CROP_PRODUCTION_ANALYSIS

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score

data=pd.read_csv("Crop Production data.csv")

# Display the first few rows of the dataset
print(data.head())

# Check for missing values
print(data.isnull().sum())

# Handle missing values
data = data.dropna()  # or use data.fillna() for imputation

# Convert categorical columns to numerical
data['State_Name'] = data['State_Name'].astype('category').cat.codes
data['District_Name'] =
data['District_Name'].astype('category').cat.codes
data['Season'] = data['Season'].astype('category').cat.codes
data['Crop'] = data['Crop'].astype('category').cat.codes

data.sample(10)
```

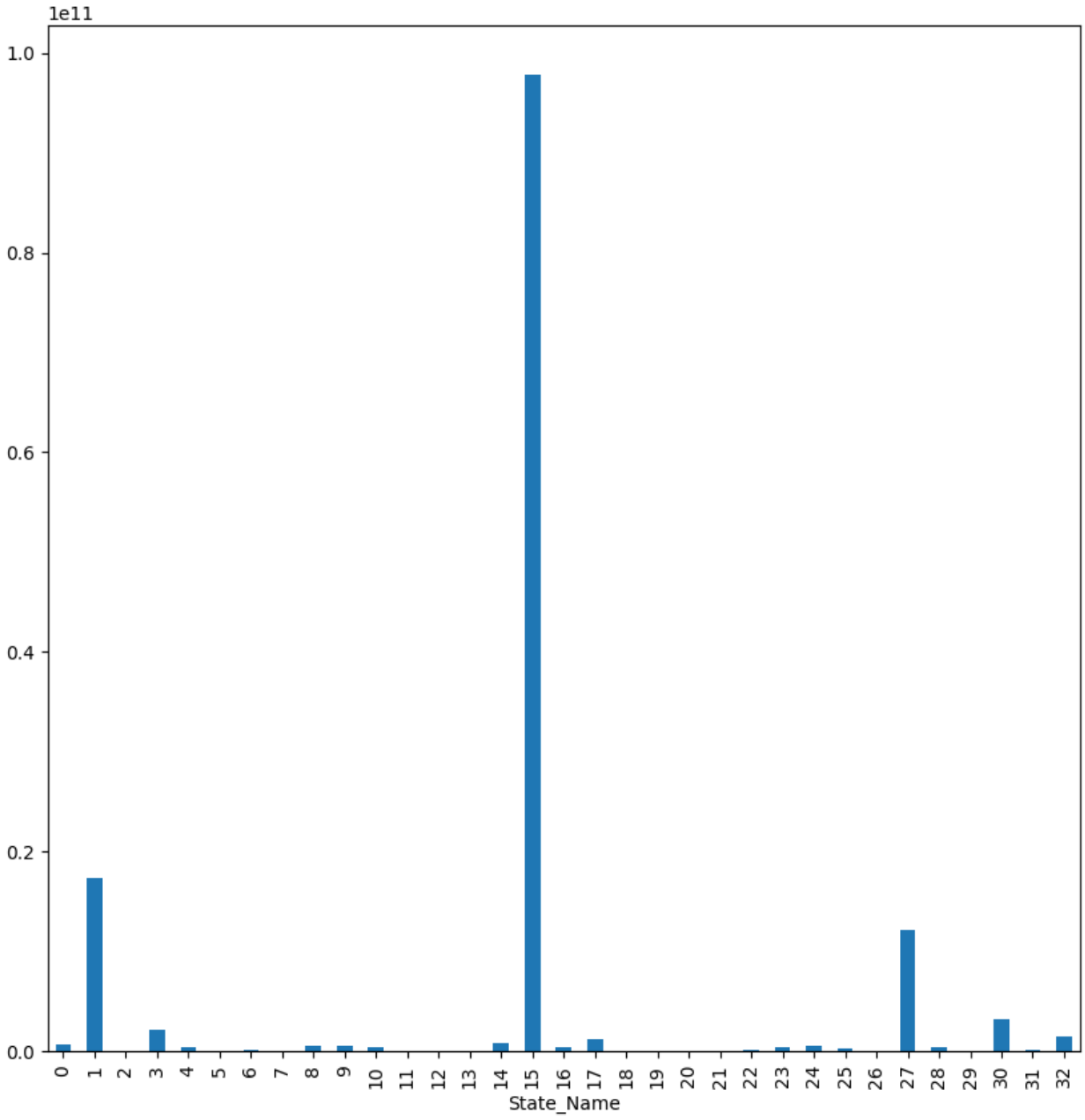
```
                    State_Name District_Name  Crop_Year
Season  \
0  Andaman and Nicobar Islands      NICOBARS       2000  Kharif

