CHAPTER 6
REPORT

6.1 Mean Imputation

The mean imputation Method is use to fill the Missing data.We have missing data in Temperature And Humidity.

Dataset:

Year	Name of the Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	Balsore	78	63	72	70	72	79	88	83	78	76	76	63
2001	Chandbali	91	80	86	75	75	86	93	89	83	77	90	90
2001	Cuttack	91	83	83	75	71	82	89	86	79	84	85	83
2001	Paradeep	88	86	82	83	79	83	90	87	81	82	89	78
2001	Bhubaneswar	89	81	80	71	71	83	94	91	85	84	85	73
2001	Gopalpur	91	82	80	86	76	85	88	86	84	85	88	78
2001	Puri	85	84	81	84	83	85	92	90	84	82	86	74
2001	Angul	89	50	NA	NA	57	75	90	NA	NA	65	85	55
2001	Baripada	91	80	NA	NA	82	76	92	85	83	89	90	78
2001	Jharsuguda	78	61	37	42	48	80	87	85	81	79	73	69
2001	Keonjhar	77	67	59	43	62	80	87	87	80	82	78	61
2001	Sambalpur	83	68	61	66	50	82	85	87	83	82	82	76
2001	Sundargarh	60	NA	NA	46	41	84	NA	90	NA	NA	NA	NA
2001	Bhawanipatna	40	NA	43	NA	50	NA	NA	NA	NA	NA	80	55
2001	Bolangir	NA	NA	NA	NA	42	NA	NA	NA	NA	NA	NA	NA
2001	Koraput	NA	NA	NA	NA	65	NA	NA	NA	NA	NA	NA	NA
2001	Phulbani	88	78	78	67	61	84	90	86	83	85	85	78
2001	Titlagarh	NA	NA	NA	NA	43	NA	NA	NA	NA	65	NA	NA

Fig, 6.1

The above dataset contain Humidity with missing data

As you can see we have many missing data, to cheack does missing data we have used the function as:

sapply(dataset, function(dataset) sum(is.na(dataset)))

```
sapply(dataset, function(dataset) sum(is.na(dataset)))
             Year Name.of.the.Station                 Jan                 Feb
                0                    0                   3                   5
              Mar                  Apr                 May                 Jun
                6                    6                   0                   4
              Jul                  Aug                 Sep                 Oct
                5                    5                   6                   4
              Nov                  Dec
                4                    4
```

Fig. 6.2

(It shows how many missing data are there in every month)

But,after applying the mean Imputation Meathod

Year	Name.of.the.Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	Balsore	78	63	72	70	72	79	88	83	78	76	76	63
2001	Chandbali	91	80	86	75	75	86	93	89	83	77	90	90
2001	Cuttack	91	83	83	75	71	82	89	86	79	84	85	83
2001	Paradeep	88	86	82	83	79	83	90	87	81	82	89	78
2001	Bhubaneswar	89	81	80	71	71	83	94	91	85	84	85	73
2001	Gopalpur	91	82	80	86	76	85	88	86	84	85	88	78
2001	Puri	85	84	81	84	83	85	92	90	84	82	86	74
2001	Angul	89	50	70.1666667	67.3333333333333	57	75	90	87.07692308	82	65	85	55
2001	Baripada	91	80	70.1666667	67.3333333333333	82	76	92	85	83	89	90	78
2001	Jharsuguda	78	61	37	42	48	80	87	85	81	79	73	69
2001	Keonjhar	77	67	59	43	62	80	87	87	80	82	78	61
2001	Sambalpur	83	68	61	66	50	82	85	87	83	82	82	76
2001	Sundargarh	60	74.0769230769231	70.1666667	46	41	84	89.6153846154	90	82	79.78571428571	83.714285714	72.214285714
2001	Bhawanipatna	40	74.0769230769231	43	67.3333333333333	50	81.7142857143	89.6153846154	87.07692308	82	79.78571428571	80	55
2001	Bolangir	81.2666666666667	74.0769230769231	70.1666667	67.3333333333333	42	81.7142857143	89.6153846154	87.07692308	82	79.78571428571	83.714285714	72.214285714
2001	Koraput	81.2666666666667	74.0769230769231	70.1666667	67.3333333333333	65	81.7142857143	89.6153846154	87.07692308	82	79.78571428571	83.714285714	72.214285714
2001	Phulbani	88	78	78	67	61	84	90	86	83	85	85	78
2001	Titlagarh	81.2666666666667	74.0769230769231	70.1666667	67.3333333333333	43	81.7142857143	89.6153846154	87.07692308	82	65	83.714285714	72.214285714

