CROP PRODUCTION ANALYSIS IN INDIA

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Abstract

This project aims to analyze crop production data in India to identify key indicators and metrics that influence crop production. Using data science techniques, the goal is to predict crop production and provide valuable insights. Various tools and technologies, including Python, Tableau, and Power BI, are used to visualize the data and develop predictive models.

Introduction

Background

The agriculture sector is crucial for the overall supply chain and is expected to undergo significant evolution due to advancements in technology. This project aims to develop a Business-to-Business collaboration platform for the agri-food sector, facilitating effective and flexible collaboration among various stakeholders.

Problem Statement

The dataset provides extensive information on crop production in India over several years. The primary goal is to predict crop production and uncover important insights, highlighting key indicators and metrics that influence crop production. The project involves creating views, dashboards, and a compelling story from the data.

Objectives

1. Analyze crop production data to identify trends and patterns.
2. Develop predictive models to forecast crop production.
3. Create visualizations and dashboards to present insights.
4. Highlight key indicators and metrics influencing crop production.

Literature Review

This section summarizes existing work and research relevant to the project and identifies gaps that the project aims to fill.

Data Description

Data Sources:
https://drive.google.com/file/d/1b3E1vpDSYpHe8YlNs3jkt30Lx6acf0Uo/view?usp=share_link

Data Characteristics: The dataset includes attributes such as State_Name, District_Name, Crop_Year, Season, Crop, Area, and Production. It contains data over several years, providing a comprehensive view of crop production in India.

Data Preprocessing:

```
python Copy code
import pandas as pd
import numpy as np

# Load the data
crp_production = pd.read_csv('crop production data.csv')

# Check for missing values and duplicates
print(crp_production.isnull().sum()) crp_production
= crp_production.dropna()
print(crp_production.isnull().sum())
print(crp_production.duplicated().sum())

# Describe the data
print(crp_production.describe())

# Encode categorical variables crp_production['State_Name']
=
crp_production['State_Name'].astype('category').cat.codes + 1
crp_production['District_Name'] =
crp_production['District_Name'].astype('category').cat.codes + 1
crp_production['Season'] =
crp_production['Season'].astype('category').cat.codes + 1
crp_production['Crop'] =
crp_production['Crop'].astype('category').cat.codes + 1
```

Methodology

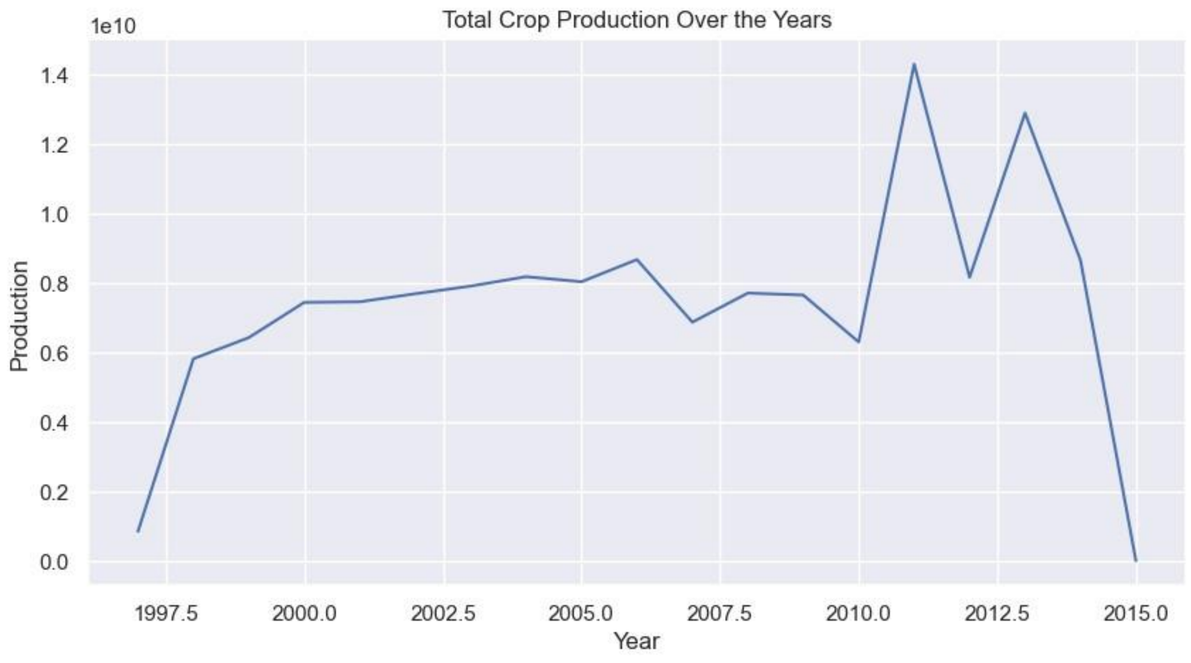
Exploratory Data Analysis (EDA):

```
python Copy
code
import matplotlib.pyplot as plt import
seaborn as sns

# Total crop production over the years plt.figure(figsize=(10,
5))
crp_production.groupby('Crop_Year')['Production'].sum().plot(kind='line')
plt.title('Total Crop Production Over the Years') plt.xlabel('Year')
plt.ylabel('Production') plt.show()
```

```
# Crop production distribution by state fig,
ax = plt.subplots(figsize=(15, 10))
sns.lineplot(x='State_Name', y='Production', data=crp_production, ax=ax)
ax.set_title('Crop Production Distribution by State')
ax.set_xlabel('State') ax.set_ylabel('Production')
ax.tick_params(axis='x', rotation=90)
plt.tight_layout() plt.show()
```

