Exploratory Data Analysis (EDA) on Indian Rice Cultivation

Introduction

This project analyzes **rice cultivation trends in India** using historical data from 1997 to 2020. The objective is to explore **seasonal variations, state-wise production trends, and the relationship between cultivation area, production, and yield** using various statistical and visualization techniques.

Data Cleaning

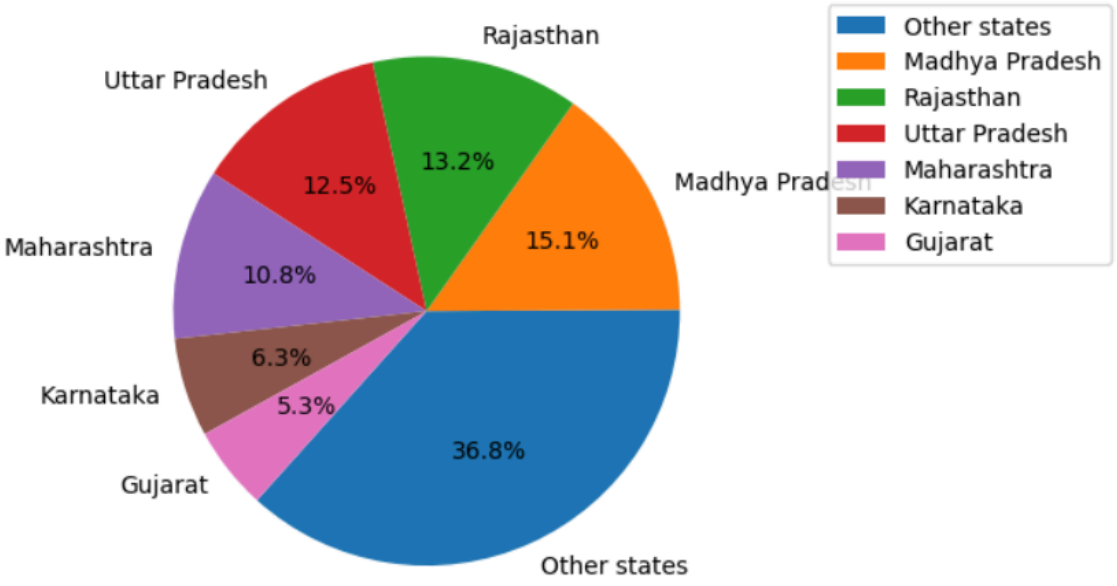
Steps Taken:

1. **Removed Year 2020-21** as it contained data from only one state, which could bias the analysis.
2. **Identified 57 unique crops** grown across India.
3. **Checked for duplicates** and found none.
4. **Removed 32 rows** with missing crop names.
5. **Filled 4,960 missing values in the 'Production' column** with the mean value of the same crop in that district and state.
6. **Final dataset is cleaned and ready for analysis.**

Data Visualization & Key Findings

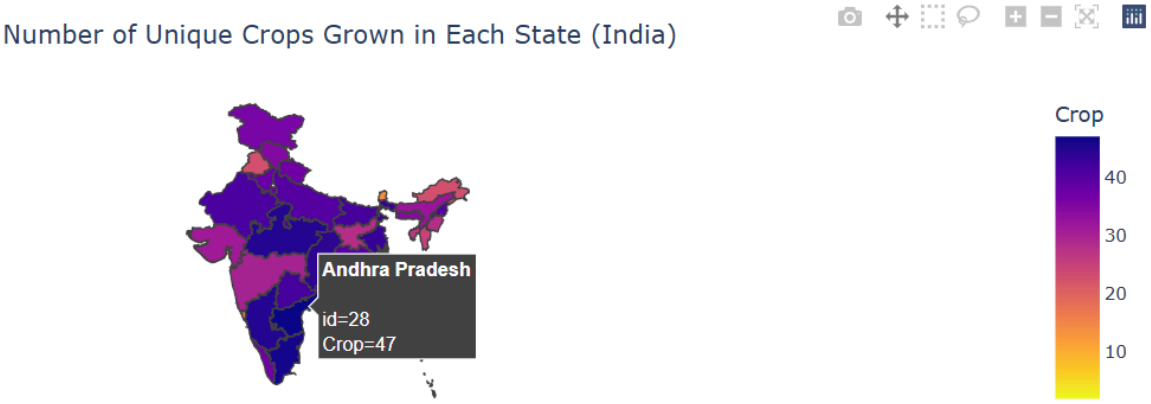
1) State-wise Cultivation Area

- **Top 5 states with the highest cultivation area:**
    - Madhya Pradesh (largest cultivation area)
    - Rajasthan
    - Uttar Pradesh
    - Maharashtra
    - Karnataka
- **Pie Chart Analysis: More than 50%** of total cultivation area is contributed by just **four states** (MP, Rajasthan, UP, Maharashtra).



