Crop Production Analysis In India

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


from google.colab import files
uploaded = files.upload()
```

```
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving Crop Production data.csv to Crop Production data.csv
```

```
df = pd.read_csv('/content/Crop Production data.csv')
```

Data Exploration and Cleaning

```
df.head()
```

	State_Name	District_Name	Crop_Year	Season	Crop	Area	Production
0	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Arecanut	1254.0	2000.0
1	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Other Kharif pulses	2.0	1.0
2	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Rice	102.0	321.0
3	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Banana	176.0	641.0
4	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Cashewnut	720.0	165.0

```
df.tail()
```

	State_Name	District_Name	Crop_Year	Season	Crop	Area	Production
246086	West Bengal	PURULIA	2014	Summer	Rice	306.0	801.0
246087	West Bengal	PURULIA	2014	Summer	Sesamum	627.0	463.0
246088	West Bengal	PURULIA	2014	Whole Year	Sugarcane	324.0	16250.0
246089	West Bengal	PURULIA	2014	Winter	Rice	279151.0	597899.0
246090	West Bengal	PURULIA	2014	Winter	Sesamum	175.0	88.0

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 246091 entries, 0 to 246090
Data columns (total 7 columns):
 #   Column         Non-Null Count   Dtype
---  ------         --------------   -----
 0   State_Name     246091 non-null  object
 1   District_Name  246091 non-null  object
 2   Crop_Year      246091 non-null  int64
 3   Season         246091 non-null  object
 4   Crop           246091 non-null  object
 5   Area           246091 non-null  float64
 6   Production     242361 non-null  float64
dtypes: float64(2), int64(1), object(4)
memory usage: 13.1+ MB
```

```
df.describe()
```

	Crop_Year	Area	Production
count	246091.000000	2.460910e+05	2.423610e+05
mean	2005.643018	1.200282e+04	5.825034e+05
std	4.952164	5.052340e+04	1.706581e+07
min	1997.000000	4.000000e-02	0.000000e+00
25%	2002.000000	8.000000e+01	8.800000e+01
50%	2006.000000	5.820000e+02	7.290000e+02
75%	2010.000000	4.392000e+03	7.023000e+03
max	2015.000000	8.580100e+06	1.250800e+09

```
df.columns
```

```
Index(['State_Name', 'District_Name', 'Crop_Year', 'Season', 'Crop', 'Area',
       'Production'],
      dtype='object')
```

```
missing_values = df.isnull().sum()
print("Missing Values\n", missing_values)
```

```
Missing Values
 State_Name          0
District_Name       0
Crop_Year           0
Season              0
Crop                0
Area                0
Production       3730
dtype: int64
```

```
duplicate_values = df.duplicated().sum()
print('Number of duplicates', duplicate_values)
```

```
Number of duplicates 0
```

```
df['Production']
```

	Production
0	2000.0
1	1.0
2	321.0
3	641.0
4	165.0
...	...
246086	801.0
246087	463.0
246088	16250.0
246089	597899.0
246090	88.0

246091 rows × 1 columns

```
missing_percentage = df['Production'].isna().mean() * 100
print(f"Percentage of missing values in 'Production': {missing_percentage}%")
```

```
Percentage of missing values in 'Production': 1.5156994770227274%
```

```
# Group by 'Crop' and 'Season' to count missing production values
missing_by_crop_season = df[df['Production'].isna()].groupby(['Crop', 'Season']).size().reset_index(name='Missing_Count')
print(missing_by_crop_season)
```

```
                Crop       Season  Missing_Count
0          Arecanut  Whole Year              39
1         Arhar/Tur  Kharif                  97
2         Arhar/Tur  Rabi                    3
3         Arhar/Tur  Whole Year              2
```

```
4             Bajra  Kharif                 42
..              ...         ...            ...
123           Wheat  Kharif                  4
124           Wheat  Rabi                   16
125           Wheat  Whole Year              1
126  other oilseeds  Kharif                 10
127  other oilseeds  Rabi                   29

[128 rows x 3 columns]
```

```
# Drop rows where 'Production' is missing
df_cleaned = df.dropna(subset=['Production'])
print(f"After dropping rows, the dataset has {df_cleaned.shape[0]} rows.")
```

```
After dropping rows, the dataset has 242361 rows.
```

```
df.to_csv('Cleaned_Crop_Production_Data.csv', index=False)
```