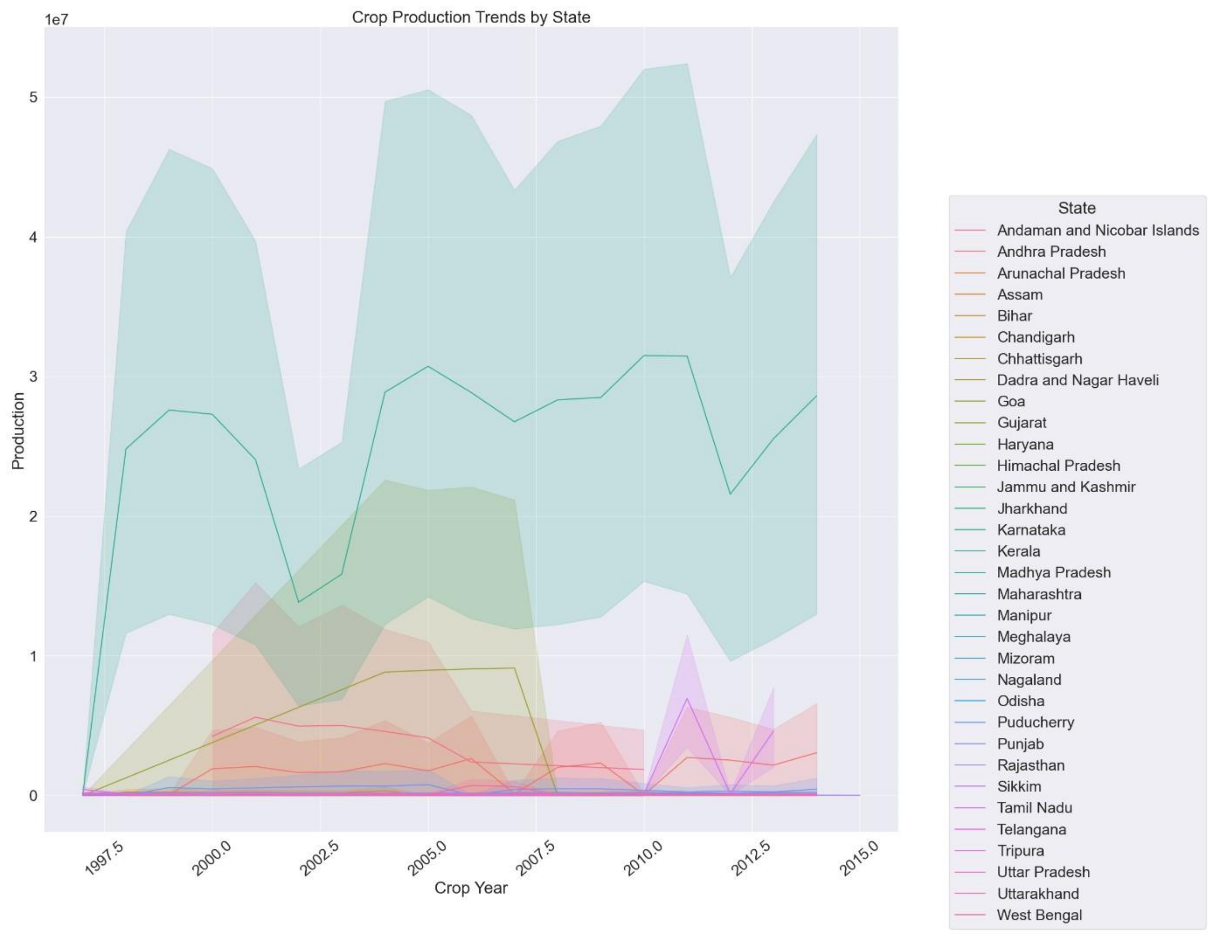
Visualizations:

Total Crop Production Over the Years



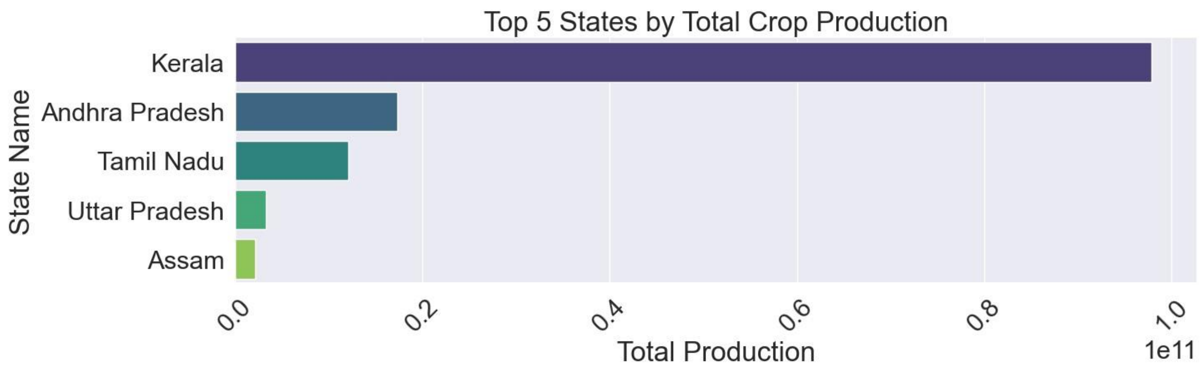
Crop Production Trends by State

```
# Crop production trends by state over the years fig,
ax = plt.subplots(figsize=(25, 20))
sns.lineplot(x='Crop_Year', y='Production', hue='State_Name',
data=crp_production, ax=ax)
ax.set_title('Crop Production Trends by State')
ax.set_xlabel('Crop Year') ax.set_ylabel('Production')
ax.legend(title='State', bbox_to_anchor=(1.05, 0.8))
ax.tick_params(axis='x', rotation=40)
plt.tight_layout() plt.show()
```



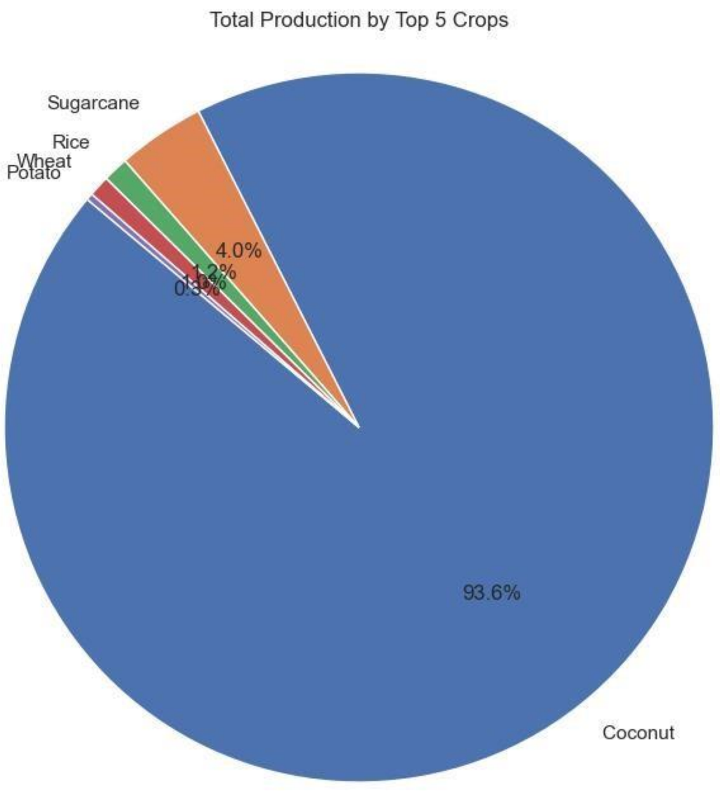
Top 5 States by Total Crop Production

```
# Top 5 states by total production state_production
=
crp_production.groupby('State_Name')['Production'].sum().reset_index()
top_states = state_production.nlargest(5, 'Production')

fig, ax = plt.subplots(figsize=(15, 5))
sns.barplot(x='Production', y='State_Name', data=top_states,
palette='viridis', ax=ax)
ax.set_title('Top 5 States by Total Crop Production')
ax.set_xlabel('Total Production')
ax.set_ylabel('State Name') ax.tick_params(axis='x',
rotation=45) plt.tight_layout() plt.show()
```