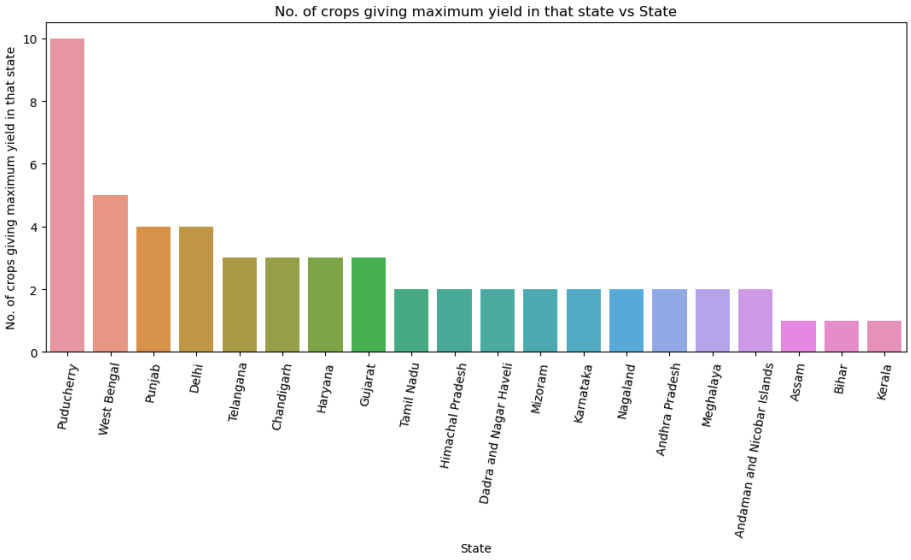
2) Crop Distribution by State

- **Andhra Pradesh grows the highest number of different crops (47),** followed by Tamil Nadu, MP, Karnataka, and West Bengal.
- **Choropleth Map Analysis:** The **southern part of India has more diverse agriculture** than northern states.

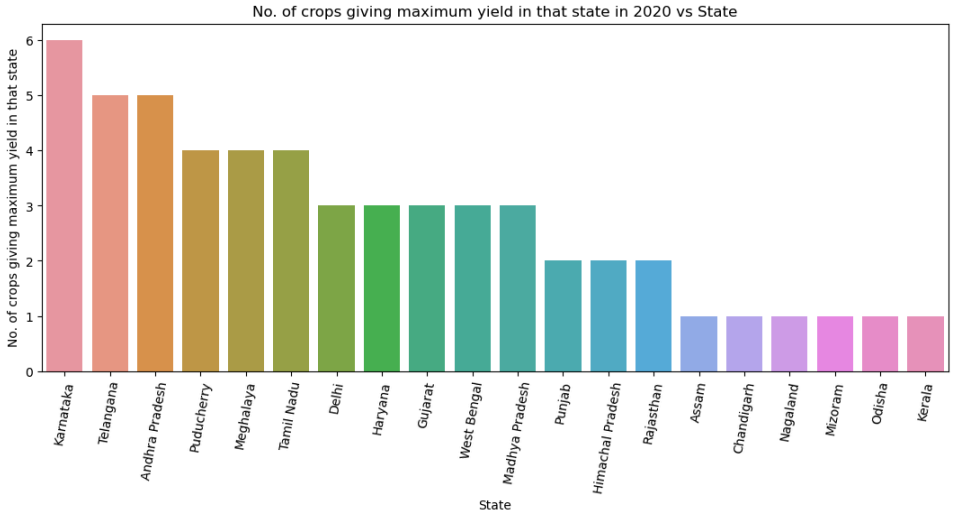


3) High-Yield Crop Analysis (1997-2020 vs. 2019-20)

- Puducherry had 10 crops with the highest yield (1997-2020).