Fig. 6.3

The above dataset contain Humidity with filled missing data

To see the missing value is filled or not we have used the function as:

sapply(dataset, function(dataset) sum(is.na(dataset)))

```
sapply(dataset, function(dataset) sum(is.na(dataset)))
      Year Name.of.the.Station                Jan                Feb
         0                  0                  0                  0
       Mar                Apr                May                Jun
         0                  0                  0                  0
       Jul                Aug                Sep                Oct
         0                  0                  0                  0
       Nov                Dec
         0                  0
```

Fig. 6.4

Its shows all the missing values is successfully filled the coloum with a mean values.

The Above Example is only for 2001 like this we did this for all other year 2002,2003,2004,2005,2006,2007,2008,2009,2010,2011,2012

6.2 K-mean

K-means clustering is a type of unsupervised learning, which is used when you have unlabeled data (i.e., data without defined categories or groups). The goal of this algorithm is to find groups

in the data, with the number of groups represented by the variable *K*. The algorithm works iteratively to assign each data point to one of *K* groups based on the features that are provided.

K-mean clustering algorithm is applied on the dataset to cluster the different districts of Karnataka which are having similar rain fall, temperature and soil type.

Before Appling Kmeam algorithm elbow method is used to determined the optimal number of cluster.

The **Elbow method** is a method of interpretation and validation of consistency within cluster analysis designed to help finding the appropriate number of clusters in a dataset.

