Analysis of Karnataka Agriculture crop production

Objectives :

1) To study about highest and lowest crop production in an year.

2) To determine most common choice cop in Karnataka for agriculture?

3) To study about district wise total production of crops.

4) To know about the best year for agriculture.

5) To determine Annual production of crops from 2010-11 to 2019-20

6) To determine the highest Crop production ever received in a year in District

7) Analysis of crop production in Dakshin Kannada and Udupi

In [1]:
```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
In [2]:  1  data=pd.read_csv("Agriculture_Karnataka.csv")
         2  data
         3
```

Out[2]:

	State	District	Crop	Year	Season	Area	Area Units	Production	Production Units	Yield
0	Karnataka	BANGALORE RURAL	Arecanut	2010-11	Whole Year	1213	Hectare	13116.0	Tonnes	10.812861
1	Karnataka	BANGALORE RURAL	Arecanut	2011-12	Whole Year	1615	Hectare	13079.0	Tonnes	8.098452
2	Karnataka	BANGALORE RURAL	Arecanut	2012-13	Whole Year	1380	Hectare	11076.0	Tonnes	8.026087
3	Karnataka	BELGAUM	Arecanut	2010-11	Whole Year	1	Hectare	11.0	Tonnes	11.000000
4	Karnataka	BELGAUM	Arecanut	2011-12	Whole Year	4	Hectare	32.0	Tonnes	8.000000
...	...	...	...	...	...	...	...	...	...	...
13663	Karnataka	MYSORE	Wheat	2019-20	Rabi	7	Hectare	8.0	Tonnes	1.142857
13664	Karnataka	RAICHUR	Wheat	2019-20	Rabi	132	Hectare	126.0	Tonnes	0.954545
13665	Karnataka	RAMANAGARA	Wheat	2019-20	Rabi	4	Hectare	5.0	Tonnes	1.250000
13666	Karnataka	TUMKUR	Wheat	2019-20	Rabi	6	Hectare	7.0	Tonnes	1.166667
13667	Karnataka	YADGIR	Wheat	2019-20	Rabi	147	Hectare	185.0	Tonnes	1.258503

13668 rows × 10 columns

```
In [3]:  1  data.shape
```

Out[3]: (13668, 10)

```
In [4]:  1  data.columns
```

Out[4]: Index(['State', 'District', 'Crop', 'Year', 'Season', 'Area', 'Area Units',
       'Production', 'Production Units', 'Yield'],
      dtype='object')

```
In [5]:   1   data.isnull().sum()
```

Out[5]: State   0
        District   0
        Crop   0
        Year   0
        Season   0
        Area   0
        Area Units   0
        Production   147
        Production Units   0
        Yield   0
        dtype: int64

```
In [6]:   1   data.dropna(subset=["Production"],axis=0,inplace=True)
```

```
In [7]:   1   data.isnull().sum()
```

Out[7]: State   0
        District   0
        Crop   0
        Year   0
        Season   0
        Area   0
        Area Units   0
        Production   0
        Production Units   0
        Yield   0
        dtype: int64

```
In [8]:   1   data.shape
```

Out[8]: (13521, 10)

In [9]:
```
1  data.describe()
```

Out[9]:

	Area	Production	Yield
count	13521.000000	1.352100e+04	13521.000000
mean	8397.974336	3.023947e+06	197.489533
std	25986.579014	4.294137e+07	1318.166394
min	1.000000	1.000000e-01	0.008586
25%	47.000000	5.500000e+01	0.500000
50%	404.000000	5.250000e+02	1.074452
75%	3383.000000	5.902000e+03	3.244482
max	613760.000000	1.452725e+09	17590.294530

Exploratory data analysis

Unique count and values for Crops and district in Karnataka

In [10]:
```
1  # list of crops in Karnataka
2  crop_list=data["Crop"].unique()
3  print("Total number of crops in Karnataka",len(crop_list))
4  print("\nWe have following unique crops in the dataset - \n", crop_list)
```

```
Total number of crops in Karnataka 45

We have following unique crops in the dataset -
 ['Arecanut' 'Arhar/Tur' 'Bajra' 'Banana' 'Black pepper' 'Cardamom'
 'Cashewnut' 'Castor seed' 'Coconut' 'Coriander' 'Cotton(lint)'
 'Cowpea(Lobia)' 'Dry chillies' 'Garlic' 'Ginger' 'Gram' 'Groundnut'
 'Horse-gram' 'Jowar' 'Linseed' 'Maize' 'Mesta' 'Moong(Green Gram)'
 'Niger seed' 'Onion' 'Other Rabi pulses' 'Other Kharif pulses'
 'Peas & beans (Pulses)' 'Potato' 'Ragi' 'Rapeseed &Mustard' 'Rice'
 'Safflower' 'Sannhamp' 'Sesamum' 'Small millets' 'Soyabean' 'Sugarcane'
 'Sunflower' 'Sweet potato' 'Tapioca' 'Tobacco' 'Turmeric' 'Urad' 'Wheat']
```

```
In [11]:  1  district_list=data['District'].unique()
          2  print("Total number of districts in Karnataka : \n ",len(district_list))
          3  print("\nDistricts are: ",district_list)
```

```
Total number of districts in Karnataka :
 30

Districts are:  ['BANGALORE RURAL' 'BELGAUM' 'BELLARY' 'BENGALURU URBAN' 'CHAMARAJANAGAR'
 'CHIKBALLAPUR' 'CHIKMAGALUR' 'CHITRADURGA' 'DAKSHIN KANNAD' 'DAVANGERE'
 'DHARWAD' 'GADAG' 'HASSAN' 'HAVERI' 'KODAGU' 'MANDYA' 'MYSORE'
 'RAMANAGARA' 'SHIMOGA' 'TUMKUR' 'UDUPI' 'UTTAR KANNAD' 'BAGALKOT' 'BIDAR'
 'BIJAPUR' 'GULBARGA' 'KOLAR' 'KOPPAL' 'RAICHUR' 'YADGIR']
```

Dealing with various units of production:

We can observe a column named production units which is a measurement of crop production.We need to

standardize the uits to one specific unit to do proper measurement.Let us get units we have in out dataset.

```
In [12]:  1  units=data["Production Units"].unique()
          2  units
```

Out[12]: array(['Tonnes', 'Nuts', 'Bales'], dtype=object)

```
In [13]:  1  # As per internet source we have 1 Ton=4.59 Bales which is Us standard of measurem
```

```
In [14]:   1  def unit_standardization(df):
           2      if df["Production Units"]=="Nuts":
           3          new_production=df["Production"] / 50
           4          return new_production
           5      elif df["Production Units"]=="Tonnes":
           6          return df["Production"]
           7      else:
           8          new_production=df["Production"] / 4.59
           9          return new_production
          10  data["New Production"]=data.apply(unit_standardization,axis=1)
          11  data.head()
```

Out[14]:

	State	District	Crop	Year	Season	Area	Area Units	Production	Production Units	Yield	New Production
0	Karnataka	BANGALORE RURAL	Arecanut	2010-11	Whole Year	1213	Hectare	13116.0	Tonnes	10.812861	13116.0
1	Karnataka	BANGALORE RURAL	Arecanut	2011-12	Whole Year	1615	Hectare	13079.0	Tonnes	8.098452	13079.0
2	Karnataka	BANGALORE RURAL	Arecanut	2012-13	Whole Year	1380	Hectare	11076.0	Tonnes	8.026087	11076.0
3	Karnataka	BELGAUM	Arecanut	2010-11	Whole Year	1	Hectare	11.0	Tonnes	11.000000	11.0
4	Karnataka	BELGAUM	Arecanut	2011-12	Whole Year	4	Hectare	32.0	Tonnes	8.000000	32.0

we can now drop Production and production units as all our units in Tonnes and New production represnts the standard production we calculated

```
In [15]:   1  data.drop(columns=["Production","Production Units"],inplace=True)
           2  data.head()
```

Out[15]:

|	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
0	Karnataka	BANGALORE RURAL	Arecanut	2010-11	Whole Year	1213	Hectare	10.812861	13116.0
1	Karnataka	BANGALORE RURAL	Arecanut	2011-12	Whole Year	1615	Hectare	8.098452	13079.0
2	Karnataka	BANGALORE RURAL	Arecanut	2012-13	Whole Year	1380	Hectare	8.026087	11076.0
3	Karnataka	BELGAUM	Arecanut	2010-11	Whole Year	1	Hectare	11.000000	11.0
4	Karnataka	BELGAUM	Arecanut	2011-12	Whole Year	4	Hectare	8.000000	32.0