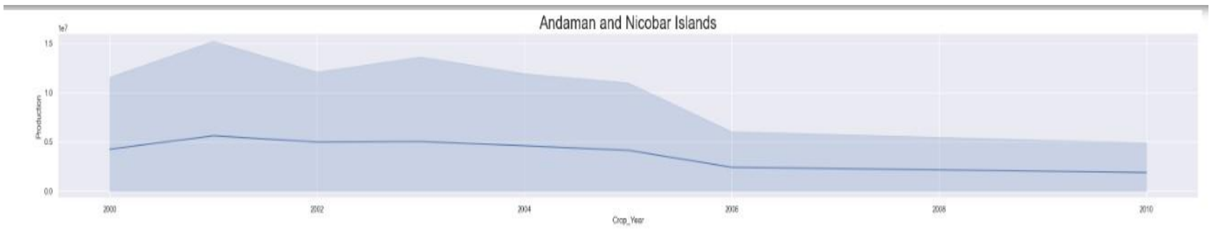


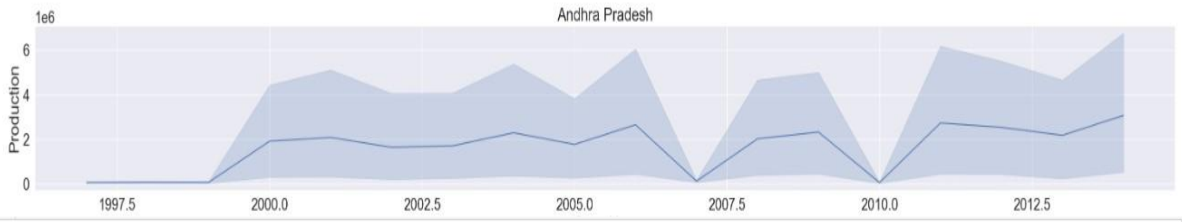
Total Production by Top 5 Crops

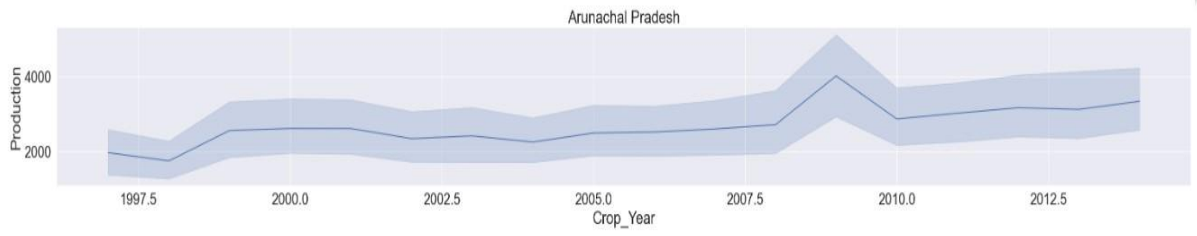
```
# Total production by top 5 crops crop_production
=
crp_production.groupby('Crop')['Production'].sum().reset_index().sort_value
s(by='Production', ascending=False) top_5_crops = crop_production.head(5)

plt.figure(figsize=(12, 8))
plt.pie(top_5_crops['Production'], labels=top_5_crops['Crop'],
autopct='%1.1f%%', startangle=140) plt.title('Total Production
by Top 5 Crops') plt.axis('equal') plt.show()
```

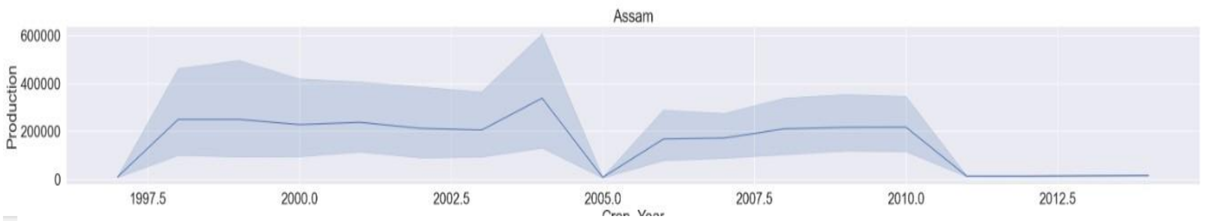


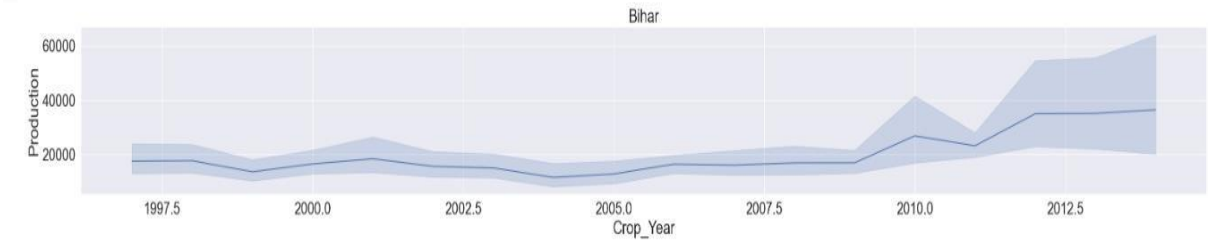
Year-wise Production of individual State and Union Territory

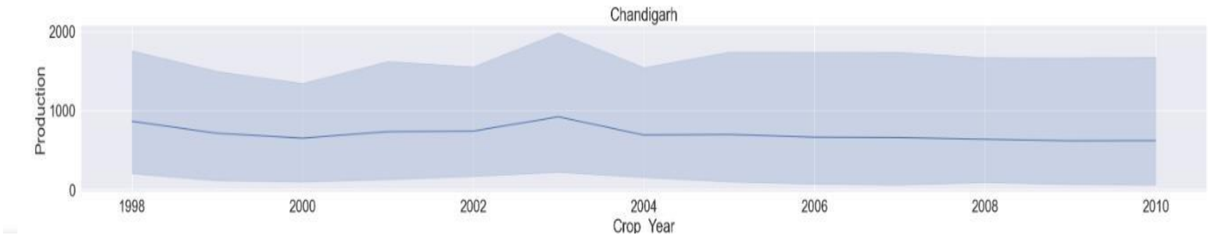


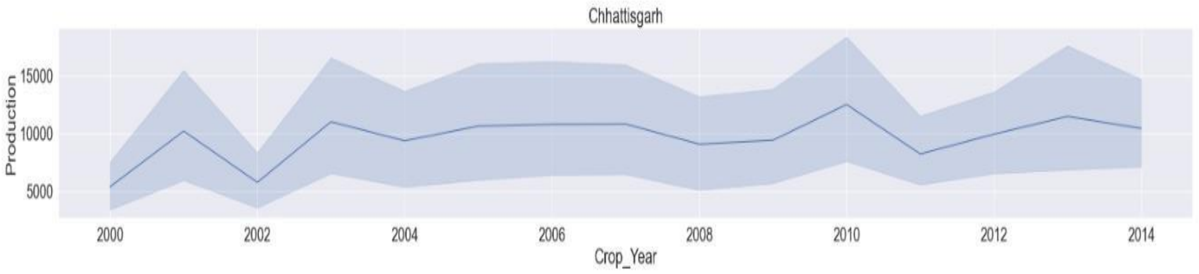











Chhattisgarh
Production
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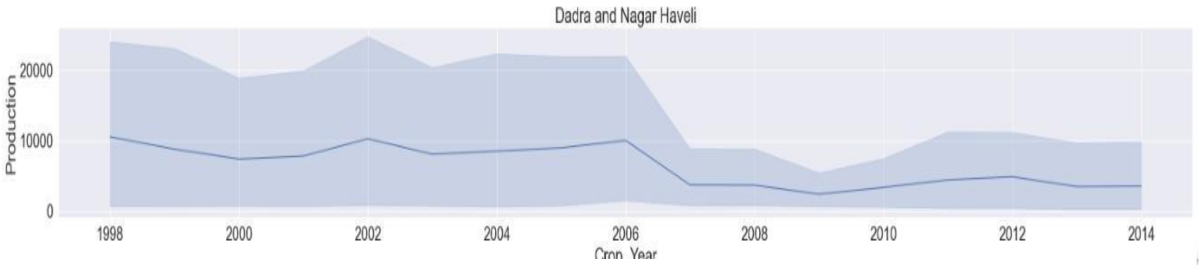
Crop_Year