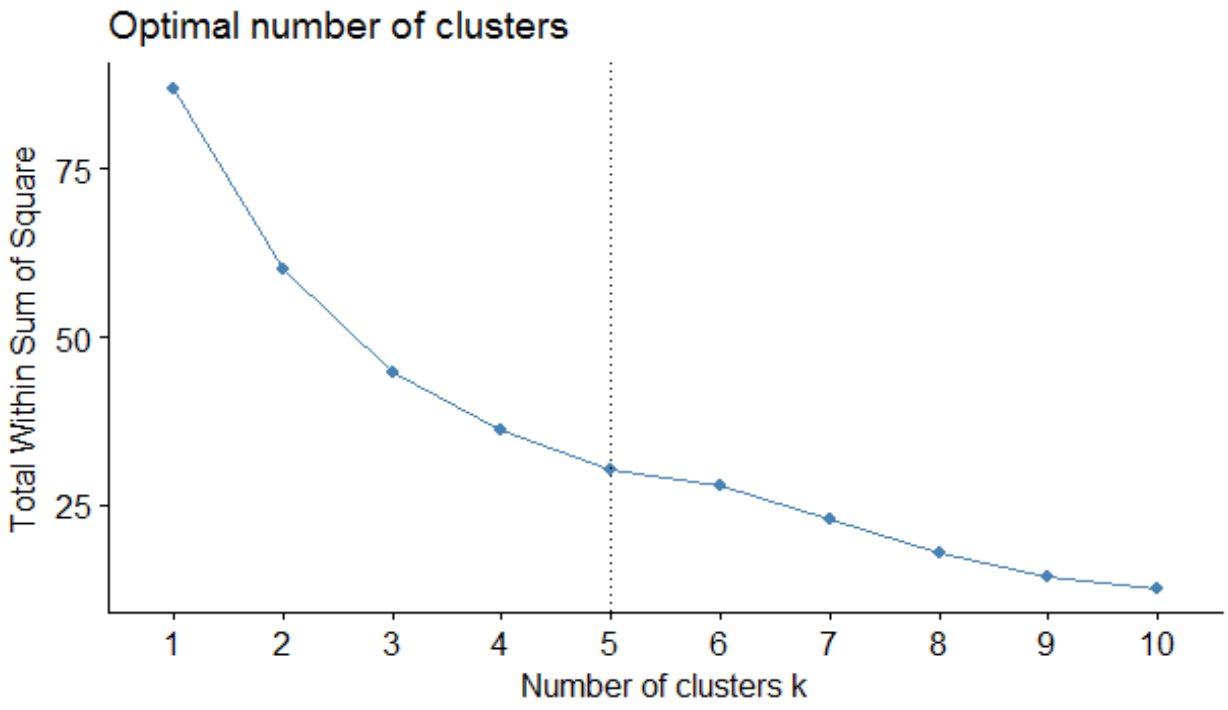


Fig.6.5

Output of Elbow

- We got the optimal number of cluster is 5

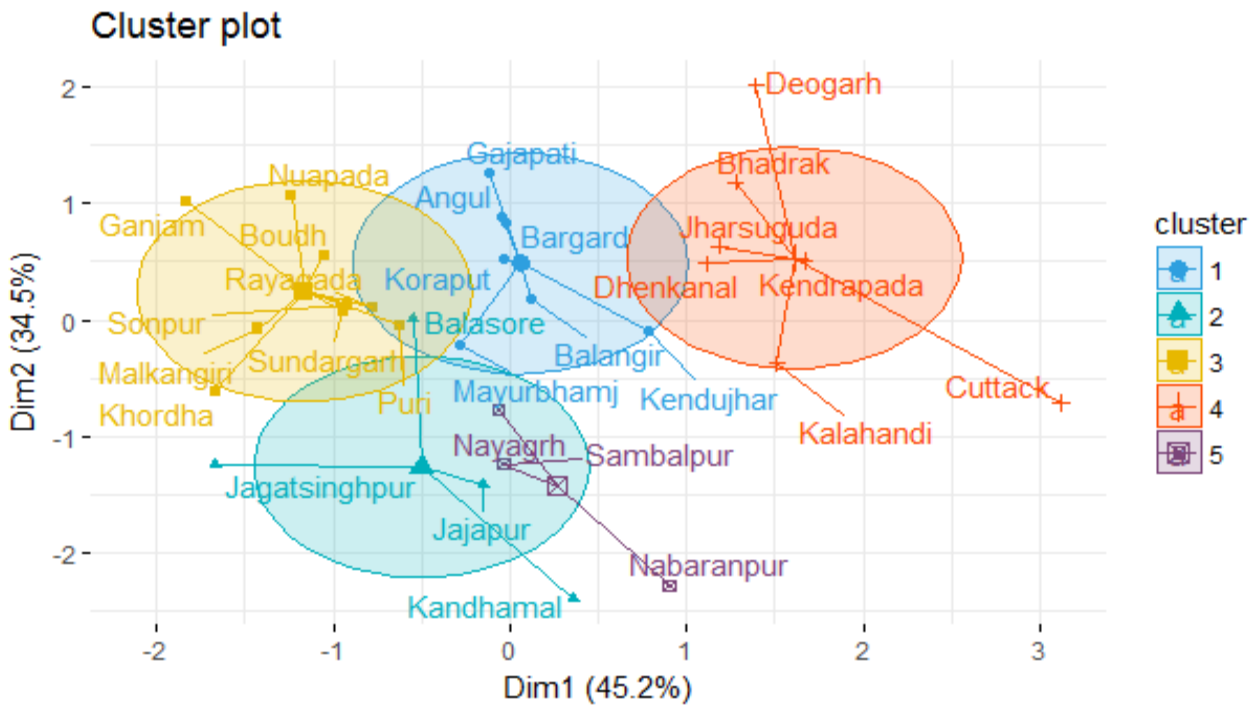


Fig.6.6

Output of k-means clustering

The District of Odisha are cluster into 5 group based on there agriculture Condition.

This is the result of K-means

```
K-means clustering with 5 clusters of sizes 7, 4, 9, 7, 3

Cluster means:
   Rain_Fall       Temp   Humidity
1 -0.1526810  0.5564808 -0.2266155
2  0.1042226 -1.7807240  0.5299351
3 -0.6553708 -0.3877486 -0.9208858
4  0.2540161  1.1170087  1.2591843
5  1.5907003 -0.3672644 -0.3532498

Clustering vector:
        Angul      Balangir      Balasore       Bargard       Bhadrak         Boudh
            1             1             2             1             4             3
      Cuttack       Deogarh     Dhenkanal     Gajapati        Ganjam Jagatsinghpur
            4             4             4             1             3             2
      Jajapur    Jharsuguda     Kalahandi     Kandhamal    Kendrapada     Kendujhar
            2             4             4             2             4             1
      Khordha       Koraput    Malkangiri    Mayurbhamj    Nabaranpur       Nayagrh
            3             1             3             1             5             5
      Nuapada          Puri     Rayagada      Sambalpur        Sonpur     Sundargarh
            3             3             3             5             3             3

Within cluster sum of squares by cluster:
[1] 4.064010 5.701012 8.033891 8.834821 2.319774
 (between_SS / total_SS =  66.7 %)
```