Highest and lowest crop production in an year

```
In [16]:   1  year=data.groupby("Year").mean()["New Production"].sort_values(ascending=False).reset_index()
           2  year
           3
```

Out[16]:

	Year	New Production
0	2014-15	108126.601103
1	2010-11	106219.108148
2	2018-19	104796.113844
3	2011-12	104298.302944
4	2012-13	104115.898222
5	2017-18	103558.222178
6	2019-20	103068.290304
7	2015-16	96327.367888
8	2013-14	95183.558111
9	2016-17	89718.637859

```
1  plt.figure(figsize=(8,8))
2  plt.bar(year["Year"],year["New Production"])
3  plt.xticks(year["Year"],rotation='vertical',size=10)
4  plt.xlabel("Year")
5  plt.ylabel("Total crop production")
6  plt.title("Crop production from 2010 to 2020")
7  plt.show()
```
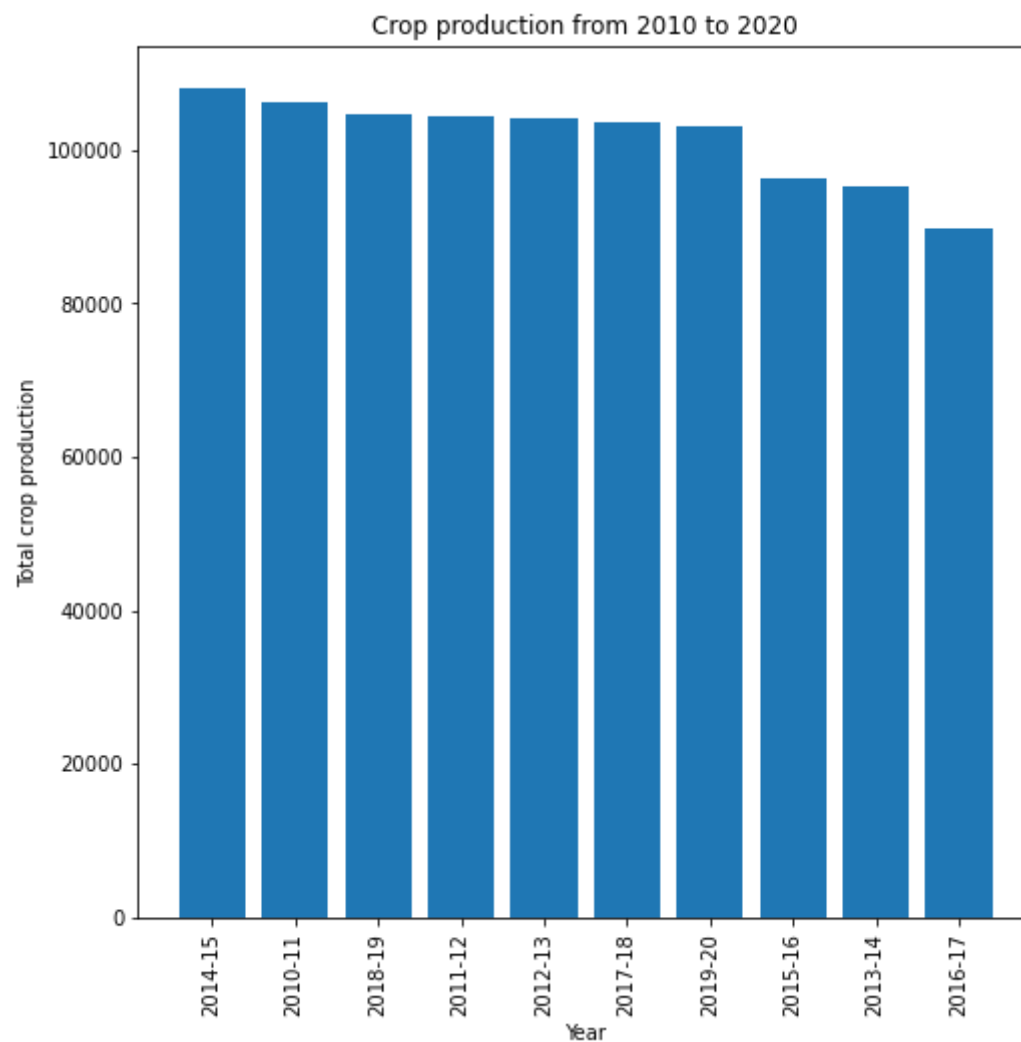
Which crop is the most common choice in Karnataka for agriculture?

```
In [18]:    1  data["Crop"].value_counts()
```

```
Out[18]: Maize                826
         Onion                693
         Rice                 689
         Dry chillies         684
         Cowpea(Lobia)        653
         Sunflower            601
         Jowar                547
         Groundnut            546
         Horse-gram           526
         Ragi                 521
         Potato               416
         Moong(Green Gram)    407
         Cotton(lint)         386
         Urad                 382
         Coconut              297
         Arhar/Tur            273
         Sesamum              267
         Sugarcane            266
         Other Kharif pulses  264
```

Best year for Agriculture

```
In [19]:    1  year_list=data["Year"].unique()
            2  year_list
```

```
Out[19]: array(['2010-11', '2011-12', '2012-13', '2013-14', '2014-15', '2015-16',
                '2016-17', '2017-18', '2018-19', '2019-20'], dtype=object)
```

```
In [20]:    1  year_production_list=[]
            2  for year in year_list:
            3      total_yearly_production=data.loc[data["Year"]==year,"New Production"].sum()
            4      year_production_list.append(total_yearly_production)
            5
            6  year_production_df=pd.DataFrame({"Year":year_list,
            7                                   "Total crop production":year_production_list})
            8  plt.figure(figsize=(8,8))
            9  plt.bar(year_production_df["Year"],year_production_df["Total crop production"])
           10  plt.xticks(year_production_df["Year"],rotation='vertical',size=10)
           11  plt.xlabel("Year")
           12  plt.ylabel("Total crop production")
           13  plt.title("Crop production from 2010 to 2020")
           14  plt.show()
```

Crop production from 2010 to 2020
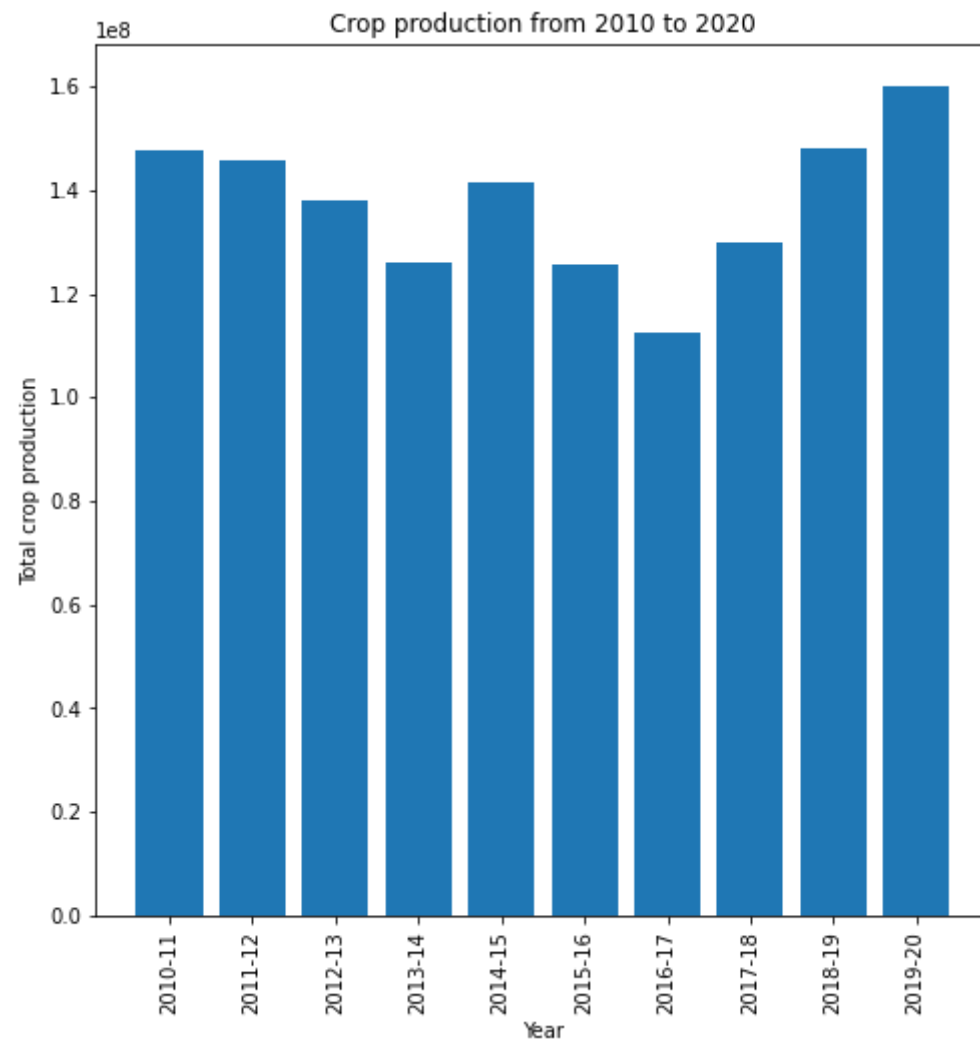
District wise total production of crops

```
In [21]:  1  total_production=[]
          2  for district in district_list:
          3      total_crop=data.loc[data["District"]==district,"New Production"].sum()
          4      total_production.append(total_crop)
          5
          6  total_production_df=pd.DataFrame({"District":district_list,
          7                                   "Total crop production":total_production})
          8  total_production_df
          9
```