1  Andaman and Nicobar Islands      NICOBARS       2000  Kharif

2  Andaman and Nicobar Islands      NICOBARS       2000  Kharif

3  Andaman and Nicobar Islands      NICOBARS       2000  Whole Year

4  Andaman and Nicobar Islands      NICOBARS       2000  Whole Year


                   Crop    Area  Production
0              Arecanut  1254.0      2000.0
1  Other Kharif pulses     2.0         1.0
2                  Rice   102.0       321.0
3                Banana   176.0       641.0
4             Cashewnut   720.0       165.0
State_Name           0
District_Name        0
Crop_Year            0
Season               0
```

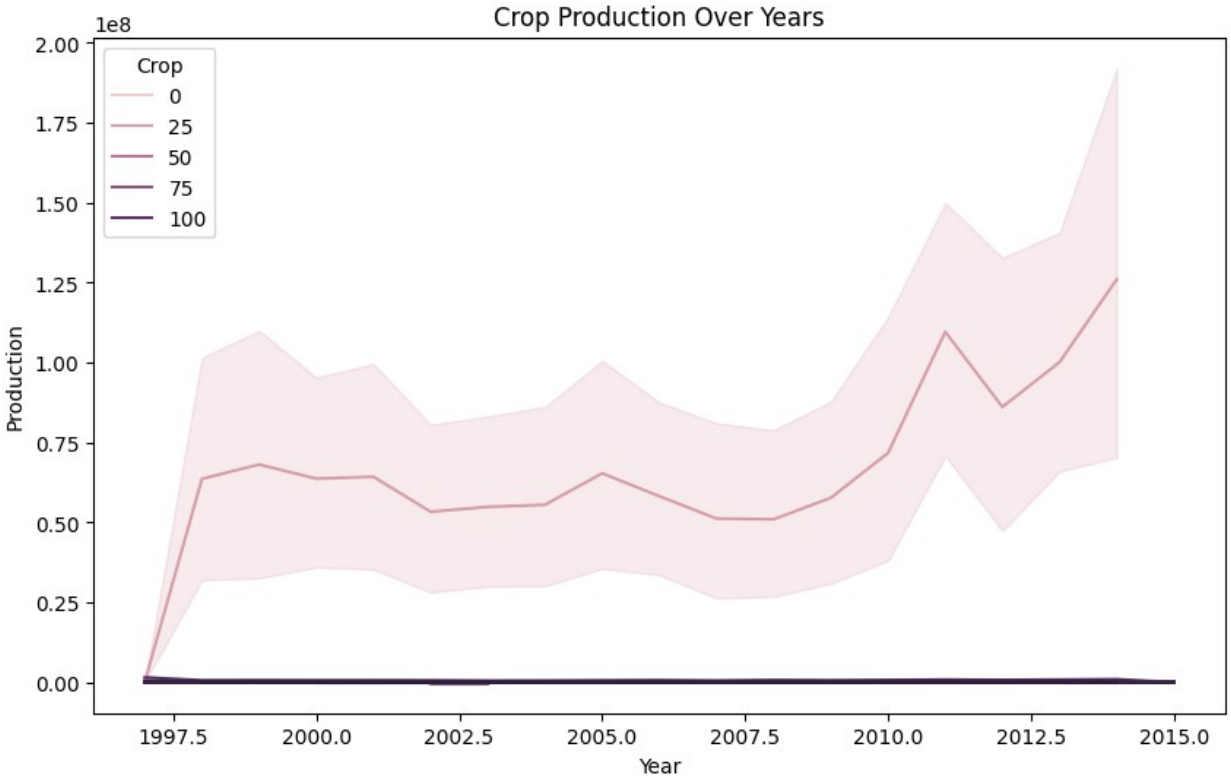
```
Crop                0
Area                0
Production       3730
dtype: int64
```