Fig.6.7

To apply the PAM calculation on the dataset, at first client need to give k (Number of bunches), where k is given as 3 in current examination. Harvest yield is Categorized into LOW, MODERATE and HIGH generation. Add up to areas are bunched into 3 groups utilizing PAM grouping strategy.. Total districts are clustered into 3 clusters using PAM clustering method.The pam algoritheam is to Grouped into 3 groud bested on there Production.

Rice crop production

Study and analysis of wheat crop production in different districts of odisha as shown in (fig. 9)

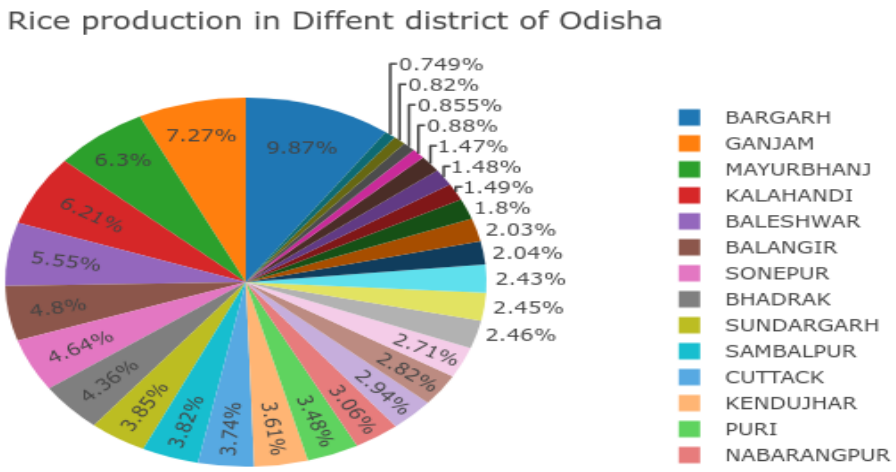


Fig 6.8

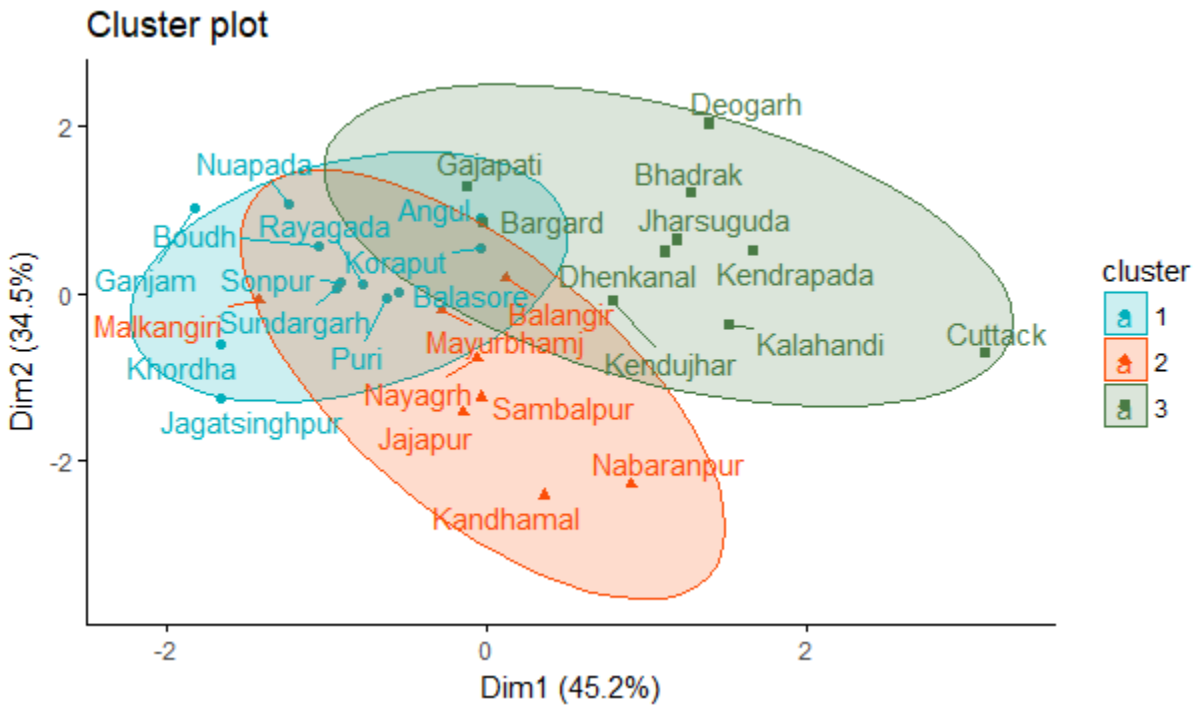


Fig. 6.9

Output of PAM

The result of Pam:

Low-moderate production	High production	Moderate-high production
Anugul,Boudh,Deogard, Gajapati,Jharsuguda,Kandhamal,Rayagada	Balangir,Baleshwer,Dargard,Ganjam,Kalahandi,Mayurbhanj,Sundargard	Cuttack,Dhenkanal,Jagatsinghapur,Jajpur,Kendrapara,Khendujhar,Khordha,Koraput,Malkangiri,Nabarangpur,Nayagarh,Nuapada,Sambalpur

Table 1

Wheat crop production

Study and analysis of wheat crop production in different districts of Odisha..