	District	Total crop production
0	BANGALORE RURAL	7.297113e+06
1	BELGAUM	1.745473e+08
2	BELLARY	1.795614e+07
3	BENGALURU URBAN	3.923495e+06
4	CHAMARAJANAGAR	2.504990e+07
5	CHIKBALLAPUR	6.908169e+06
6	CHIKMAGALUR	6.665467e+07
7	CHITRADURGA	9.604459e+07
8	DAKSHIN KANNAD	5.956483e+07
9	DAVANGERE	3.907778e+07
10	DHARWAD	9.192294e+06
11	GADAG	7.071751e+06
12	HASSAN	9.312516e+07
13	HAVERI	1.618433e+07
14	KODAGU	4.721559e+06
15	MANDYA	1.007280e+08
16	MYSORE	5.661403e+07
17	RAMANAGARA	3.314690e+07
18	SHIMOGA	2.546731e+07
19	TUMKUR	2.661391e+08
20	UDUPI	4.683713e+07
21	UTTAR KANNAD	2.124025e+07
22	BAGALKOT	8.807812e+07
23	BIDAR	1.782395e+07
24	BIJAPUR	3.899588e+07

	District	Total crop production
25	GULBARGA	2.182855e+07
26	KOLAR	5.976663e+06
27	KOPPAL	9.421221e+06
28	RAICHUR	9.665671e+06
29	YADGIR	5.521160e+06

```
In [22]:  1 plt.figure(figsize=(8,8))
          2 plt.bar(total_production_df["District"],total_production_df["Total crop production"])
          3 plt.xticks(total_production_df["District"],rotation='vertical',size=10)
          4 plt.xlabel("District")
          5 plt.ylabel("Total crop production")
          6 plt.title("District wise Total crop production")
          7 plt.show()
```

District wise Total crop production
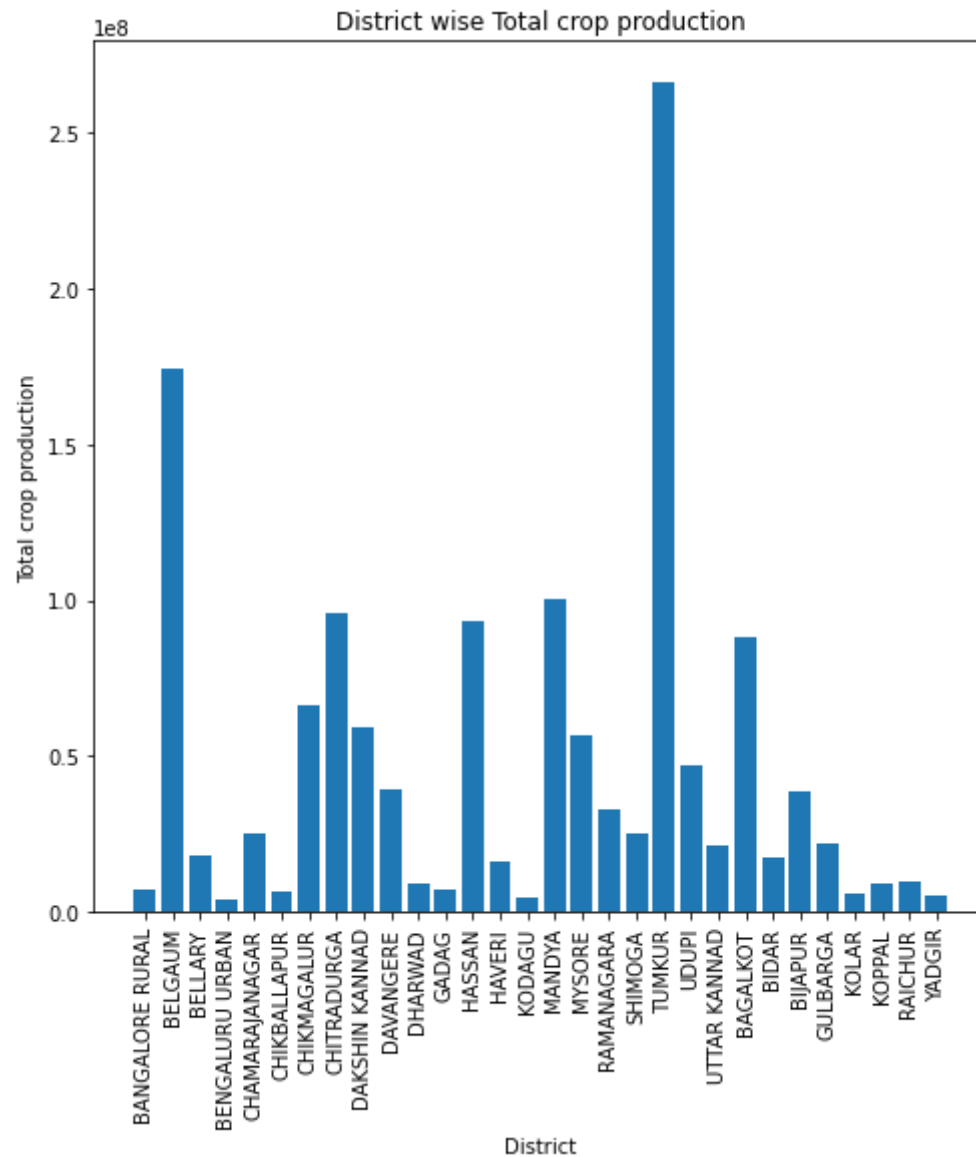
```
In [23]:   1   # From the above bar graph we conclude that Tumkur and Belgaum are the top 2 districts with highest total crop pr
           2   # total of years from 2010 to 2020
```

Annual production of crops from 2010-11 to 2019-20

```
In [24]:  1  data.groupby("Year").mean()["New Production"].plot(ylim=(80000,120000),color='k',marker='o',
          2                                         markerfacecolor='red',linestyle='-',linewidth=2,figsize=(12,10)
          3  plt.xlabel('Year',fontsize=20)
          4  plt.ylabel("Annual Production",fontsize=20)
          5  plt.title('Annual production of crops from 2010-11 to 2019-20',fontsize=20)
          6  plt.grid()
```