Data Analysis

```
print(df['State_Name'].unique())
```

```
['Andaman and Nicobar Islands' 'Andhra Pradesh' 'Arunachal Pradesh'
 'Assam' 'Bihar' 'Chandigarh' 'Chhattisgarh' 'Dadra and Nagar Haveli'
 'Goa' 'Gujarat' 'Haryana' 'Himachal Pradesh' 'Jammu and Kashmir '
 'Jharkhand' 'Karnataka' 'Kerala' 'Madhya Pradesh' 'Maharashtra' 'Manipur'
 'Meghalaya' 'Mizoram' 'Nagaland' 'Odisha' 'Puducherry' 'Punjab'
 'Rajasthan' 'Sikkim' 'Tamil Nadu' 'Telangana ' 'Tripura' 'Uttar Pradesh'
 'Uttarakhand' 'West Bengal']
```

```
print(df['Crop'].unique())
```

```
['Arecanut' 'Other Kharif pulses' 'Rice' 'Banana' 'Cashewnut' 'Coconut '
 'Dry ginger' 'Sugarcane' 'Sweet potato' 'Tapioca' 'Black pepper'
 'Dry chillies' 'other oilseeds' 'Turmeric' 'Maize' 'Moong(Green Gram)'
 'Urad' 'Arhar/Tur' 'Groundnut' 'Sunflower' 'Bajra' 'Castor seed'
 'Cotton(lint)' 'Horse-gram' 'Jowar' 'Korra' 'Ragi' 'Tobacco' 'Gram'
 'Wheat' 'Masoor' 'Sesamum' 'Linseed' 'Safflower' 'Onion'
 'other misc. pulses' 'Samai' 'Small millets' 'Coriander' 'Potato'
 'Other  Rabi pulses' 'Soyabean' 'Beans & Mutter(Vegetable)' 'Bhindi'
 'Brinjal' 'Citrus Fruit' 'Cucumber' 'Grapes' 'Mango' 'Orange'
 'other fibres' 'Other Fresh Fruits' 'Other Vegetables' 'Papaya'
 'Pome Fruit' 'Tomato' 'Rapeseed &Mustard' 'Mesta' 'Cowpea(Lobia)' 'Lemon'
 'Pome Granet' 'Sapota' 'Cabbage' 'Peas  (vegetable)' 'Niger seed'
 'Bottle Gourd' 'Sannhamp' 'Varagu' 'Garlic' 'Ginger' 'Oilseeds total'
 'Pulses total' 'Jute' 'Peas & beans (Pulses)' 'Blackgram' 'Paddy'
 'Pineapple' 'Barley' 'Khesari' 'Guar seed' 'Moth'
 'Other Cereals & Millets' 'Cond-spcs other' 'Turnip' 'Carrot' 'Redish'
 'Arcanut (Processed)' 'Atcanut (Raw)' 'Cashewnut Processed'
 'Cashewnut Raw' 'Cardamom' 'Rubber' 'Bitter Gourd' 'Drum Stick'
 'Jack Fruit' 'Snak Guard' 'Pump Kin' 'Tea' 'Coffee' 'Cauliflower'
 'Other Citrus Fruit' 'Water Melon' 'Total foodgrain' 'Kapas' 'Colocosia'
 'Lentil' 'Bean' 'Jobster' 'Perilla' 'Rajmash Kholar' 'Ricebean (nagadal)'
 'Ash Gourd' 'Beet Root' 'Lab-Lab' 'Ribed Guard' 'Yam' 'Apple' 'Peach'
 'Pear' 'Plums' 'Litchi' 'Ber' 'Other Dry Fruit' 'Jute & mesta']
```

```
print(df['Season'].unique())
```

```
['Kharif     ' 'Whole Year ' 'Autumn     ' 'Rabi       ' 'Summer     '
 'Winter     ']
```