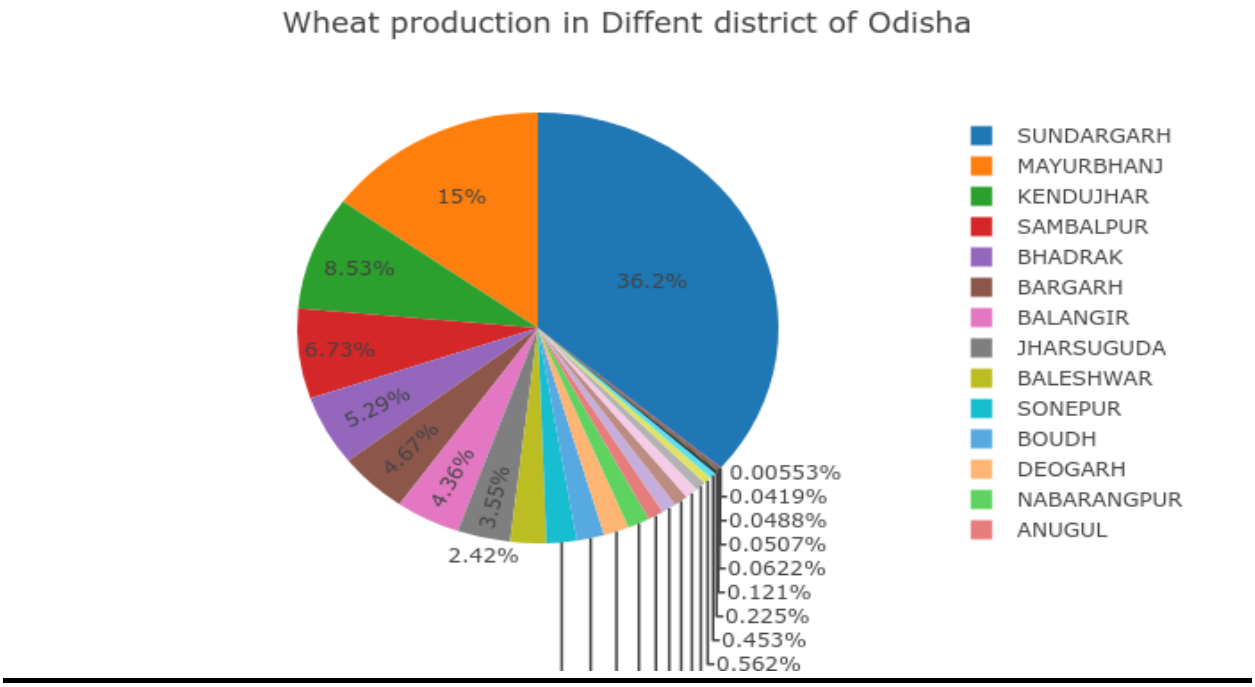


Fig. 6.10

Pie chart of wheat production of different state

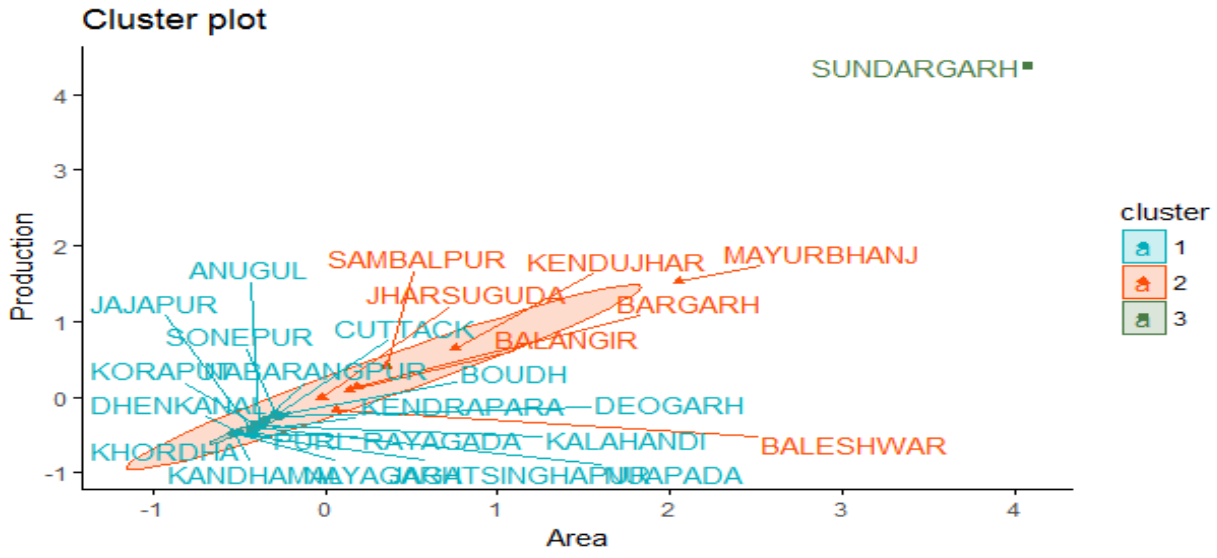


Fig. 6.11

Output of PAM

Low-moderate production	High production	Moderate-high production
Anugul,boudh,Cuttack,Deogrh,Dhenkanal,Jagatsinghapur,Jajpur,Kalahandi,Kandhamal,Kendrapara,Khordha,Koraput,Nabaranpur,Nayagard,Nuapada,PuriRayagada,sonepur	Sundargard	Balangir,Baleshwar,Bargard,Jharsuguda,Kendujhar,Mayurbhahanj,Sambalpur

Table 2

Result of PAM

Groundnut crop production

Study and analysis of Groundnut crop production in different districts of Odisha.