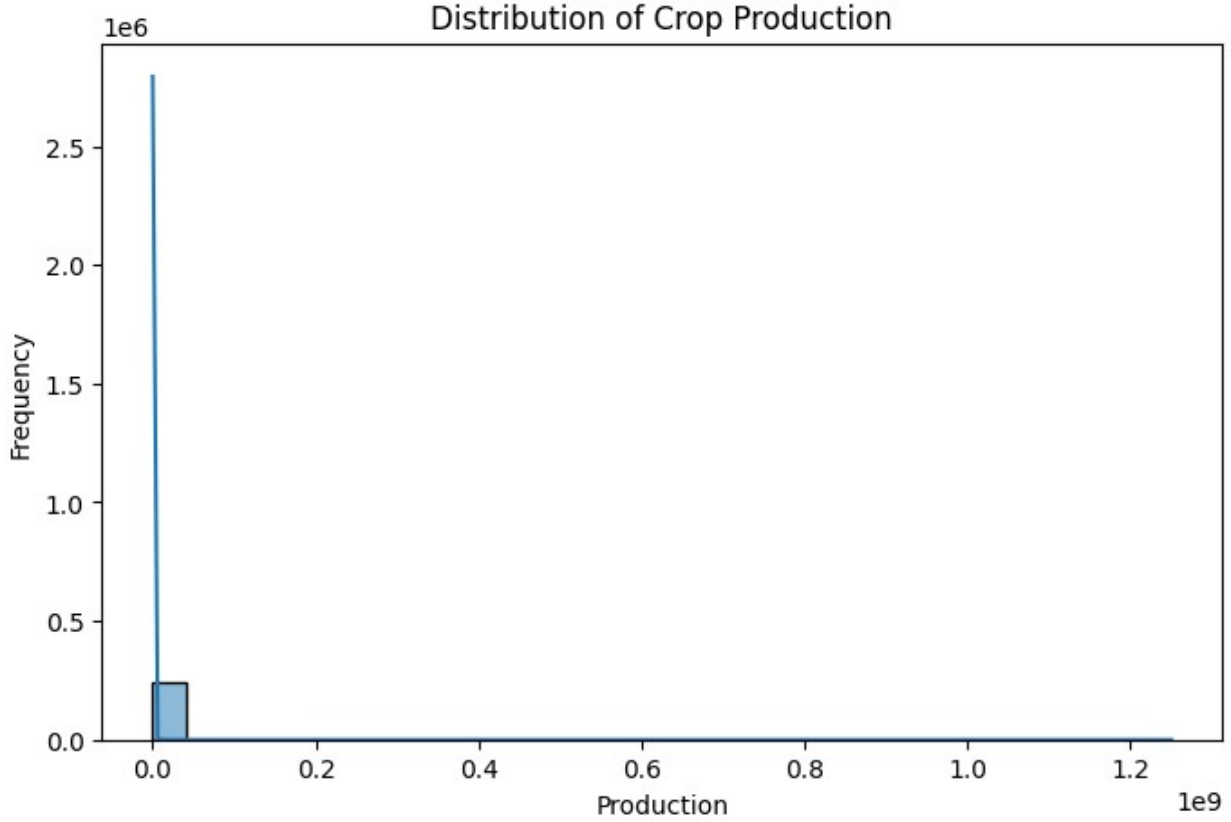
```
            State_Name District_Name  Crop_Year       Season
Crop  \
150204          Odisha       DEOGARH       2005  Autumn
Groundnut
151724          Odisha        GANJAM       2008  Winter
Maize
225919   Uttar Pradesh        RAMPUR       2000  Rabi
Urad
3121    Andhra Pradesh        GUNTUR       2012  Rabi
Sesamum
171977       Rajasthan      JHALAWAR       2004  Whole Year
Potato
182111      Tamil Nadu       MADURAI       2002  Kharif
Ragi
183298      Tamil Nadu      NAMAKKAL       2013  Rabi
Cotton(lint)
100220          Kerala     KOZHIKODE       2003  Whole Year
Brinjal
119490  Madhya Pradesh         SATNA       2002  Whole Year
Garlic
99217           Kerala     KASARAGOD       1998  Whole Year
Banana