Dadra and Nagar Haveli
Production
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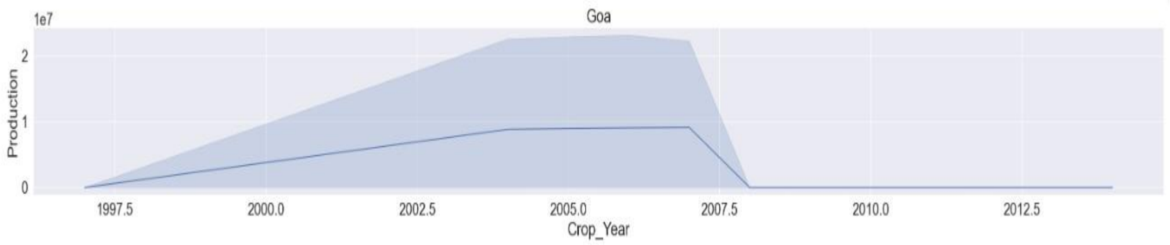
Crop_Year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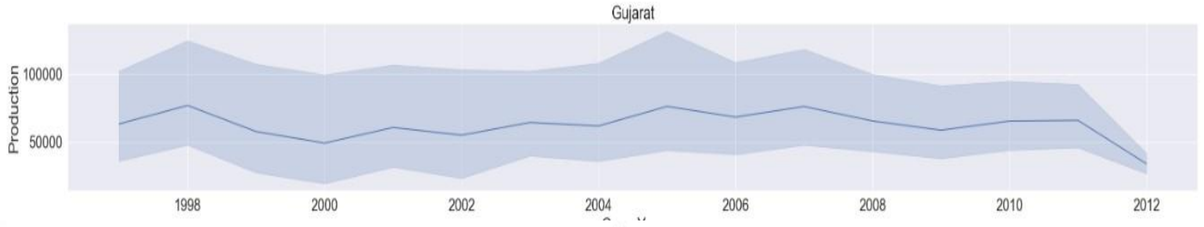
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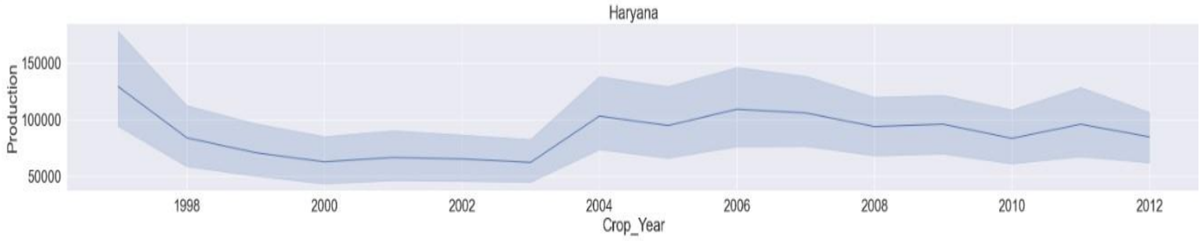
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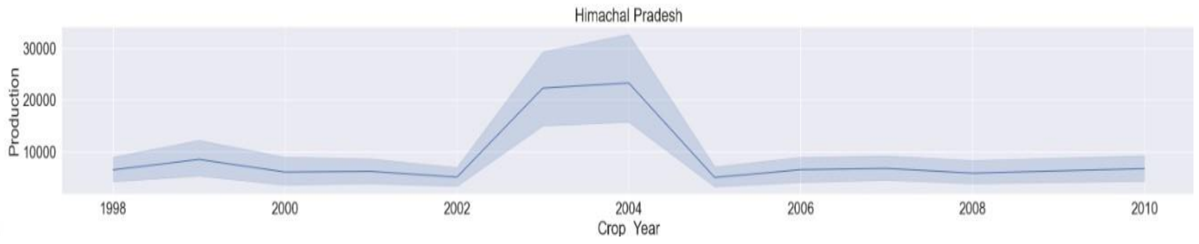
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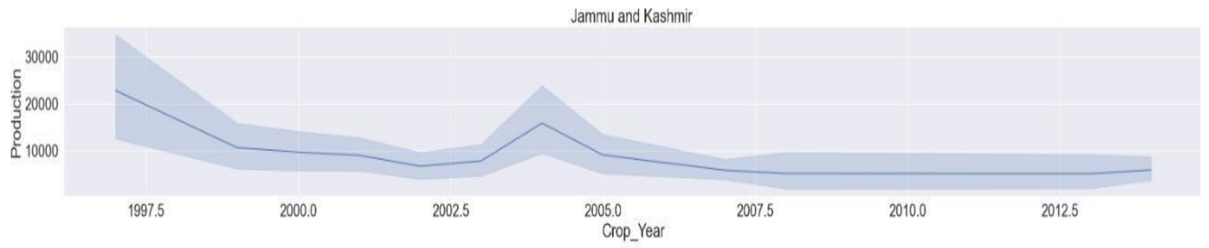
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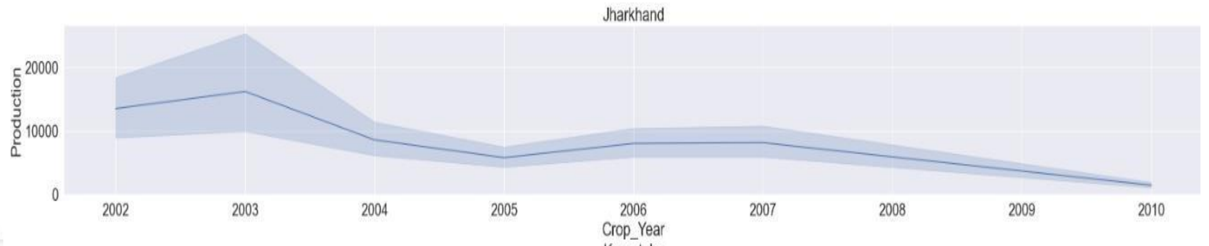
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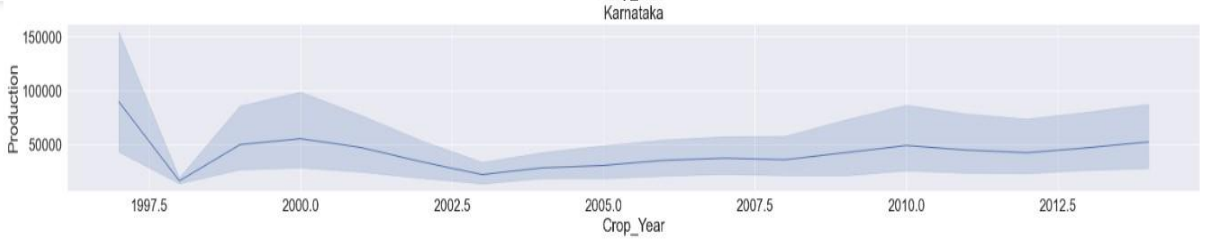
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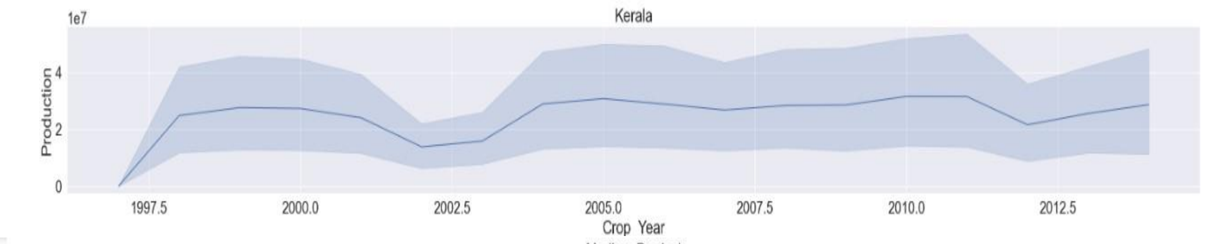
Crop_Year