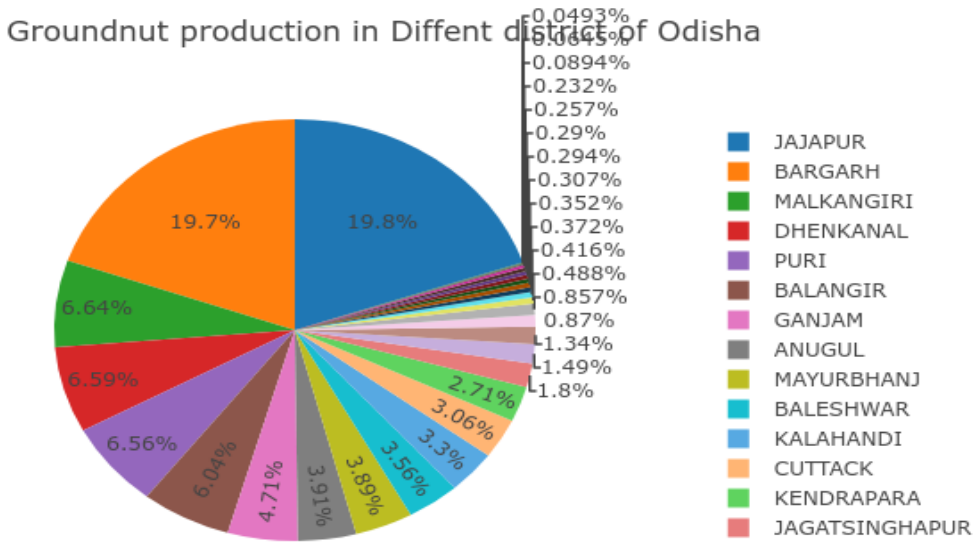


Fig. 6.12

Pie chart of groundnut production of different district

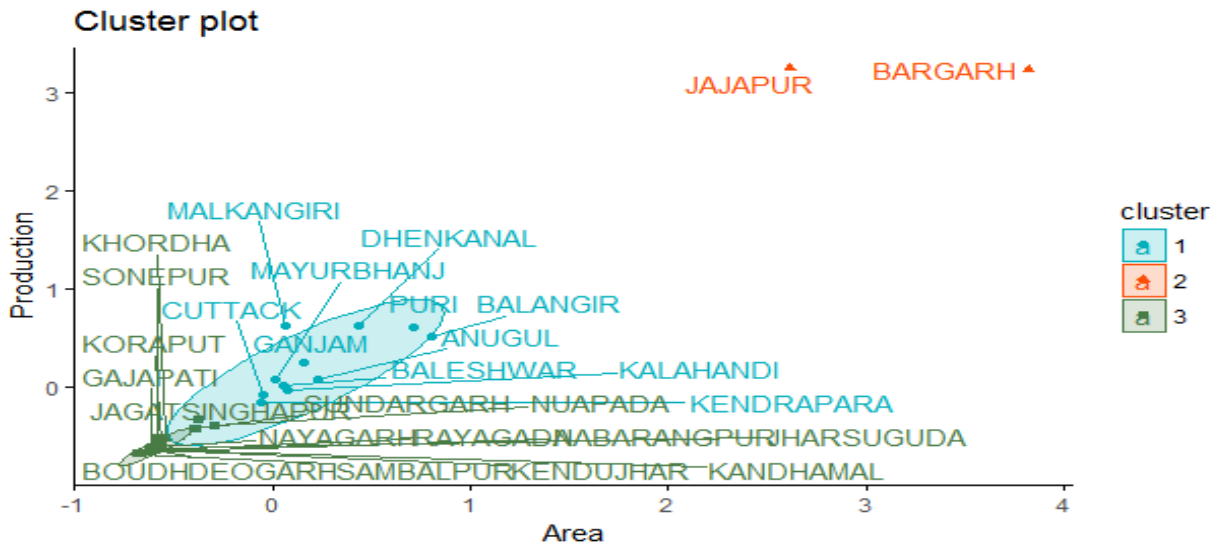


Fig. 6.13

Output of PAM

Result of Pam:

Low-moderate production	High production	Moderate-high production
Boudh,Deogard,Jagatsinghapur,Jharsuguda,Kandhamal,Gajapati,Kendujhar,Khordha,Koraput, Nabarangpur,Nayagarh, Nuapada,Rayagada,Sambalpur,Sonepur,Sundargard	Jajpur,Bargard	Anugul,Balangir,Baleshwar,Cuttak,Dhenkanal,Kalahandi,Ganjam,Kendrapada,Malkangiri,Mayurbhanj,Puri

Table 3

Ragi crop production

Study and analysis of Ragi crop production in different districts of Odisha.