Annual production of crops from 2010-11 to 2019-20
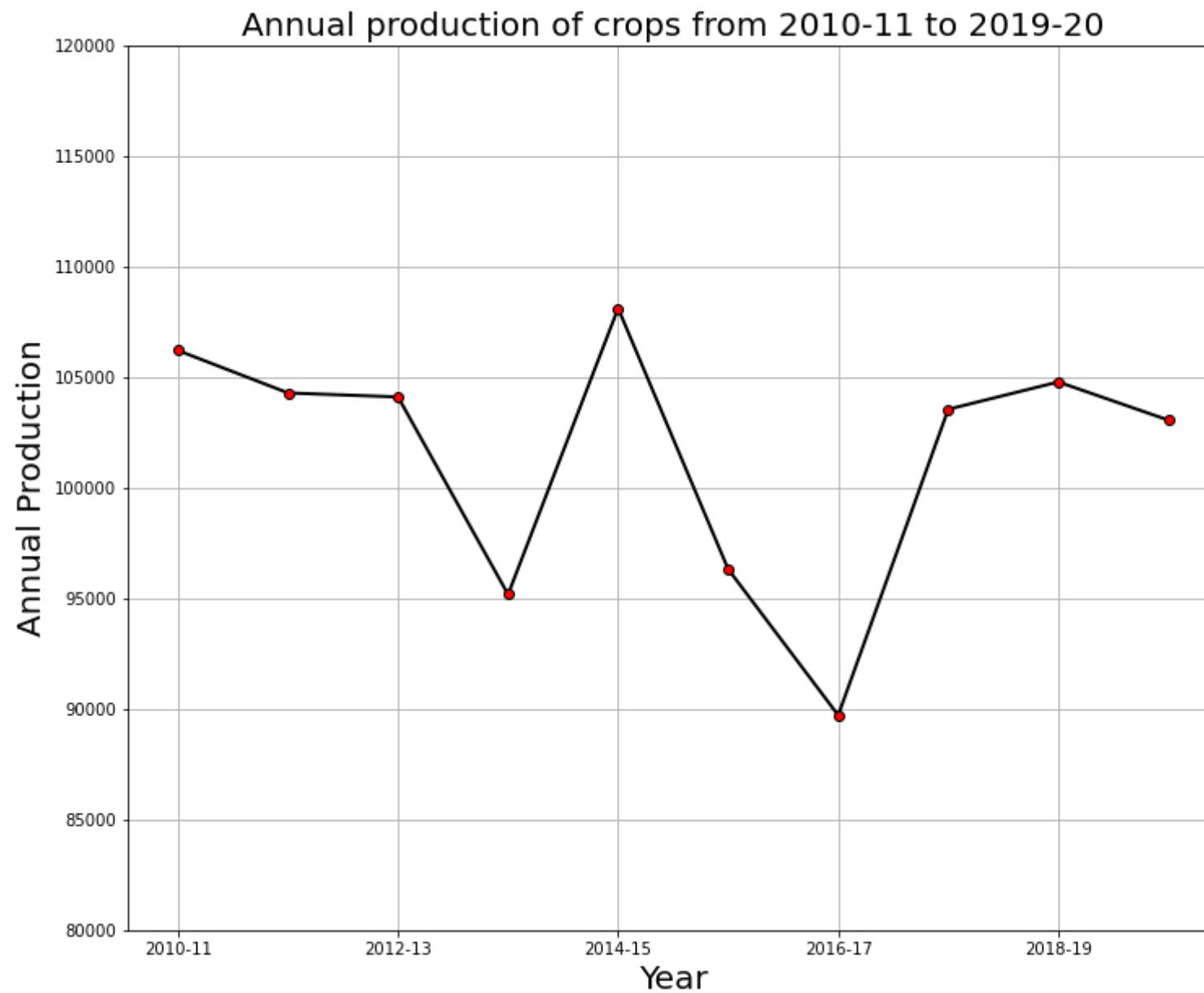
Highest Crop production ever received in a year in District

```
1
2  plt.figure(figsize=(10,8))
3  data.groupby(["District","Year"])["New Production"].sum().sort_values(ascending=False).plot()
4  plt.grid()
5  plt.xticks(rotation='vertical',size=10)
6  plt.xlabel("District,Year",fontsize=15)
7  plt.ylabel("Anual crop production",fontsize=15)
8  plt.title("Highest Crop production ever received in a year in District",fontsize=15)
```

Out[25]: Text(0.5, 1.0, 'Highest Crop production ever received in a year in District')
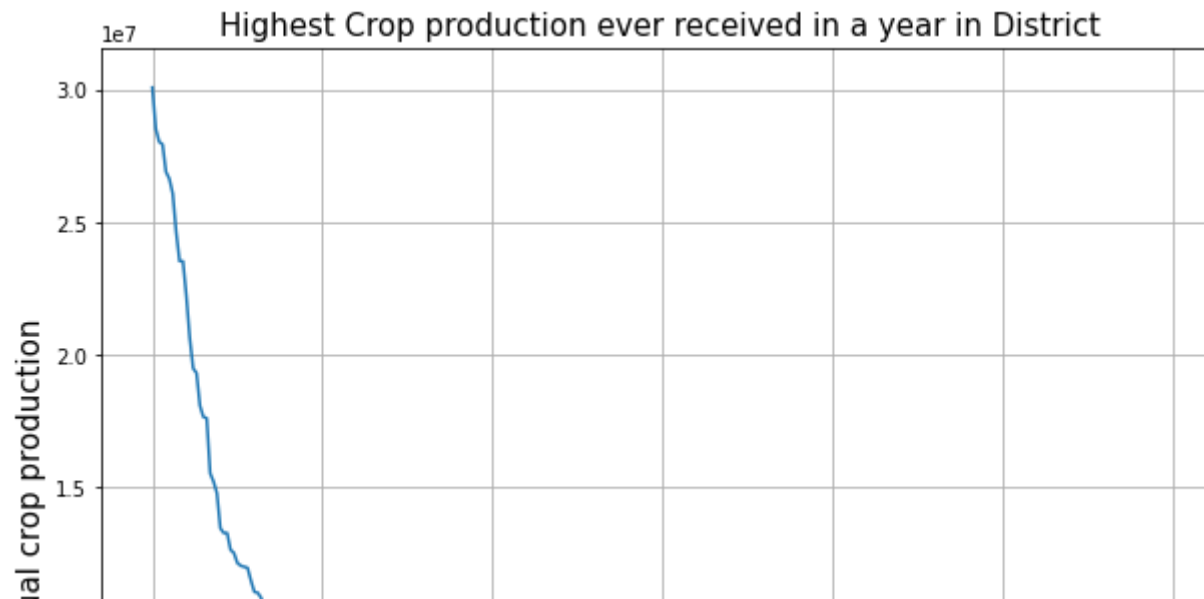
Analysis of crop production in Coastal region

In [26]:
```
1  dk=data[data["District"]=="DAKSHIN KANNAD"]
2  #dk.head(2)
```

```
In [27]:   1  udp=data[data["District"]=="UDUPI"]
           2  #udp.head(2)
```

```
In [28]:   1  uk=data[data["District"]=="UTTAR KANNAD"]
           2  #uk.head(2)
```

```
In [29]:   1  #Average crop production from 2010-11 in Dakshin Kannada
           2  dk_1=dk.groupby("Year").mean()["New Production"].reset_index()
           3  dk_1.rename(columns={'Year':'Year',
           4                       'New Production':'Average Production DK'},inplace=True)
           5  dk_1.head(2)
```

Out[29]:

	Year	Average Production DK
0	2010-11	219118.231818
1	2011-12	220452.168182

```
In [30]:   1  #Average crop production from 2010-11 to 2019-20 in Udupi
           2  udp_1=udp.groupby("Year").mean()["New Production"].reset_index()
           3  udp_1.rename(columns={'Year':'Year',
           4                        'New Production':'Average Production Udupi'},inplace=True)
           5  udp_1.head(2)
```

Out[30]:

	Year	Average Production Udupi
0	2010-11	140735.329167
1	2011-12	153493.350000

```
In [31]:   1  #Average crop production from 2010-11 to 2019-20 in Uttara Kannada
           2  uk_1=uk.groupby("Year").mean()["New Production"].reset_index()
           3  uk_1.rename(columns={'Year':'Year',
           4                       'New Production':'Average Production UK'},inplace=True)
           5  uk_1.head(2)
           6
```

Out[31]:

	Year	Average Production UK
0	2010-11	50780.174510
1	2011-12	49513.839403

```
In [32]:  1  plt.figure(figsize=(8,5))
          2  plt.plot(dk_1["Year"],dk_1["Average Production DK"],label="Dakshina Kannada")
          3  plt.plot(udp_1["Year"],udp_1["Average Production Udupi"],label="Udupi")
          4  plt.plot(uk_1["Year"],uk_1["Average Production UK"],label="Uttara Kannada")
          5  plt.title("Average crop production in coastal region from 2010 to 2020")
          6  plt.legend(loc='upper left')
          7
          8  plt.show
```