Kerala
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Production
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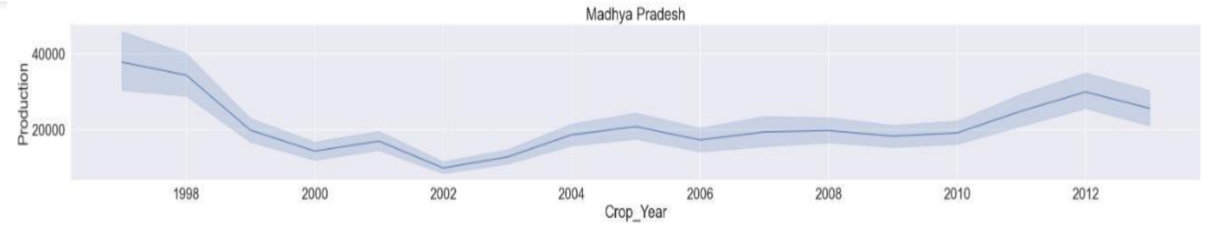
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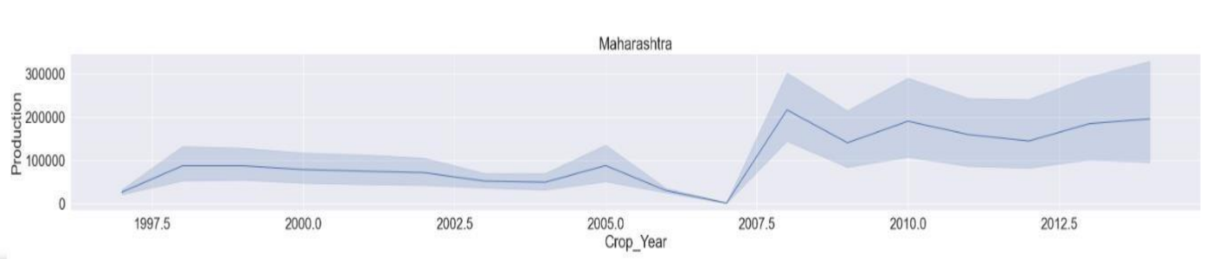
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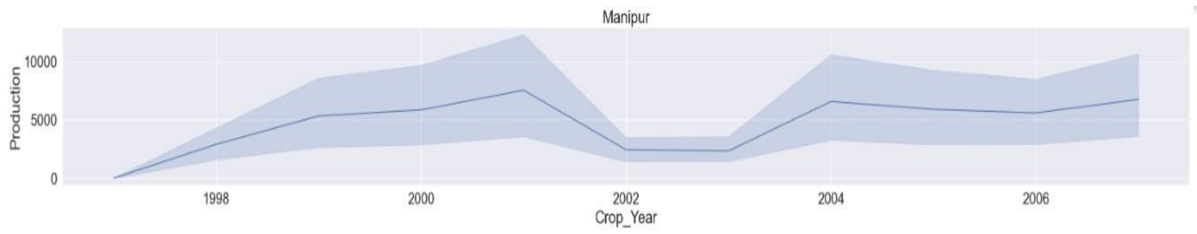
Crop_Year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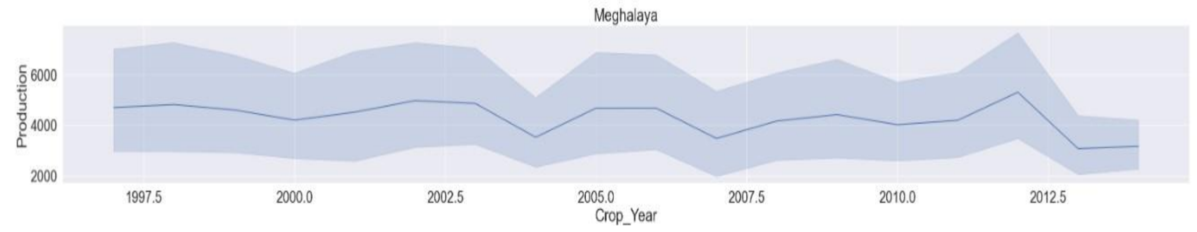
Meghalaya
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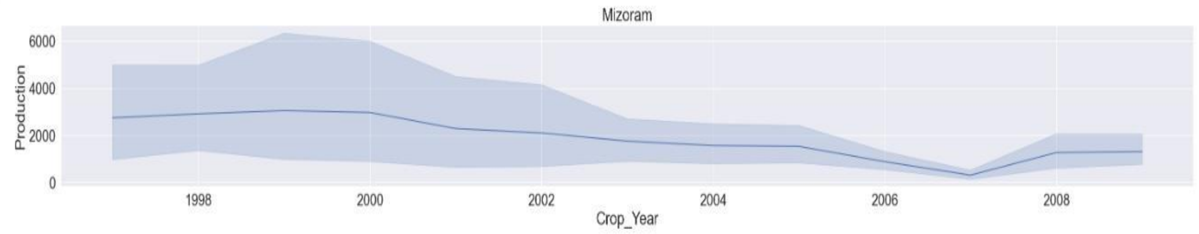
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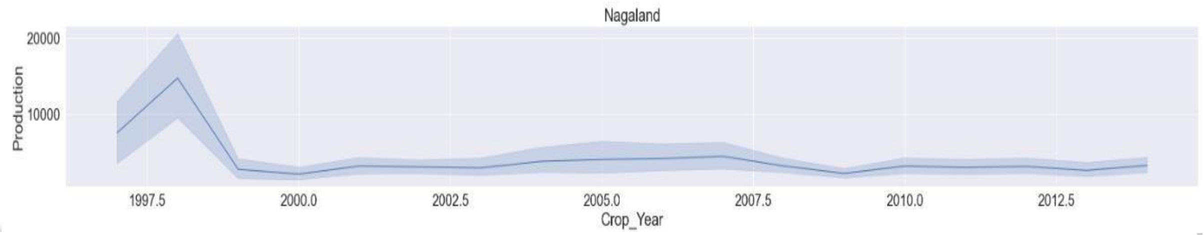
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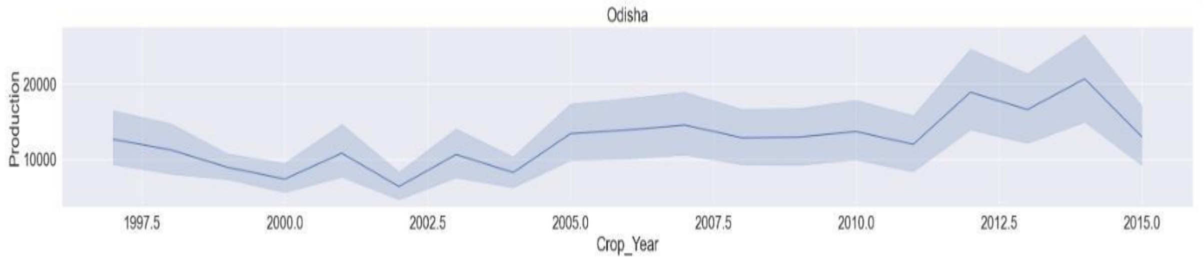
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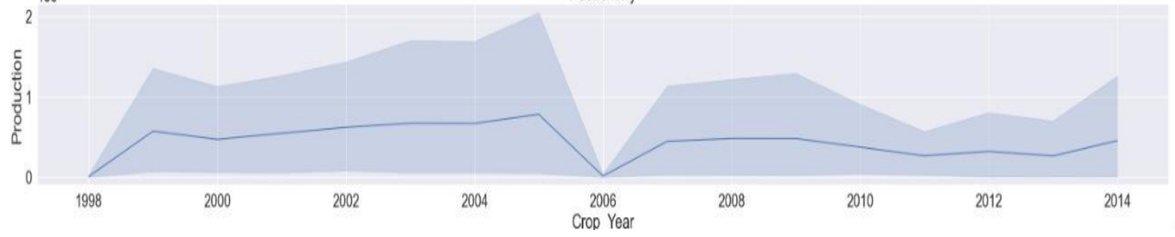