(a) Total production and area per crop:

```
crop_summary = df.groupby('Crop').agg({'Area': 'sum', 'Production': 'sum'}).reset_index()
print(crop_summary)
```

```
                    Crop          Area    Production
0                  Apple  9.000000e+00  0.000000e+00
1    Arcanut (Processed)  1.441160e+05  1.928310e+05
2              Arecanut  6.012013e+06  2.034659e+07
3             Arhar/Tur  5.779154e+07  3.933139e+07
4             Ash Gourd  1.644000e+03  0.000000e+00
..                  ...           ...           ...
119               Wheat  4.707136e+08  1.332826e+09
120                 Yam  1.775000e+03  0.000000e+00
121         other fibres  1.263800e+04  0.000000e+00
122   other misc. pulses  3.084300e+04  9.704220e+03
123       other oilseeds  2.249815e+06  4.769909e+06

[124 rows x 3 columns]
```

(b) Production per year:

```
# Production per year
yearly_production = df.groupby('Crop_Year').agg({'Production': 'sum'}).reset_index()
print(yearly_production)
```

```
    Crop_Year    Production
0        1997  8.512329e+08
1        1998  5.825321e+09
2        1999  6.434666e+09
3        2000  7.449709e+09
4        2001  7.465541e+09
5        2002  7.696955e+09
6        2003  7.917974e+09
7        2004  8.189462e+09
8        2005  8.043757e+09
9        2006  8.681913e+09
10       2007  6.879442e+09
11       2008  7.717018e+09
12       2009  7.660494e+09
13       2010  6.307609e+09
14       2011  1.430890e+10
15       2012  8.171055e+09
16       2013  1.290359e+10
17       2014  8.664541e+09
18       2015  6.935065e+06
```

(c) State-wise production analysis:

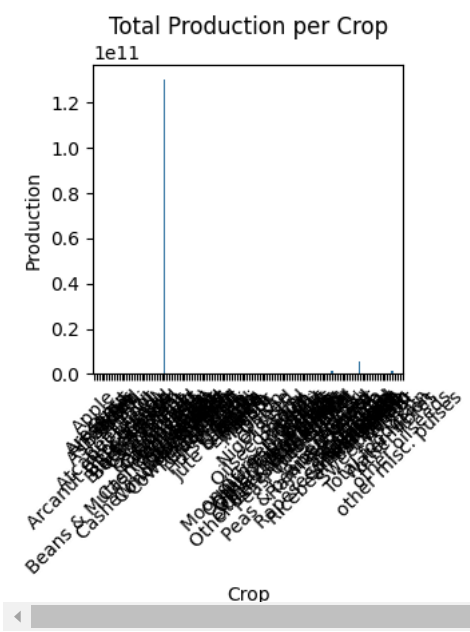
```
# Group by state to find total production per state
state_summary = df.groupby('State_Name').agg({'Production': 'sum', 'Area': 'sum'}).reset_index()
print(state_summary)
```

```
                      State_Name    Production          Area
0   Andaman and Nicobar Islands  7.182232e+08  3.378961e+05
1                Andhra Pradesh  1.732459e+10  1.315458e+08
2             Arunachal Pradesh  6.823913e+06  4.364346e+06
3                         Assam  2.111752e+09  7.037876e+07
4                         Bihar  3.664836e+08  1.282720e+08
5                    Chandigarh  6.395650e+04  1.252200e+04
6                  Chhattisgarh  1.009519e+08  8.303966e+07
7         Dadra and Nagar Haveli  1.847871e+06  3.965150e+05
8                           Goa  5.057558e+08  1.205680e+06
9                       Gujarat  5.242913e+08  1.549440e+08
10                      Haryana  3.812739e+08  8.959731e+07
11             Himachal Pradesh  1.780517e+07  1.000388e+07
12           Jammu and Kashmir   1.329102e+07  9.264623e+06
13                    Jharkhand  1.077774e+07  9.391046e+06
14                    Karnataka  8.634298e+08  2.029101e+08
15                       Kerala  9.788005e+10  3.190807e+07
16                Madhya Pradesh  4.488407e+08  3.298131e+08
17                   Maharashtra  1.263641e+09  3.222062e+08
18                       Manipur  5.230917e+06  2.007264e+06
19                     Meghalaya  1.211250e+07  4.035028e+06
20                       Mizoram  1.661540e+06  9.937352e+05
21                      Nagaland  1.276595e+07  6.070974e+06
22                        Odisha  1.609041e+08  1.105336e+08
23                    Puducherry  3.847245e+08  5.487420e+05
24                        Punjab  5.863850e+08  1.267256e+08
25                     Rajasthan  2.813203e+08  2.720249e+08
26                        Sikkim  2.435735e+06  1.524479e+06
27                    Tamil Nadu  1.207644e+10  9.589787e+07
28                    Telangana   3.351479e+08  8.136062e+07
29                       Tripura  1.252292e+07  4.641609e+06
30                  Uttar Pradesh  3.234493e+09  4.336316e+08
31                    Uttarakhand  1.321774e+08  1.879318e+07
32                    West Bengal  1.397904e+09  2.154052e+08
```