Out[32]: <function matplotlib.pyplot.show(close=None, block=None)>

Average crop production in coastal region from 2010 to 2020
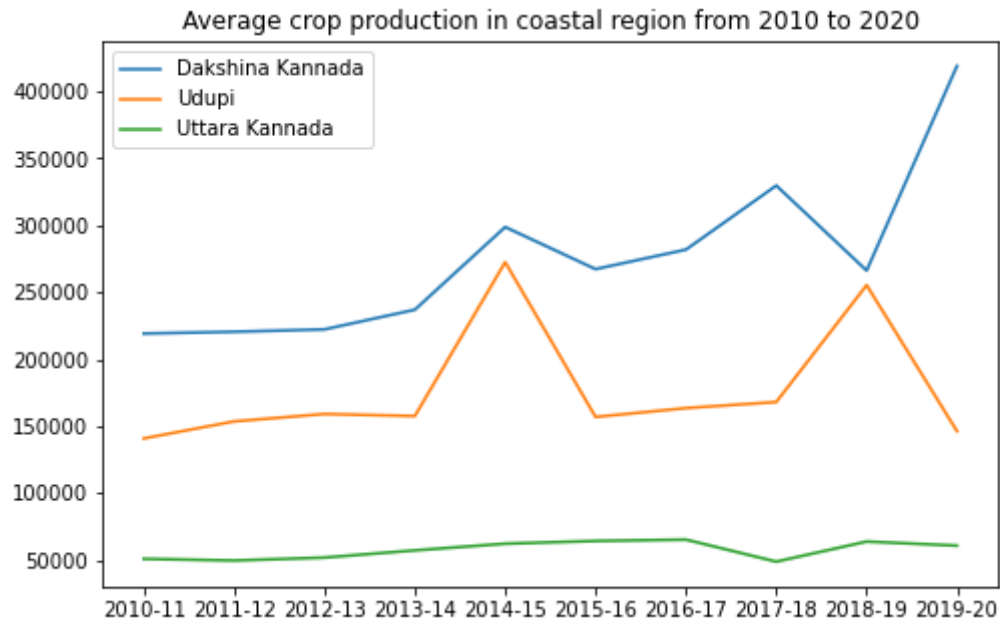
```
In [ ]:  1
```

```
In [ ]:  1
```

```
In [63]:    1  dk_2=dk.groupby("Crop")["New Production"].mean().sort_values(ascending=False)
            2  dk_2.head()
            3
            4
```

Out[63]: Crop
          Coconut   5.300308e+06
          Arecanut   5.032946e+05
          Rice   3.910418e+04
          Cashewnut   2.578800e+04
          Banana   8.727000e+03
          Name: New Production, dtype: float64

```
In [64]:    1  udp_2=udp.groupby("Crop")["New Production"].mean().sort_values(ascending=False)
            2  udp_2.head()
            3
```

Out[64]: Crop
          Coconut   4.419666e+06
          Arecanut   1.065997e+05
          Rice   4.295983e+04
          Banana   2.707850e+04
          Cashewnut   1.019870e+04
          Name: New Production, dtype: float64

```
In [65]:    1  uk_2=uk.groupby("Crop")["New Production"].mean().sort_values(ascending=False)
            2  uk_2.head()
            3
```

Out[65]: Crop
          Coconut   1332248.0
          Sugarcane   365455.0
          Arecanut   273590.1
          Rice   45487.6
          Banana   27518.5
          Name: New Production, dtype: float64

```
In [36]:  1  #Anova
          2  dk_anova=data[data["District"]=="DAKSHIN KANNAD"][data["Crop"]=="Arecanut"]
          3  dk_anova.head(2)
```

Out[36]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
23	Karnataka	DAKSHIN KANNAD	Arecanut	2010-11	Whole Year	27668	Hectare	12.285890	339926.0
24	Karnataka	DAKSHIN KANNAD	Arecanut	2011-12	Whole Year	27734	Hectare	12.365111	342934.0

```
In [37]:  1  udp_anova=data[data["District"]=="UDUPI"][data["Crop"]=="Arecanut"]
          2  udp_anova.head(2)
```

Out[37]:

|	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
57	Karnataka	UDUPI	Arecanut	2010-11	Whole Year	7028	Hectare	12.281019	86311.0
58	Karnataka	UDUPI	Arecanut	2011-12	Whole Year	7403	Hectare	7.786303	57642.0

```
In [38]:  1  uk_anova=data[data["District"]=="UTTAR KANNAD"][data["Crop"]=="Arecanut"]
          2  uk_anova.head(2)
```

Out[38]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
60	Karnataka	UTTAR KANNAD	Arecanut	2010-11	Whole Year	16634	Hectare	13.973849	232441.0
61	Karnataka	UTTAR KANNAD	Arecanut	2011-12	Whole Year	17075	Hectare	14.082753	240463.0

```python
In [39]:  1  #Checking for normality
          2
          3  plt.figure(figsize=(10,4))
          4  a1=dk_anova["New Production"]
          5  a2=udp_anova["New Production"]
          6  a3=uk_anova["New Production"]
          7
          8  plt.subplot(1,3,1)
          9  sns.distplot(a1,color='b')
         10  plt.title("DaKshina Kannada")
         11
         12  plt.subplot(1,3,2)
         13  sns.distplot(a2,color='r')
         14  plt.title("Udupi")
         15
         16  plt.subplot(1,3,3)
         17  sns.distplot(a3,color='g')
         18  plt.title("Uttara Kannada")
         19
         20  plt.show()
```
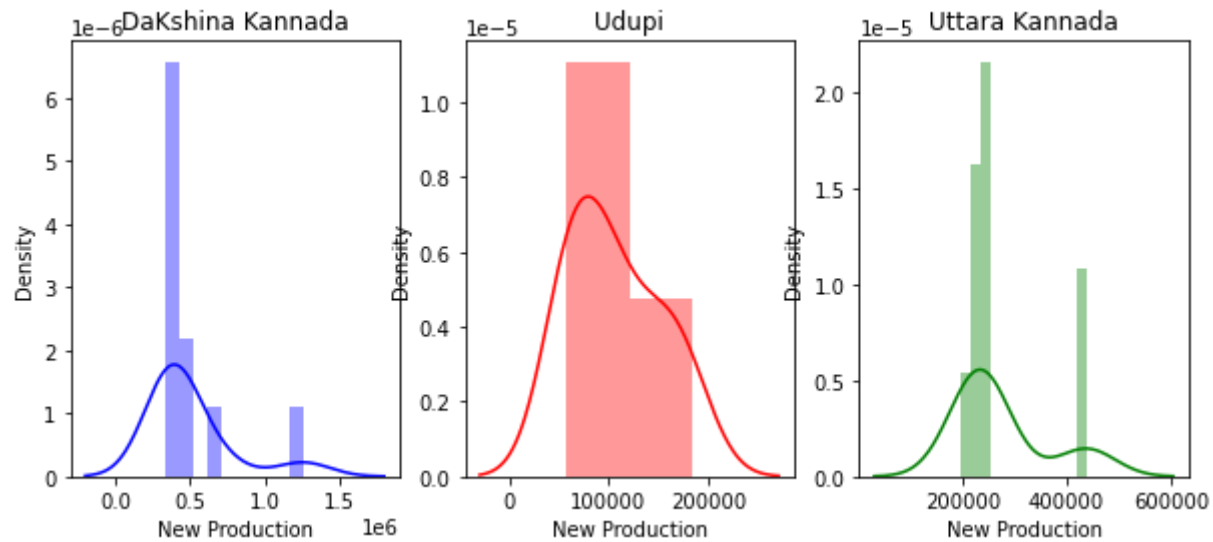
```
In [40]:   1  # One way Anova
           2  import scipy.stats as stats
           3  data_1=dk_anova["New Production"]
           4  data_2=udp_anova["New Production"]
           5  data_3=uk_anova["New Production"]
           6  f_value,p_value=stats.f_oneway(data_1,data_2,data_3)
           7  print("F value is : ",f_value)
           8  print("p value is : ",p_value)
           9
          10
```

```
F value is :  13.105883282154167
p value is :  0.00010527061835138392
```

```
In [41]:   1  # Significance difference between mean production oh "Maize" in North Karnata and South Karnataka
```

```
In [42]:   1  north=data.loc[data["District"].isin(['BIDAR','GULBARGA','RAICHUR','BIJAPUR','BAGALKOT','KOPPAL',
           2                                        'GADAG','DHARWAD','BELGAUM','HAVERI','CHITRADURGA', 'BELLARY','YADGIR','DAVANGERE
           3
           4  north.head(5)
           5
           6
```