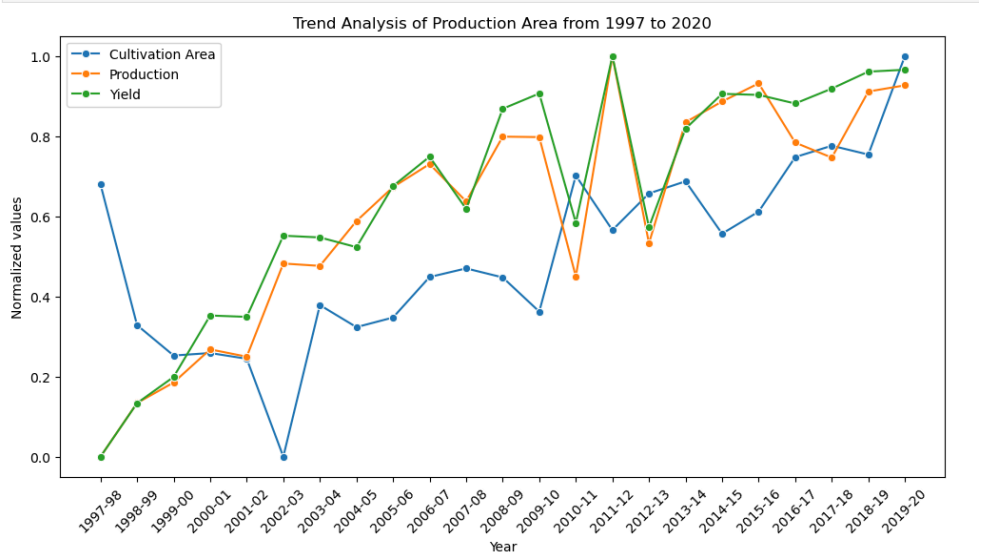
- **In 2019-20:**
    - **Karnataka (6 crops), Telangana (5 crops), and Andhra Pradesh (5 crops) emerged as top states.**



    - States like Puducherry, Punjab, and West Bengal showed a decline in high-yield crop production.

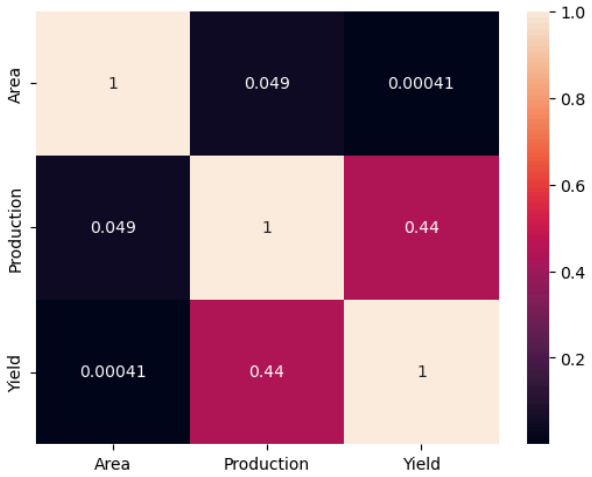
4) Trend Analysis of Area, Production, and Yield (1997-2020)

- **Key Observations from Line Plot Analysis:**
    - **2002-03:** Sudden **drop in cultivation area**, but **high production led to better yields.**
    - **2010-11 & 2012-13:** Drastic **drop in production**, leading to lower yields.
    - **2016-2020:** Crop yields remained **relatively stable**.



5) Correlation Analysis (Heatmap)

- **Correlation between Area & Yield = 0.00041** → No strong relationship.
- **Correlation between Production & Yield = 0.44** → **Moderate positive correlation**, meaning higher production tends to increase yield but is not a direct factor.