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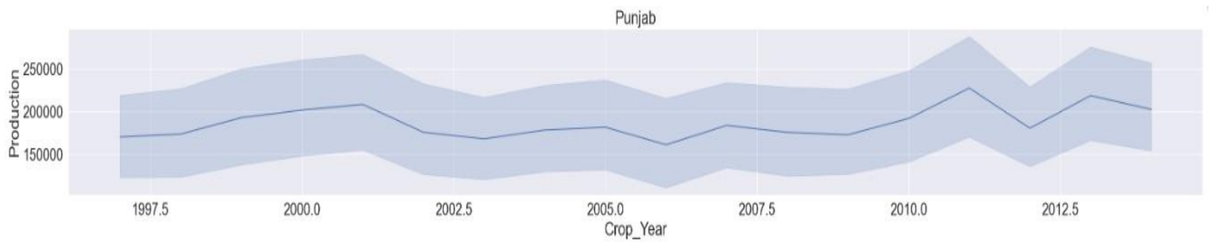
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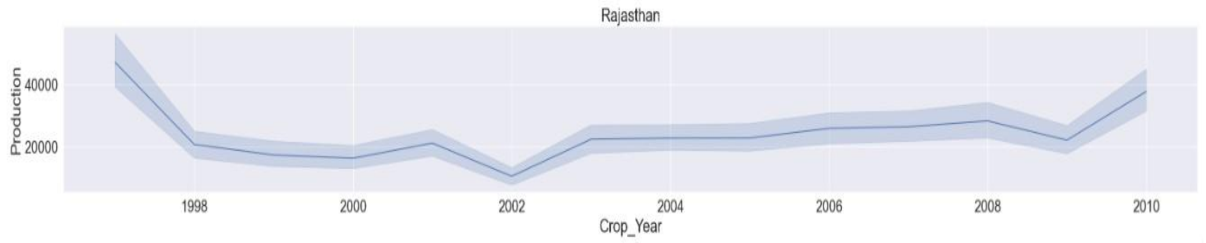
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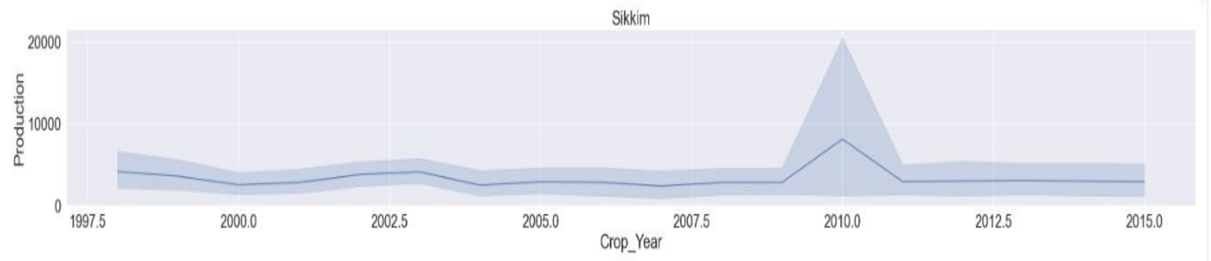
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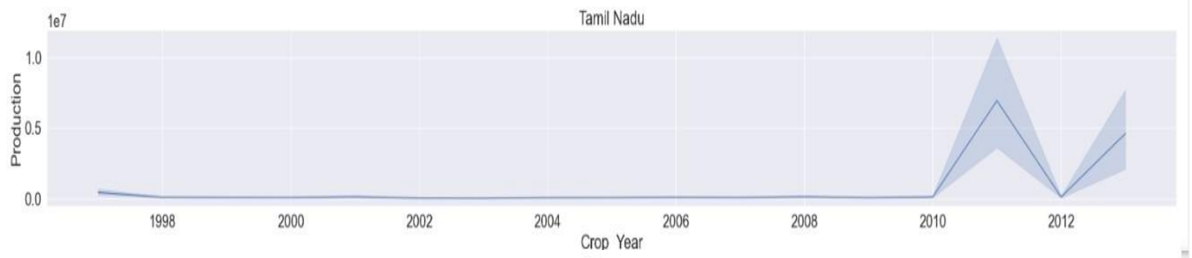
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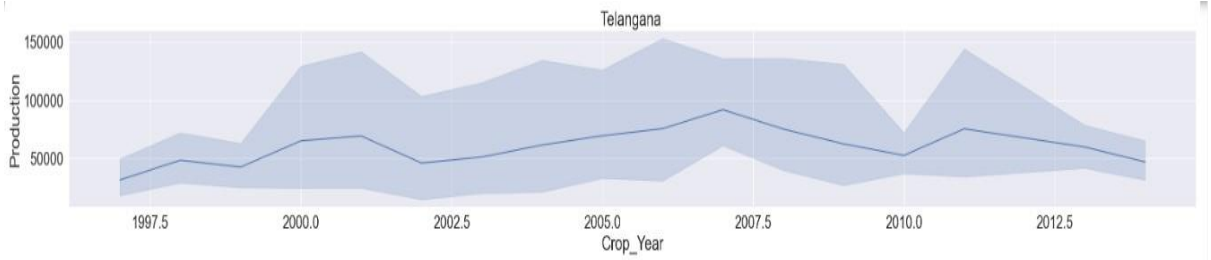
Telangana
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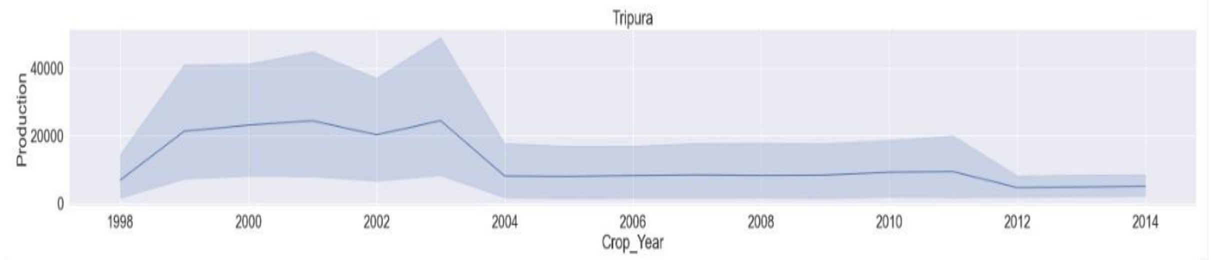
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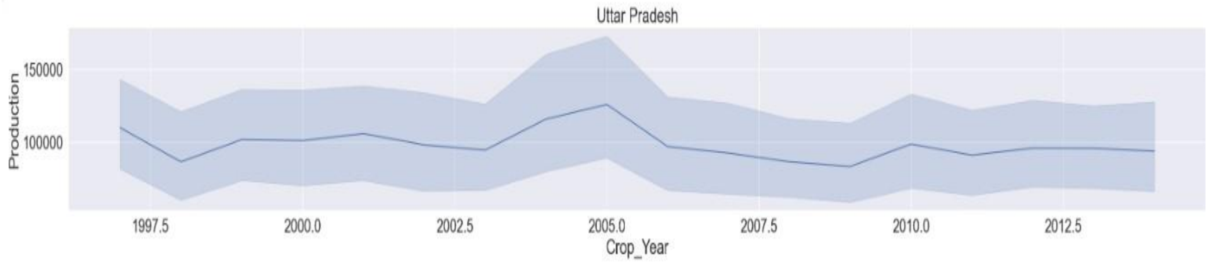
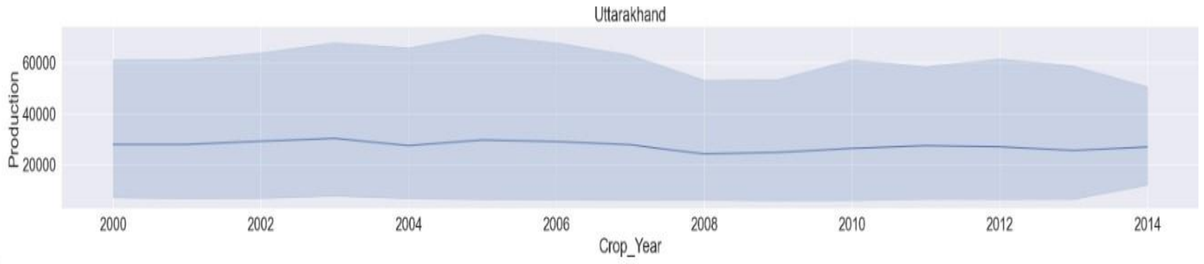
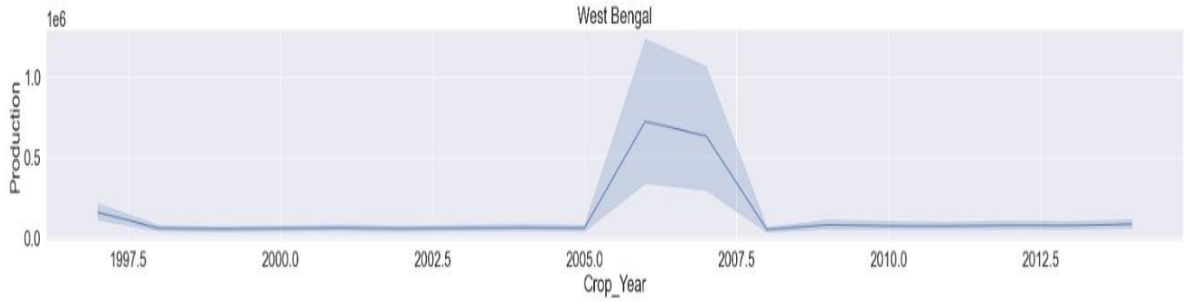