Out[42]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
3	Karnataka	BELGAUM	Arecanut	2010-11	Whole Year	1	Hectare	11.000000	11.0
4	Karnataka	BELGAUM	Arecanut	2011-12	Whole Year	4	Hectare	8.000000	32.0
5	Karnataka	BELLARY	Arecanut	2010-11	Whole Year	103	Hectare	10.815534	1114.0
6	Karnataka	BELLARY	Arecanut	2011-12	Whole Year	108	Hectare	8.101852	875.0
7	Karnataka	BELLARY	Arecanut	2012-13	Whole Year	132	Hectare	8.022727	1059.0

```
In [43]:  1  south=data.loc[data["District"].isin(['BANGALORE RURAL','BENGALURU URBAN','CHAMARAJANAGAR','CHIKBALLAPUR','CHIKMA
          2                                        'DAKSHIN KANNAD','HASSAN','KODAGU', 'MANDYA', 'MYSORE','RAMANAGARA',
          3                                        'SHIMOGA','TUMKUR','UDUPI','UTTAR KANNAD','KOLAR'])]
          4  south.head(5)
```

Out[43]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
0	Karnataka	BANGALORE RURAL	Arecanut	2010-11	Whole Year	1213	Hectare	10.812861	13116.0
1	Karnataka	BANGALORE RURAL	Arecanut	2011-12	Whole Year	1615	Hectare	8.098452	13079.0
2	Karnataka	BANGALORE RURAL	Arecanut	2012-13	Whole Year	1380	Hectare	8.026087	11076.0
8	Karnataka	BENGALURU URBAN	Arecanut	2010-11	Whole Year	383	Hectare	10.812010	4141.0
9	Karnataka	BENGALURU URBAN	Arecanut	2011-12	Whole Year	401	Hectare	8.097257	3247.0

```
In [44]:  1  south_coconut=south[south["Crop"]=="Rice"]
          2  south_coconut.head(1)
```

Out[44]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
3080	Karnataka	BANGALORE RURAL	Rice	2010-11	Kharif	1531	Hectare	2.930111	4486.0

```
In [45]:  1  north_coconut=north[north["Crop"]=="Rice"]
          2  north_coconut.head(1)
```

Out[45]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
3075	Karnataka	BAGALKOT	Rice	2010-11	Kharif	121	Hectare	3.206612	388.0

In [46]:
```
1  north_1=north_coconut.groupby("District").mean()["New Production"].reset_index()
2  north_1.head()
```

Out[46]:

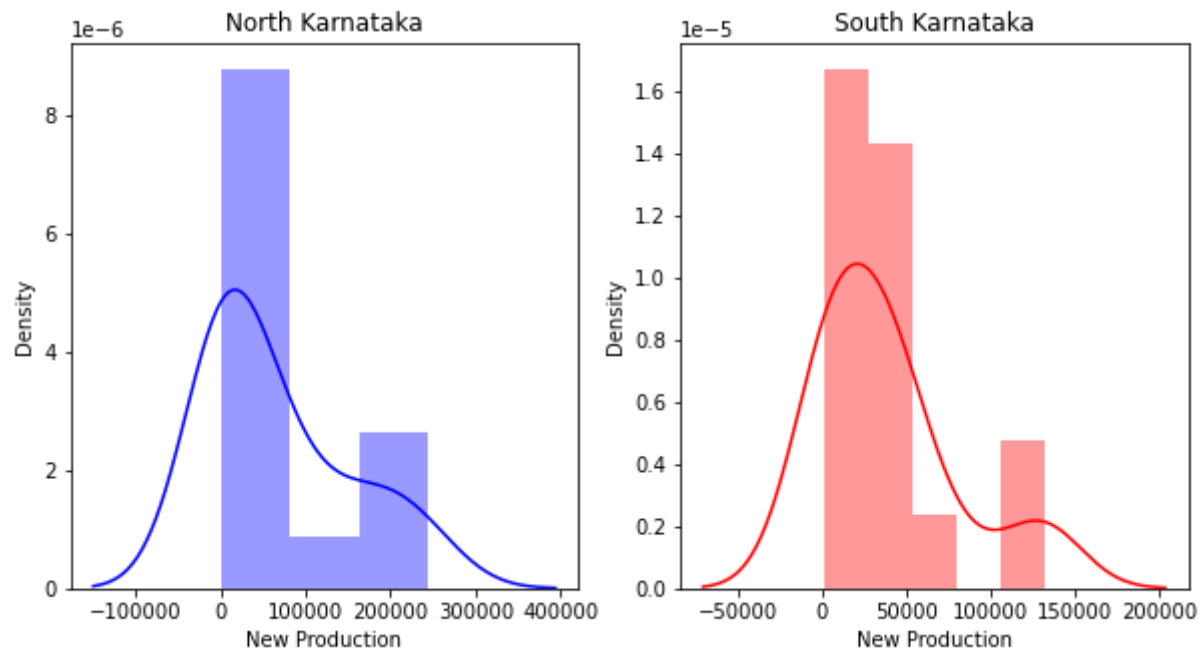|	District	New Production
0	BAGALKOT	136.666667
1	BELGAUM	64910.250000
2	BELLARY	171707.680000
3	BIDAR	2568.090909
4	BIJAPUR	189.545455

In [47]:
```
1  south_1=south_coconut.groupby("District").mean()["New Production"].reset_index()
2  south_1.head()
```

Out[47]:

	District	New Production
0	BANGALORE RURAL	1134.590909
1	BENGALURU URBAN	1300.583333
2	CHAMARAJANAGAR	13438.172414
3	CHIKBALLAPUR	3594.142857
4	CHIKMAGALUR	43009.650000

```
1  #Checking for normality
2
3  plt.figure(figsize=(10,5))
4  b1=north_1["New Production"]
5  b2=south_1["New Production"]
6
7  plt.subplot(1,2,1)
8  sns.distplot(b1,color='b')
9  plt.title("North Karnataka")
10
11 plt.subplot(1,2,2)
12 sns.distplot(b2,color='r')
13 plt.title("South Karnataka")
```

Out[48]: Text(0.5, 1.0, 'South Karnataka')

```
In [49]:  1  from scipy.stats import ttest_ind
          2  b1=north_1["New Production"]
          3  b2=south_1["New Production"]
          4
          5  stat,p=ttest_ind(b1,b2)
          6  print('statistic=%.3f , p_value =%.3f' % (stat ,p))
          7
          8
          9
```

statistic=1.220 , p_value =0.233

```
In [ ]:  1
```

```
In [ ]:  1
```

```
In [ ]:  1
```

```
In [ ]:  1
```

```
In [ ]:  1
```

```
In [50]:  1  dk=data[data["District"]=="DAKSHIN KANNAD"]
          2  dk.head(2)
```

Out[50]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
23	Karnataka	DAKSHIN KANNAD	Arecanut	2010-11	Whole Year	27668	Hectare	12.285890	339926.0
24	Karnataka	DAKSHIN KANNAD	Arecanut	2011-12	Whole Year	27734	Hectare	12.365111	342934.0

```
In [51]:  1  dk.groupby("Year").mean()["New Production"].sort_values(ascending=False)
```

Out[51]: Year
2019-20   419079.140000
2017-18   329687.476190
2014-15   298699.990476
2016-17   281812.161905
2015-16   267255.695455
2018-19   266179.900000
2013-14   236918.238095
2012-13   222231.893345
2011-12   220452.168182
2010-11   219118.231818
Name: New Production, dtype: float64

```
In [52]:  1  dk.groupby("Year").mean()["New Production"].plot(ylim=(200000,450000),color='k',marker='*',
          2                                                 markerfacecolor='green',linestyle='-',linewidth=2,figsize=(12,1
          3  plt.xlabel('Year',fontsize=20)
          4  plt.ylabel("Annual Production",fontsize=20)
          5  plt.title('Annual production of crops in Dakshina Kannada from 2010-11 to 2019-20',fontsize=15)
          6  plt.grid()
```