          Area  Production
150204   337.0       291.5
151724     1.0         0.7
225919    14.0         6.0
3121    1863.0       490.0
171977   101.0      1266.0
182111   209.0       312.0
183298   602.0      1808.0
100220     1.0         0.0
119490    93.0       204.0
99217    727.0      9427.0
```

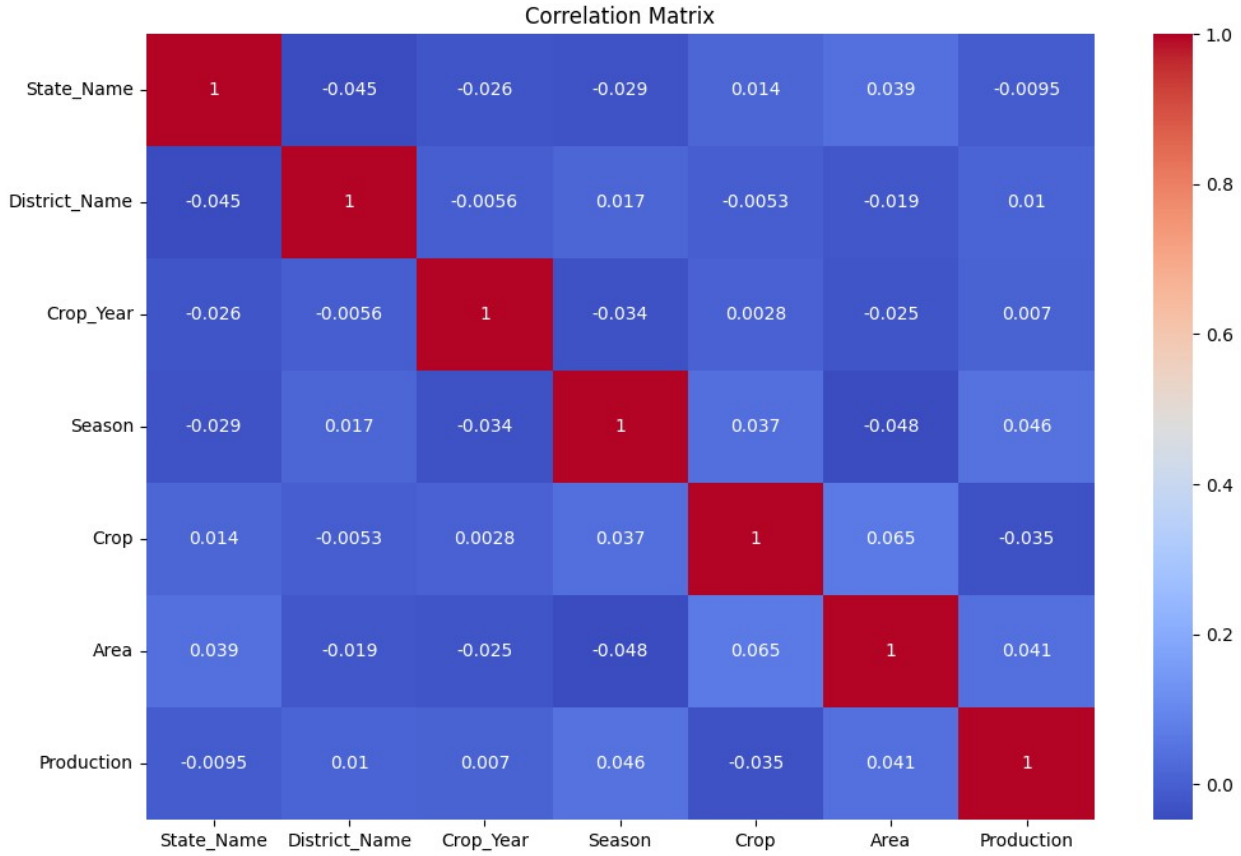
```
#FIG_1
State_wis=data.groupby(data['State_Name'])["Production"].sum()
State_wis.head(10)
State_wis.plot(kind='bar',figsize=(10,10))
#FIG_2
plt.figure(figsize=(10, 6))
sns.lineplot(data=data, x='Crop_Year', y='Production', hue='Crop')
plt.title('Crop Production Over Years')
plt.xlabel('Year')
plt.ylabel('Production')
```