Data Visualisation

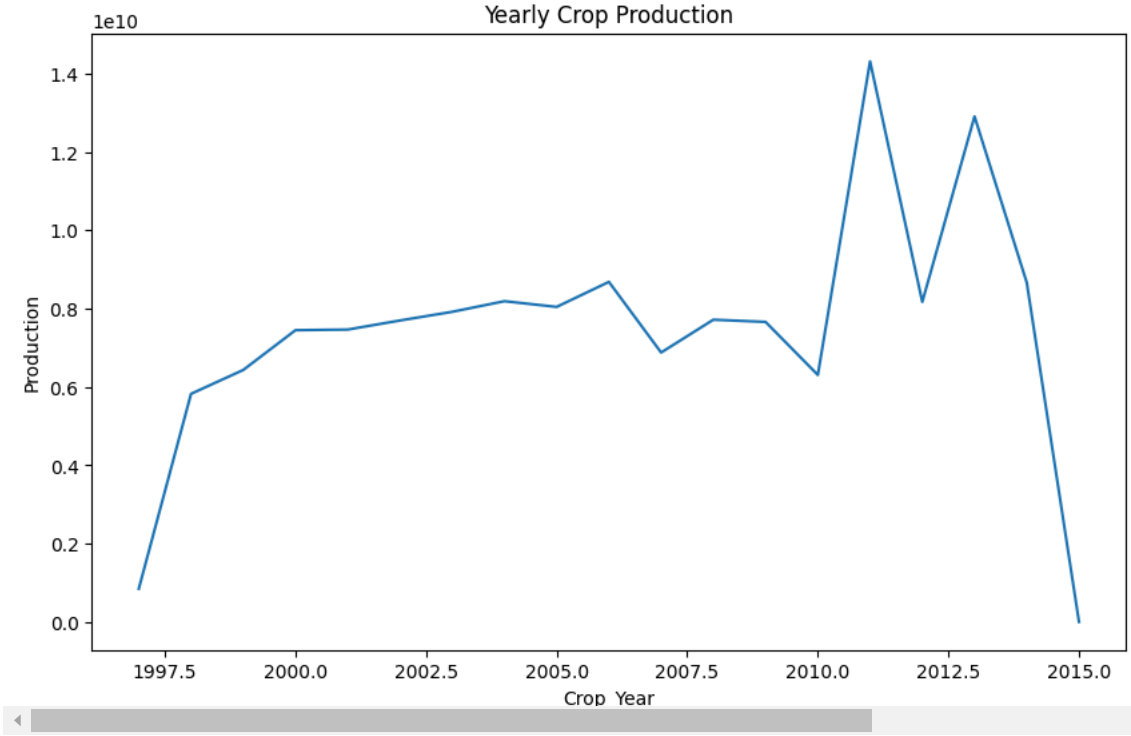
(a) Production per crop:

```
# Bar plot for production per crop
plt.figure(figsize=(3, 3))
sns.barplot(x='Crop', y='Production', data=crop_summary)
plt.title('Total Production per Crop')
plt.xticks(rotation=45)
plt.show()
```