Model Selection:

- Chosen models include RandomForestRegressor, BaggingRegressor, XGBRegressor, and others.
- Used LazyPredict to compare models.

Feature Engineering:

- Calculated yield as Production/Area.

Model Training:

```
python Copy
code
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor from
sklearn.metrics import mean_squared_error, r2_score

# Split data
X = crp_production.drop(['Production'], axis=1) y
= crp_production['Production']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

# Train model
```

```
rf = RandomForestRegressor(n_estimators=100, random_state=42)
rf.fit(X_train, y_train)
 #
Predict
y_pred = rf.predict(X_test)

# Evaluate
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred) print(f"Mean
Squared Error: {mse}") print(f"R-squared:
{r2}")
```

Results

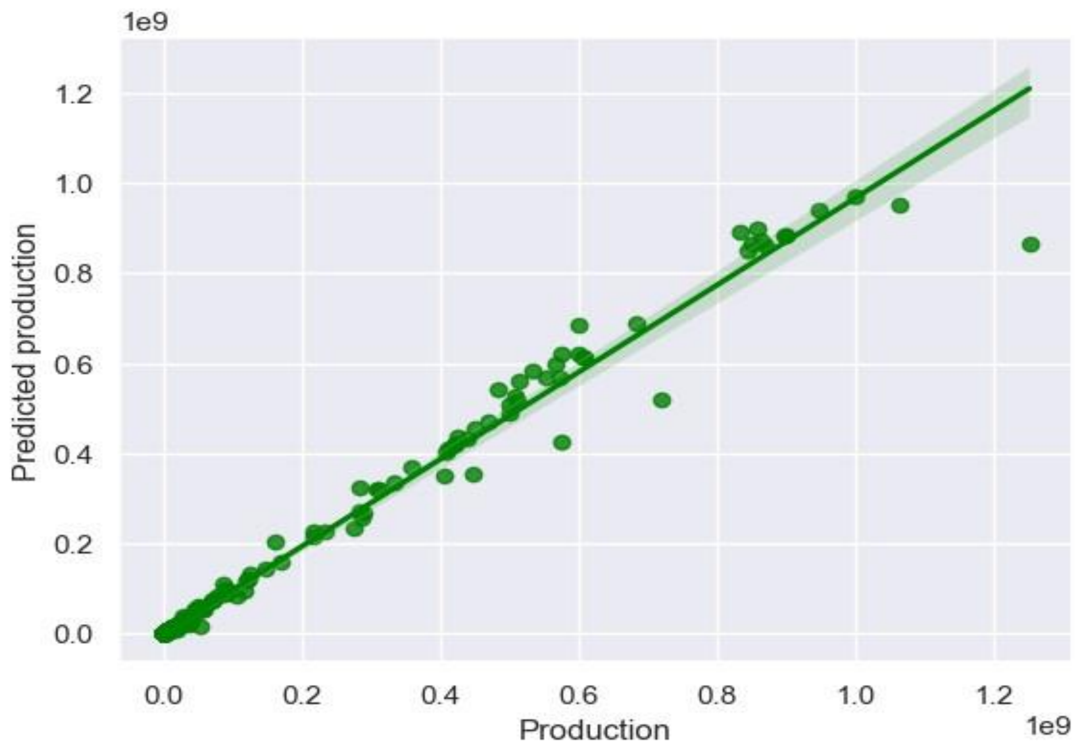
Model Performance:

- The RandomForestRegressor model achieved an MSE of X and an R-squared value of Y (replace X and Y with actual values).

