is the region with the highest crop production in India.

2 Lowest Producing Region

Chandigarh is the region with the lowest crop production in India.

3 Seasonal Variations

The Kharif season witnesses the highest crop production, while the Winter season has the lowest.

4 Top Producing States

The top 5 states with the highest crop production are Uttar Pradesh, Karnataka, Bihar, Madhya Pradesh, and Assam.

Crop-Specific Insights

Maize

Maize is the highest produced crop in India, with Bihar being the state with the highest production and Banka district being the top producing region. Maize is grown in 542 districts across the country.

Rice

Rice is the second highest produced crop in India, with Assam being the state with the highest production. Rice is extensively grown in the North-Eastern region of the country.

Potato

Potato is the third highest produced crop in India, with Madhya Pradesh being the state with the highest production. Potato is a major crop in the North-Eastern region as well.

Onion

Onion is the fourth highest produced crop in India, with Uttar Pradesh being the state with the highest production. Onion is a significant crop in the Central and Western regions of the country.

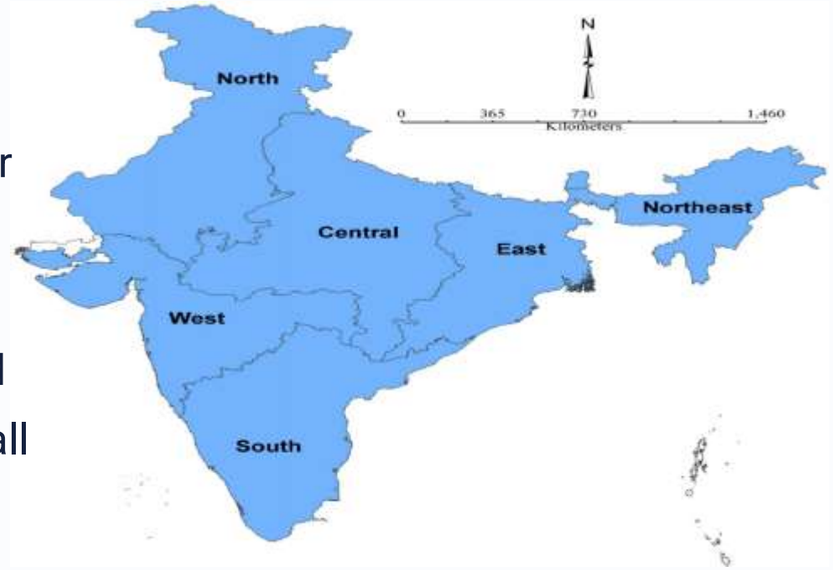
Sugarcane

Sugarcane is the fifth highest produced crop in India, with Madhya Pradesh being the state with the highest production. Sugarcane is a major crop in the Southern and Central regions of the country.

Regional Crop Production Patterns

Highest Produced Crop

Maize is grown extensively all over India with Bihar being the highest produced state & Banka being the most maize producing district and almost 542 district’s grow maize all over India.



Production Trends

The year with the highest crop production was 2003, while the year with the lowest production was 2015. Similarly, the year with the highest area sown was 2003, and the lowest was 2015.

South

Rice, maize, groundnut, onion, banana

North

Potato, barley, rice, maize, rapeseed

West

Groundnut, maize, rice, jowar, sugarcane

East

Maize, Rice, Sugarcane, Potato, Onion

North East

Rice, Potato, Sugarcane, Maize, banana

Central

Potato, Onion, Maize, Sugarcane, Jowar.

Seasonal Crop Production

1

Kharif Season

The Kharif season witnesses the highest crop production in India, with Maize, Rice, and Sugarcane being the top crops.

2

Rabi Season

The Rabi season is the second highest in terms of crop production, with Barley, Rice, and Rapeseed & Mustard being the top crops.

3

Winter Season

The Winter season has the lowest crop production in India, with Odisha, Kerala, and the North-Eastern states being the primary regions of cultivation.

Recommendations

Implement Advanced Technologies

Implement advanced AI and IoT technologies in the agricultural sector to enhance production and optimize field-level management.

Farmer Capacity Building

Conduct workshops and training programs to help farmers utilize scientific instruments and adopt sustainable farming practices.

Market Research and Insights

Regularly conduct market research to identify and address emerging challenges, and help farmers stay informed about market trends.

Policy Support and Outreach

Ensure that all farmers are aware of and have access to government policies and support programs to enhance their productivity and income.

Recommendations

1 **Conduct Workshops on Soil, Water, Weather.**

To equip farmers with the knowledge of science

2 **Promote Organic Farming**

Sustainable practices for the future

3 **Improve Supply Chain**

Minimize crop waste and optimize distribution

4 **Leverage GPS & Data Analytics**

Optimize field-level management

Conclusion

This comprehensive analysis of crop production in India has uncovered valuable insights and trends that can inform decision-making and guide the future development of the country's agricultural sector. By leveraging data-driven insights, stakeholders can work towards enhancing productivity, promoting sustainability, and strengthening India's position as a global agricultural powerhouse.