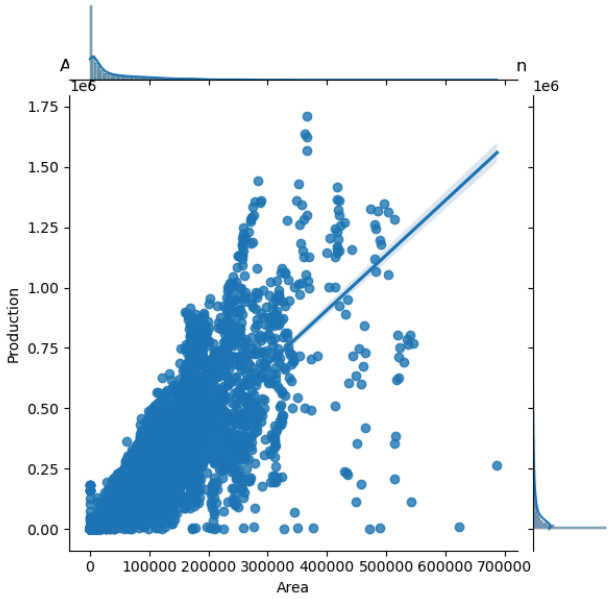


- **Insight:** Increasing the cultivated area does not necessarily improve crop yield; other factors like irrigation, soil quality, and farming techniques play a bigger role.

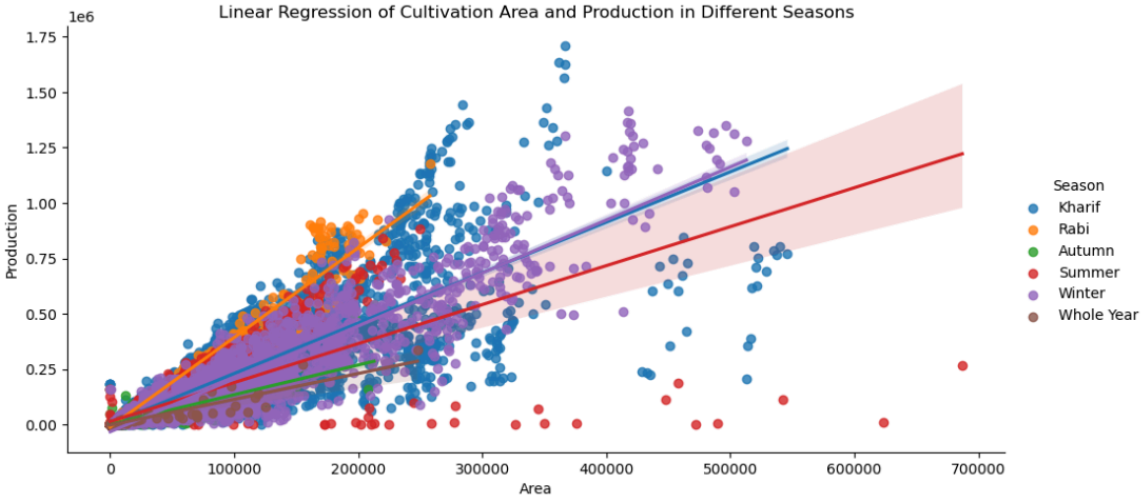
6) Crop-Specific Analysis: Rice

- **Seasonal Trends:**
  - Rice is mostly grown in the Kharif season, followed by Summer, Autumn, Winter, Rabi, and Whole Year.

    - Rabi season had the highest average rice yield, likely due to controlled irrigation and better soil conditions.
- **State-wise Rice Yield (2019-20):**
    - **Puducherry** had the **highest** rice yield.
- **Joint Plot (Area vs. Production):**
    - Higher area does not always mean higher production, as efficiency varies by region.



- **LM Plot (Regression Analysis by Season):**
    - **Rabi season** has the **highest regression trendline**, indicating better efficiency.



- **Strip Plot (Yearly Yield Trends):**
    - Rice yield reached its peak in some areas between 2004-07**.**

Conclusion & Key Takeaways

1. Madhya Pradesh, Rajasthan, and UP dominate the area of cultivation, but high-yield crops are found in Karnataka, Andhra Pradesh, and Telangana.
2. Southern states have diversified their crop production more than northern states.
3. Karnataka has more number of highest yielding crops in 2019-20 compared to other crops.
4. Puducherry had the highest yield of rice in 2019-20, despite being a small state.
5. Yield fluctuations were observed in 2010-11 and 2012-13 due to production drops.
6. Area expansion does not directly increase yield → Efficiency depends on irrigation, soil quality, and agricultural techniques.
7. Rabi season consistently shows higher rice yield than other seasons.