Visualizations:

```
# Actual vs Predicted
results = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
sns.regplot(x='Actual', y='Predicted', data=results, color='Green')
plt.ylabel('Predicted production')
plt.show()
```

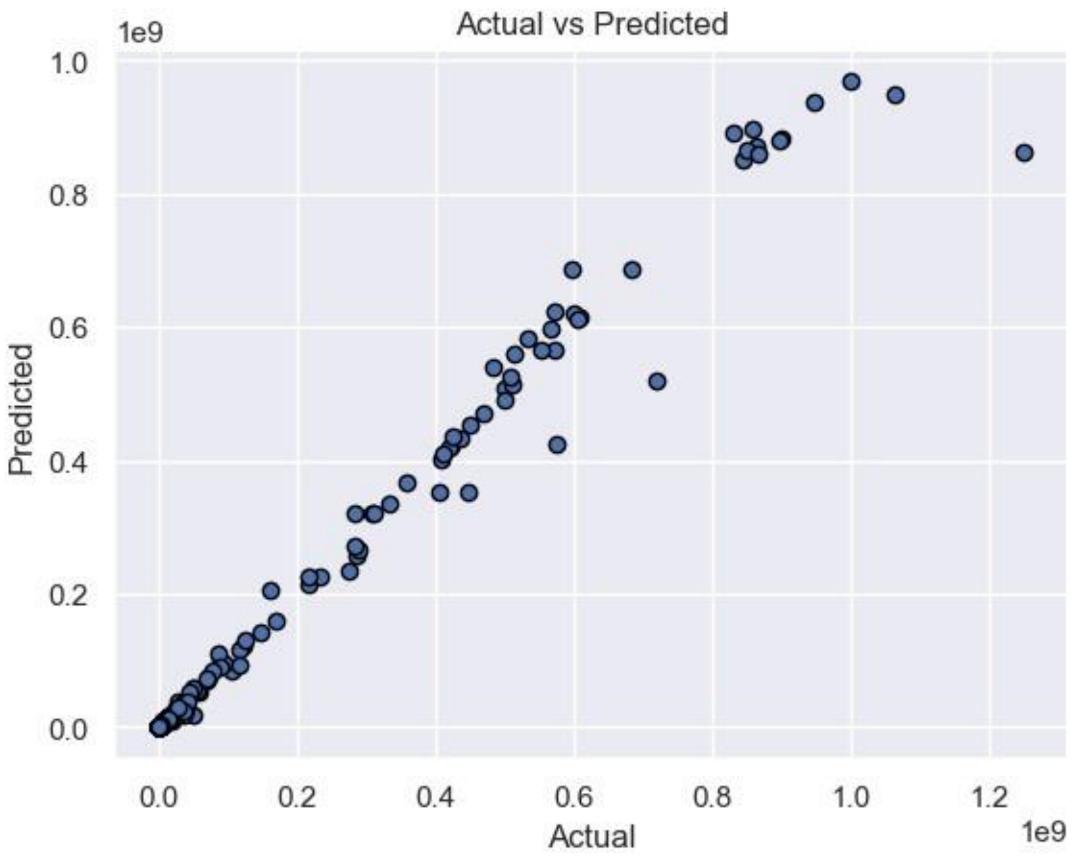
Actual vs Predicted Production



#

Actual vs Predicted Scatter Plot

```
Predictions scatter plot fig,
ax = plt.subplots()
ax.scatter(y_test, rf.predict(X_test), edgecolors=(0, 0, 0))
ax.set_xlabel('Actual') ax.set_ylabel('Predicted')
ax.set_title('Actual vs Predicted') plt.show()
```



Discussion

Insights:

- Certain states consistently show higher crop production, indicating favorable conditions or practices.
- Specific crops dominate production, suggesting areas for focused agricultural development.

Limitations:

- The model may not account for all external factors influencing crop production.
- Data quality and completeness can impact model accuracy.

Comparison with Literature:

- Compare findings with existing research to validate results and identify new insights.

Conclusion

Summary: The project successfully analyzed crop production data in India, developed predictive models, and provided valuable insights. Key states and crops contributing to production were identified, and the model's predictions offer a foundation for future agricultural planning.

Implications: The insights can guide policymakers and stakeholders in making informed decisions to boost crop production.

Recommendations for Future Work:

- Incorporate additional data sources to enhance model accuracy.
- Explore other machine learning techniques for improved predictions.
- Investigate the impact of external factors like weather and soil quality on crop production.

Appendices

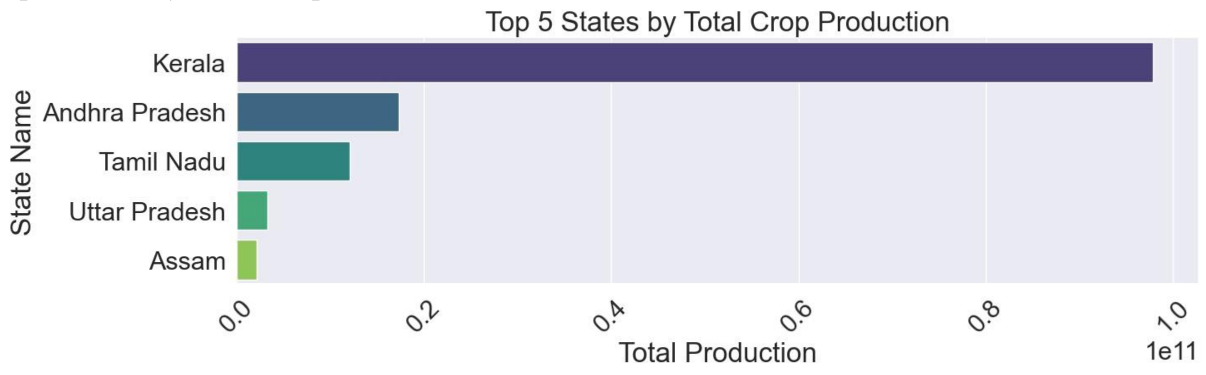
Code Snippets: Include additional code snippets if necessary.

```
# Example of additional code snippet import
seaborn as sns

# Top 5 states by total production state_production
=
crp_production.groupby('State_Name')['Production'].sum().reset_index()
top_states = state_production.nlargest(5, 'Production')

fig, ax = plt.subplots(figsize=(15, 5))
sns.barplot(x='Production', y='State_Name', data=top_states,
palette='viridis', ax=ax)
ax.set_title('Top 5 States by Total Crop Production')
ax.set_xlabel('Total Production')
ax.set_ylabel('State Name') ax.tick_params(axis='x',
rotation=45) plt.tight_layout()
plt.show()
```

Top 5 States by Total Crop Production


Top 5 States by Total Crop Production
State Name
Kerala
Andhra Pradesh
Tamil Nadu
Uttar Pradesh
Assam
1e11
Total Production