Annual production of crops in Dakshina Kannada from 2010-11 to 2019-20
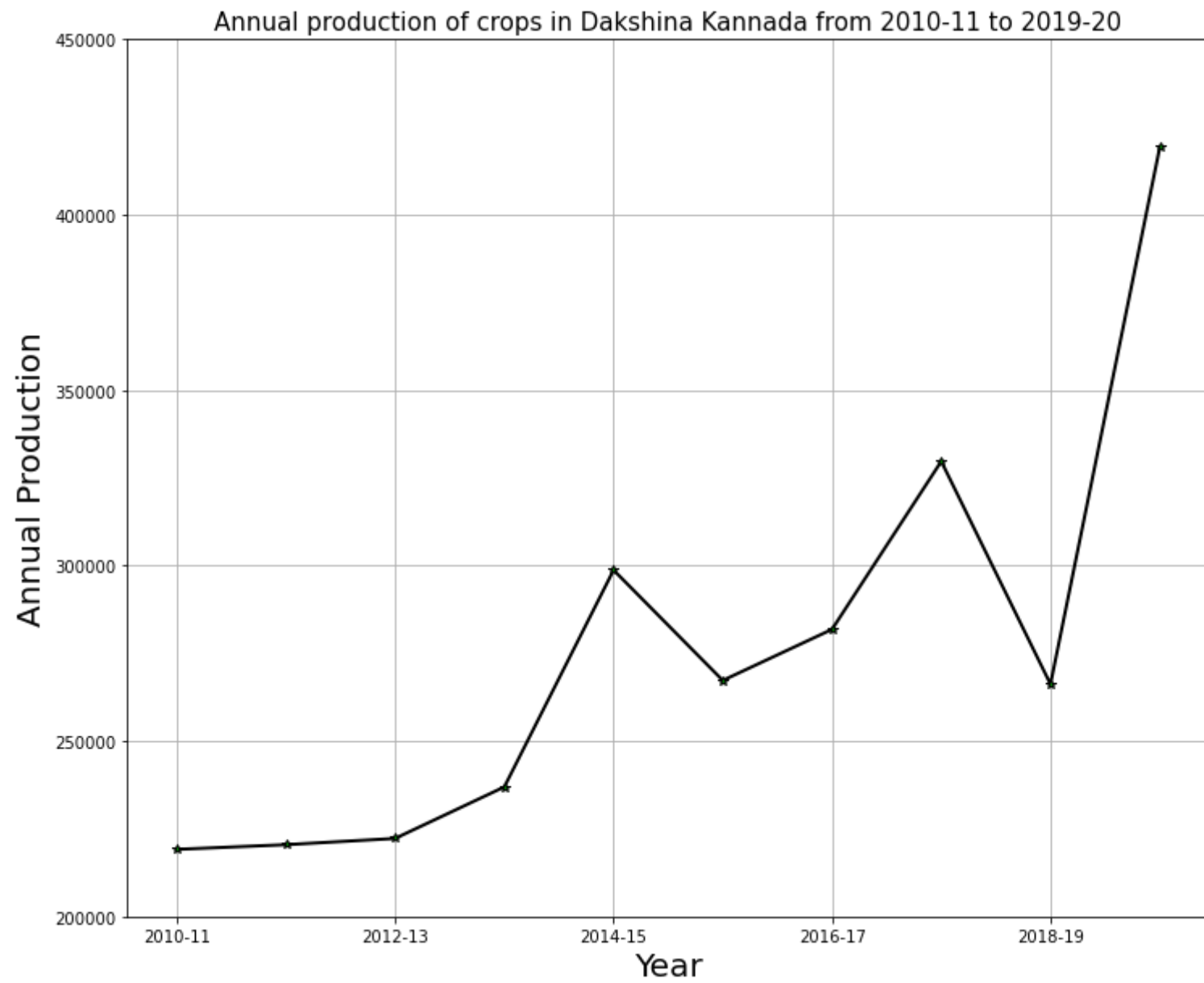
```
In [53]:  1  udp=data[data["District"]=="UDUPI"]
          2  udp.head(2)
```

Out[53]:

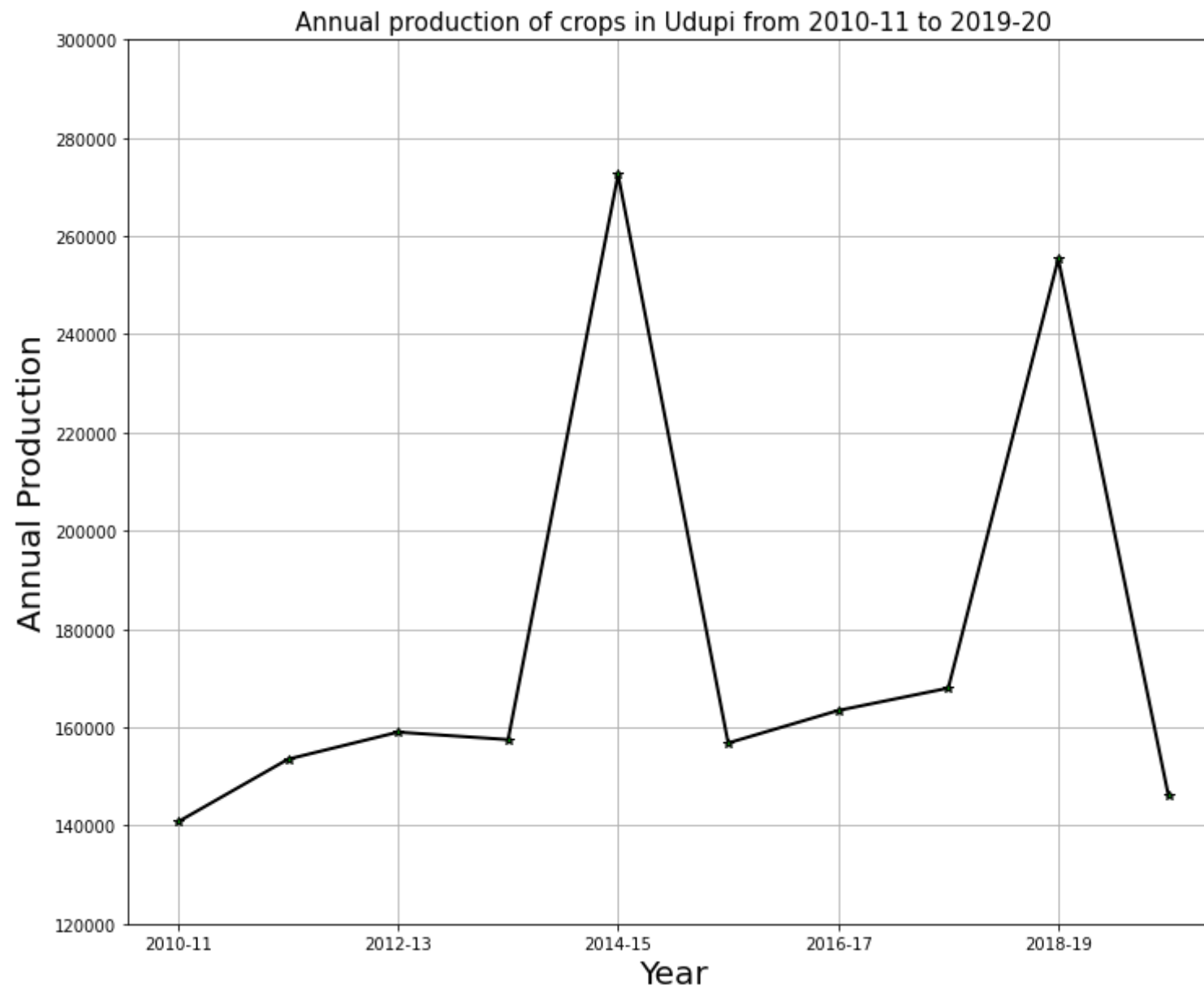|	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
57	Karnataka	UDUPI	Arecanut	2010-11	Whole Year	7028	Hectare	12.281019	86311.0
58	Karnataka	UDUPI	Arecanut	2011-12	Whole Year	7403	Hectare	7.786303	57642.0

```
In [54]:  1  udp.groupby("Year").mean()["New Production"].sort_values(ascending=False)
```

```
Out[54]:  Year
          2014-15    272462.233333
          2018-19    255307.718750
          2017-18    167961.524000
          2016-17    163411.596154
          2012-13    159004.086957
          2013-14    157478.041667
          2015-16    156790.228000
          2011-12    153493.350000
          2019-20    146184.386111
          2010-11    140735.329167
          Name: New Production, dtype: float64
```

```
In [55]:  1  udp.groupby("Year").mean()["New Production"].plot(ylim=(120000,300000),color='k',marker='*',
          2                                 markerfacecolor='green',linestyle='-',linewidth=2,figsize=(12,1
          3  plt.xlabel('Year',fontsize=20)
          4  plt.ylabel("Annual Production",fontsize=20)
          5  plt.title('Annual production of crops in Udupi from 2010-11 to 2019-20',fontsize=15)
          6  plt.grid()
```