```
plt.show()
#FIG_3
plt.figure(figsize=(8, 5))
sns.histplot(data['Production'], bins=30, kde=True)
plt.title('Distribution of Crop Production')
plt.xlabel('Production')
plt.ylabel('Frequency')
plt.show()
#FIG_4
plt.figure(figsize=(12, 8))
sns.heatmap(data.corr(), annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()

plt.show()
```

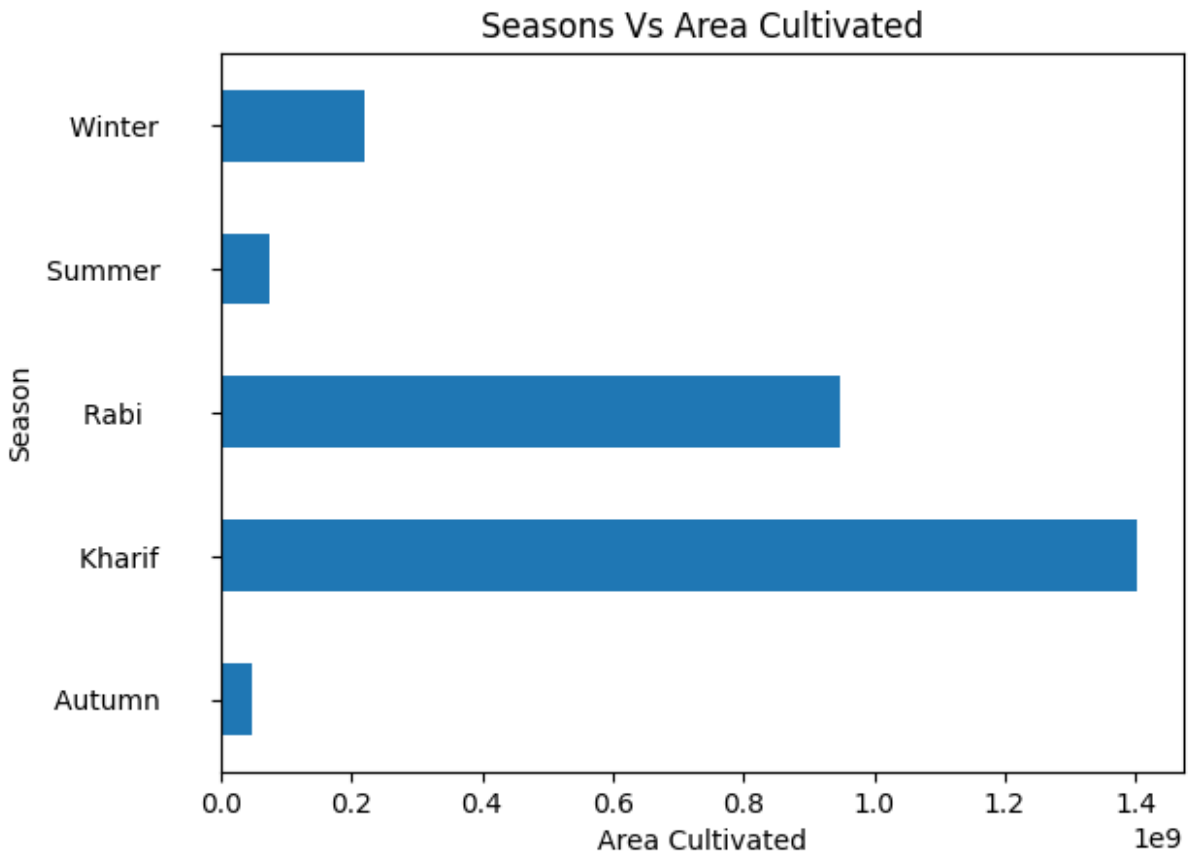

1e11
1.0
0.8
0.6
0.4
0.2
0.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
State_Name


Crop Production Over Years
1e8
Crop
0
25
50
75
100
Production
Year
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
1997.5
2000.0
2002.5
2005.0
2007.5
2010.0
2012.5
2015.0


Distribution of Crop Production
1e6
Frequency
Production
1e9
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2




```
# Area Cultivated by Season
Season_Area=data[['Season','Area']].groupby('Season',as_index=False).sum()
Season_Area=Season_Area[Season_Area['Season'].str.strip() != 'Whole Year']
Season_Area.plot(kind='barh',x='Season',y='Area',legend=False)
plt.ylabel('Season')
plt.xlabel('Area Cultivated')
plt.title('Seasons Vs Area Cultivated')
plt.show()
```