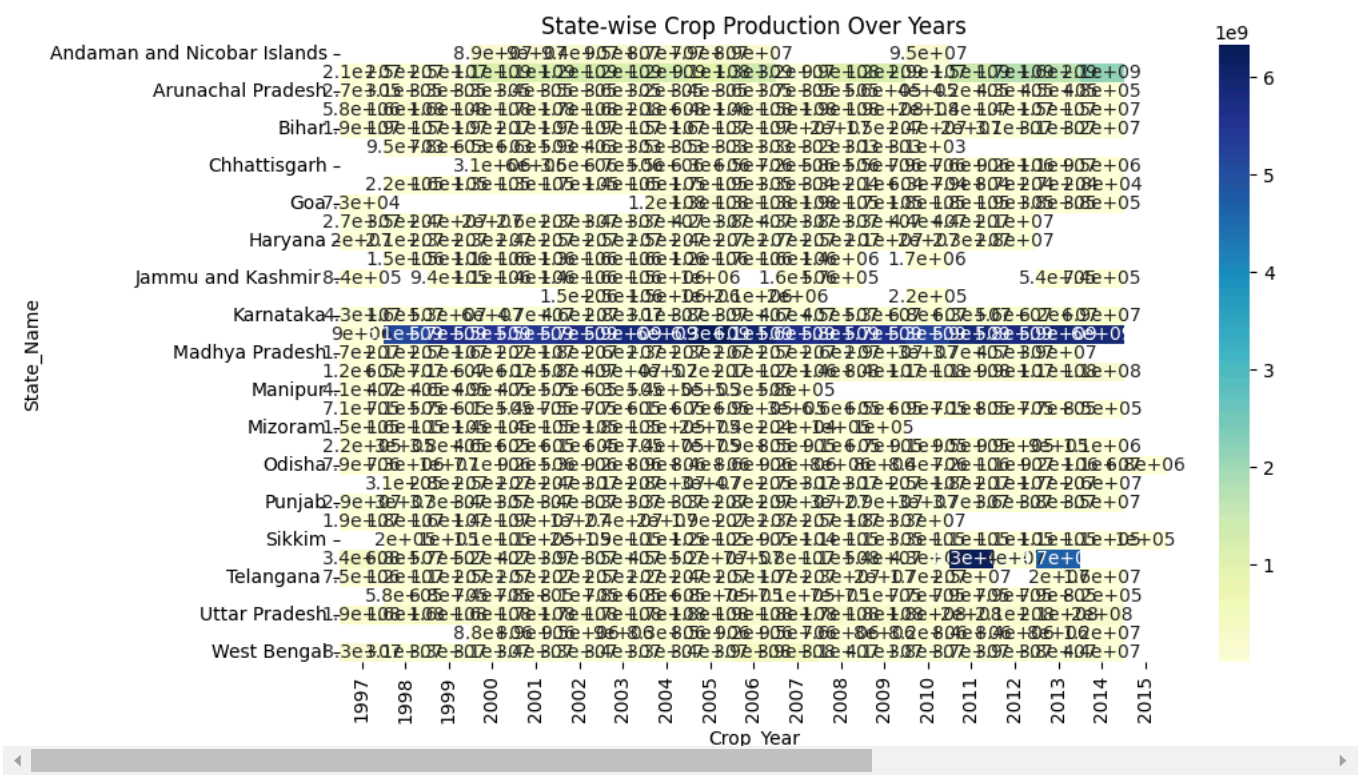
(b) Yearly production trends:

```
# Line plot for production over years
plt.figure(figsize=(10, 6))
sns.lineplot(x='Crop_Year', y='Production', data=yearly_production)
plt.title('Yearly Crop Production')
plt.show()
```



(c) State-Wise Production:

```
# Heatmap for production by state (if multiple states are available)
plt.figure(figsize=(10, 6))
state_pivot = df.pivot_table(values='Production', index='State_Name', columns='Crop_Year', aggfunc='sum')
sns.heatmap(state_pivot, annot=True, cmap='YlGnBu')
plt.title('State-wise Crop Production Over Years')
plt.show()
```



Correlation Analysis

```
# Correlation between Area and Production
correlation = df[['Area', 'Production']].corr()
print(correlation)
```

```
                Area  Production
Area        1.000000    0.040587
Production  0.040587    1.000000
```