Annual production of crops in Udupi from 2010-11 to 2019-20

```
In [56]:  1  uk=data[data["District"]=="UTTAR KANNAD"]
          2  uk.head(2)
          3
```

Out[56]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
60	Karnataka	UTTAR KANNAD	Arecanut	2010-11	Whole Year	16634	Hectare	13.973849	232441.0
61	Karnataka	UTTAR KANNAD	Arecanut	2011-12	Whole Year	17075	Hectare	14.082753	240463.0

```
In [57]:  1  uk.groupby("Year").mean()["New Production"].sort_values(ascending=False)
```

Out[57]: Year
   2016-17   65132.209952
          2015-16   64145.554216
          2018-19   63686.963368
          2014-15   62103.574681
          2019-20   60670.315076
          2013-14   57099.582244
          2012-13   51715.377537
          2010-11   50780.174510
          2011-12   49513.839403
          2017-18   48682.978938
          Name: New Production, dtype: float64
```

```python
uk.groupby("Year").mean()["New Production"].plot(ylim=(45000,68000),color='k',marker='*',
                                    markerfacecolor='green',linestyle='-',linewidth=2,figsize=(12,1
plt.xlabel('Year',fontsize=20)
plt.ylabel("Annual Production",fontsize=20)
plt.title('Annual production of crops in Uttara Kannada from 2010-11 to 2019-20',fontsize=15)
plt.grid()
```

Annual production of crops in Uttara Kannada from 2010-11 to 2019-20
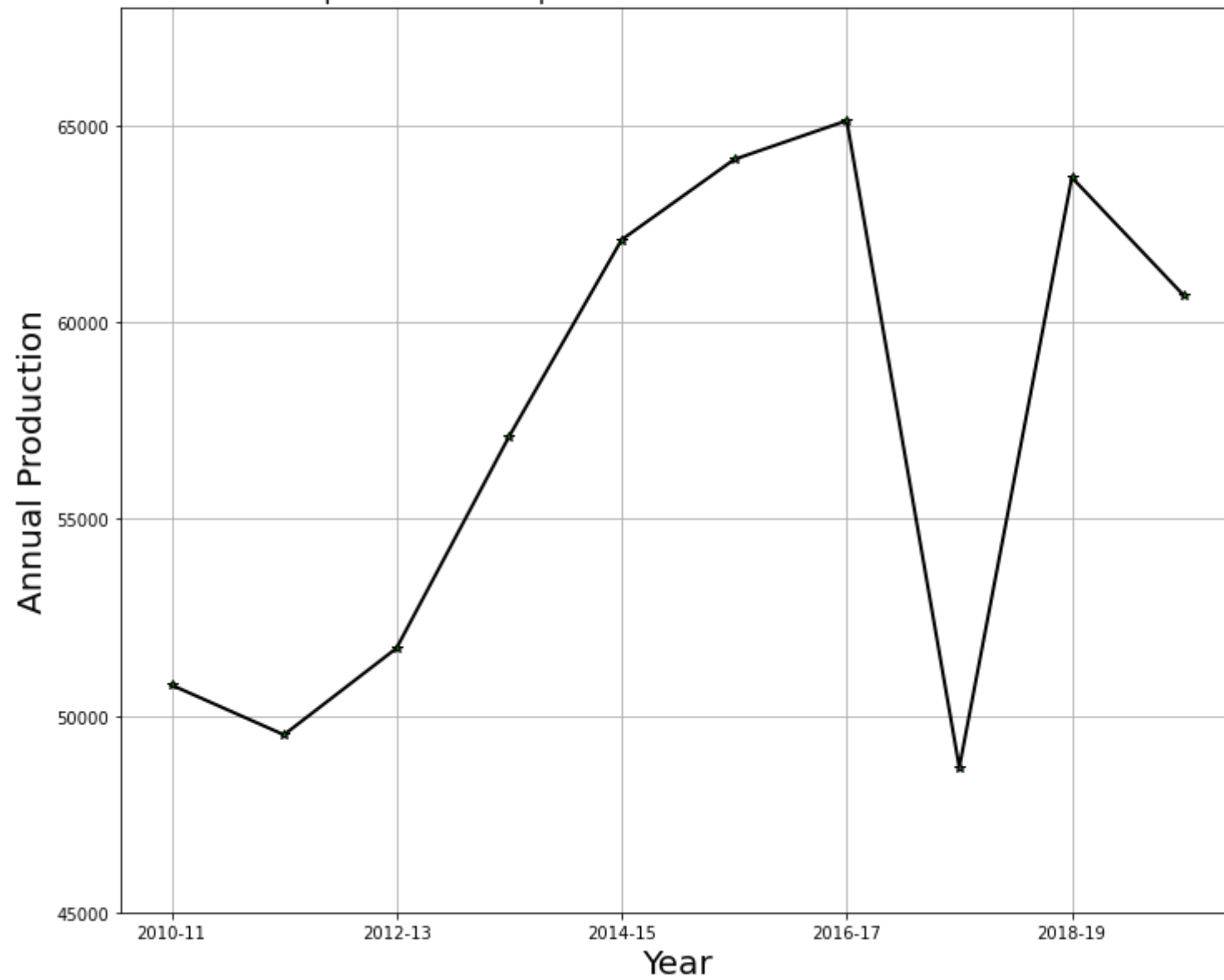
```
In [59]:  1  coastal_1=data.loc[data["District"].isin(["DAKSHIN KANNAD",'UDUPUI','UTTAR KANNAD'])]
          2  coastal_1
```

Out[59]:

	State	District	Crop	Year	Season	Area	Area Units	Yield	New Production
23	Karnataka	DAKSHIN KANNAD	Arecanut	2010-11	Whole Year	27668	Hectare	12.285890	339926.0
24	Karnataka	DAKSHIN KANNAD	Arecanut	2011-12	Whole Year	27734	Hectare	12.365111	342934.0
25	Karnataka	DAKSHIN KANNAD	Arecanut	2012-13	Whole Year	27921	Hectare	12.365102	345246.0
60	Karnataka	UTTAR KANNAD	Arecanut	2010-11	Whole Year	16634	Hectare	13.973849	232441.0
61	Karnataka	UTTAR KANNAD	Arecanut	2011-12	Whole Year	17075	Hectare	14.082753	240463.0
...	...	...	...	...	...	...	...	...	...
13556	Karnataka	UTTAR KANNAD	Tobacco	2019-20	Whole Year	1	Hectare	1.000000	1.0
13583	Karnataka	UTTAR KANNAD	Turmeric	2019-20	Whole Year	15	Hectare	6.400000	96.0
13641	Karnataka	UTTAR KANNAD	Urad	2019-20	Rabi	161	Hectare	0.465839	75.0
13642	Karnataka	UTTAR KANNAD	Urad	2019-20	Summer	56	Hectare	0.500000	28.0
13653	Karnataka	DAKSHIN KANNAD	Wheat	2019-20	Rabi	2	Hectare	1.000000	2.0

587 rows × 9 columns

```
In [60]:  1  data.groupby("Crop").mean()["New Production"].sort_values(ascending=False).re
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
~\AppData\Local\Temp/ipykernel_6316/1178549214.py in <module>
----> 1 data.groupby("Crop").mean()["New Production"].sort_values(ascending=False).re

~\anaconda3\lib\site-packages\pandas\core\generic.py in __getattr__(self, name)
   5485         ):
   5486             return self[name]
-> 5487         return object.__getattribute__(self, name)
   5488
   5489     def __setattr__(self, name: str, value) -> None:

AttributeError: 'Series' object has no attribute 're'
```

```
In [ ]:  1  coastal_1.groupby("Crop").mean()["New Production"].sort_values(ascending=False)
```

```
In [ ]:  1
```