```
crops=data[['Crop','Production']].groupby('Crop').sum()
ordered_crops=crops.sort_values(by='Production',ascending=False)
top5_Crops=ordered_crops.iloc[0:5,:]
print('\n\033[1mTop 5 Crops According to Total Production:\033[0m')
top5_Crops
```

```
Top 5 Crops According to Total Production:

              Production
Crop
Coconut     1.299816e+11
Sugarcane   5.535682e+09
Rice        1.605470e+09
Wheat       1.332826e+09
Potato      4.248263e+08
```

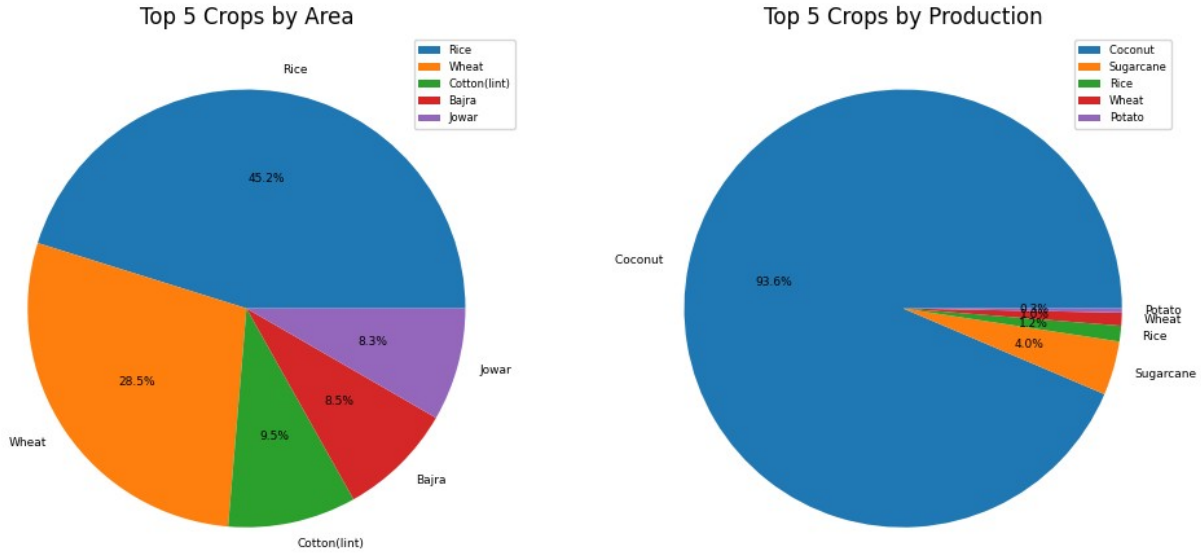
```
# Plotting Pie chart for Crop vs Area
crops=data[['Crop','Area']].groupby('Crop').sum()
ordered_crops=crops.sort_values(by='Area',ascending=False)
top5_Crops_Area=ordered_crops.iloc[0:5,:]
print('\n\033[1mTop 5 Crops According to Total Area of Cultivation:\
```

```
033[0m')
top5_Crops_Area
```

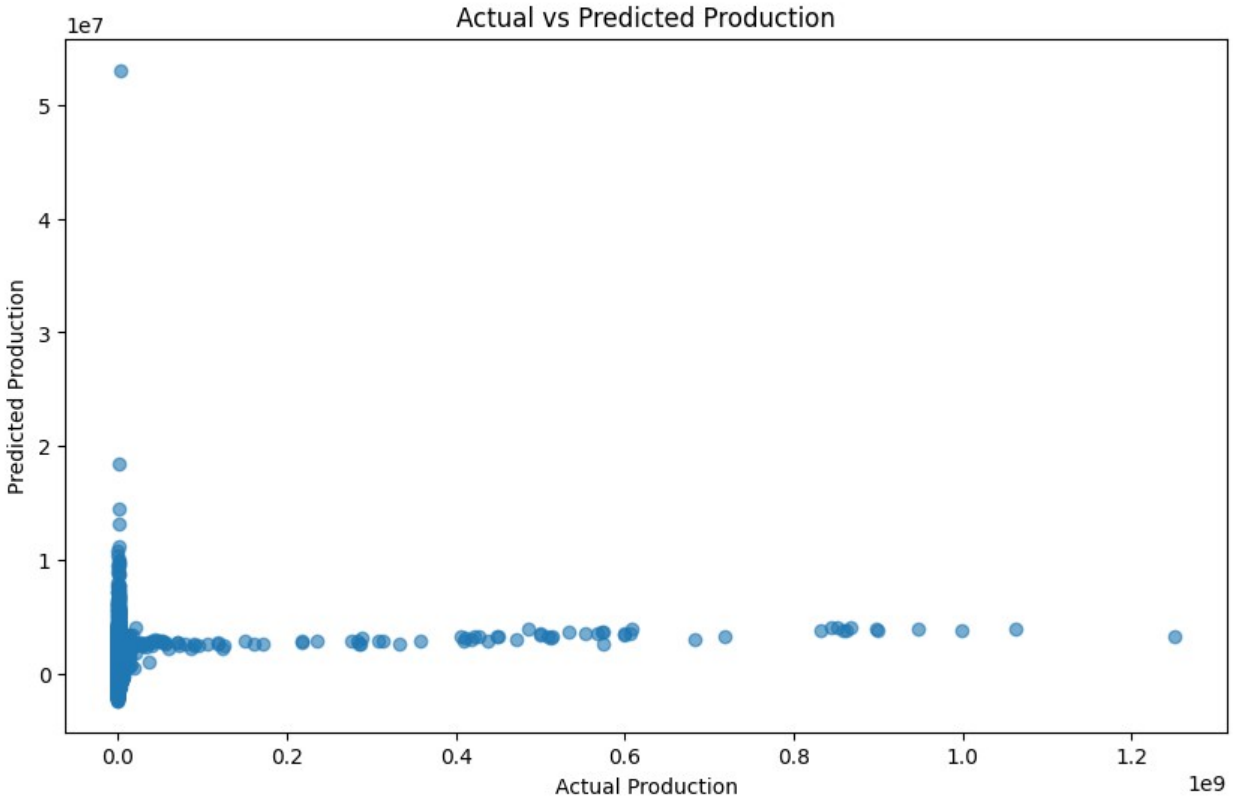
```
Top 5 Crops According to Total Area of Cultivation:033[0m
```

Crop	Area
Rice	7.463186e+08
Wheat	4.707132e+08
Cotton(lint)	1.565579e+08
Bajra	1.409679e+08
Jowar	1.376593e+08

```
# Plotting Pie charts for Crops vs Production and Crops Vs Area
fig=plt.figure(figsize=(12,20))
ax1=fig.add_subplot(1,2,1)
ax2=fig.add_subplot(1,2,2)
# Plotting Pie chart for Crop vs Area
top5_Crops_Area['Area'].plot(kind='pie',autopct='%1.1f%
%',ax=ax1,fontsize=6.5)
ax1.set_ylabel('')
ax1.set_title('Top 5 Crops by Area')
ax1.legend(labels=top5_Crops_Area.index,loc='upper right',fontsize=6)
# Plotting Pie chart for Crop vs Production
top5_Crops['Production'].plot(kind='pie',autopct='%1.1f%
%',ax=ax2,fontsize=6.5)
ax2.set_ylabel('')
ax2.set_title('Top 5 Crops by Production')
ax2.legend(labels=top5_Crops.index,loc='upper right',fontsize=6)
plt.show()
```



```
# Create new features if necessary
data['Production_per_Area'] = data['Production'] / data['Area']

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score


data['State_Name'] = data['State_Name'].astype('category').cat.codes
data['District_Name'] =
data['District_Name'].astype('category').cat.codes
data['Season'] = data['Season'].astype('category').cat.codes
data['Crop'] = data['Crop'].astype('category').cat.codes


X = data[['Area', 'Crop_Year', 'State_Name', 'District_Name',
'Season', 'Crop']]
y = data['Production']

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)


model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions
y_pred = model.predict(X_test)

# Evaluate the model
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
print(f'Mean Squared Error: {mse}')
print(f'R^2 Score: {r2}')

Mean Squared Error: 399775706589348.4
R^2 Score: 0.006368027228819684

# Visualization of actual vs predicted values
plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred, alpha=0.6)
plt.xlabel('Actual Production')
plt.ylabel('Predicted Production')
plt.title('Actual vs Predicted Production')
plt.show()

# Save the final dataset
data.to_csv('processed_crop_production_data.csv', index=False)
```


Actual vs Predicted Production
1e7
5
4
3
2
1
0
Predicted Production
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1e9
Actual Production