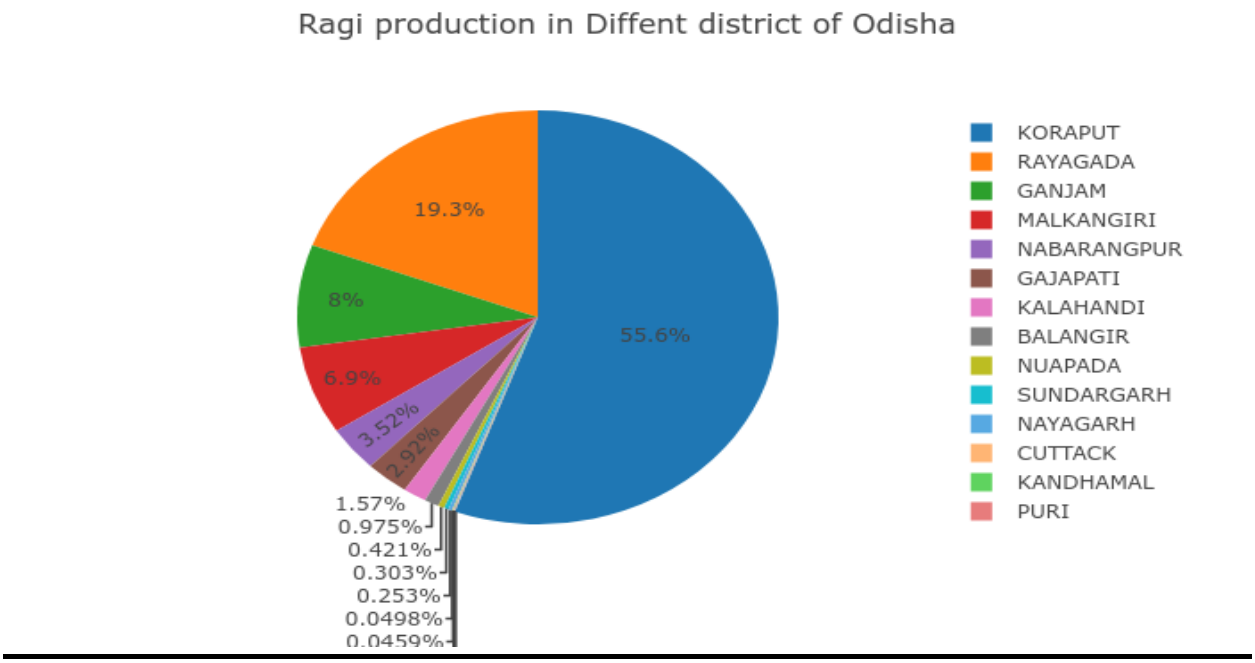


Fig. 6.14

Pie chart of ragi production of different district

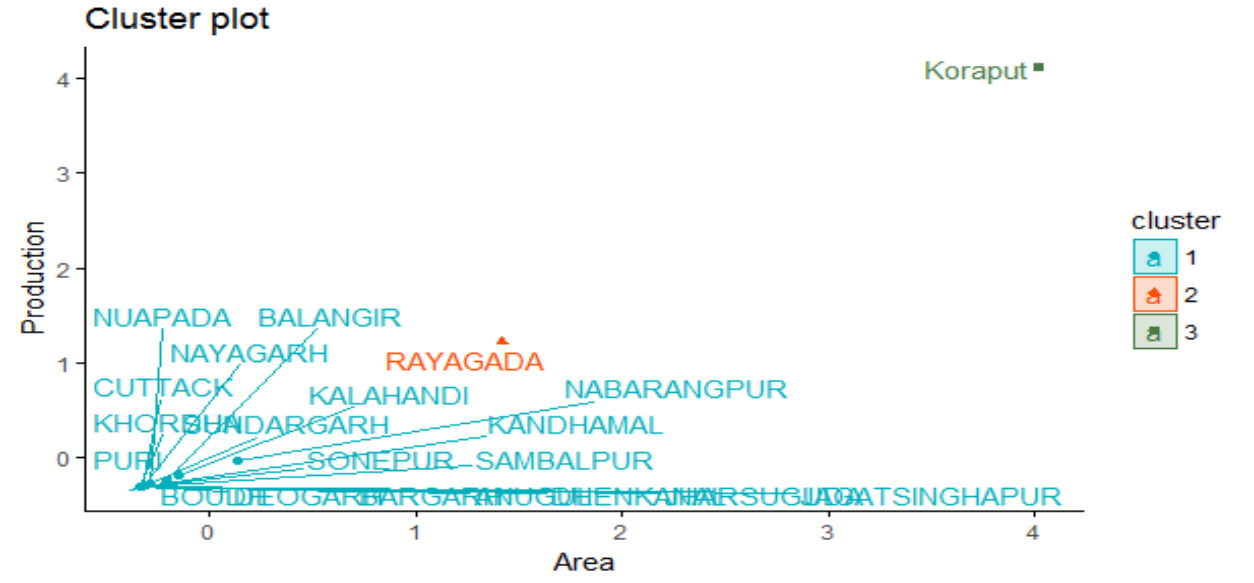


Fig. 6.15

Output of PAM

Result of PAM

Low-moderate production	High production	Moderate-high production
Anugul,Balangir,Bargarh,Boudh,Cuttack,Deogarh,Denkanal,Jagatsingapur,Jharsuguda,Kalahandi,Kamdamal,Khordha,Nabarangpur,Nayagarh,Nuapara,Puri,Sambalpur,sonepur,Sundargard	Koraput	Rayagada

Table 4

Urad crop production

Study and analysis of Urad crop production in different districts of Odisha.

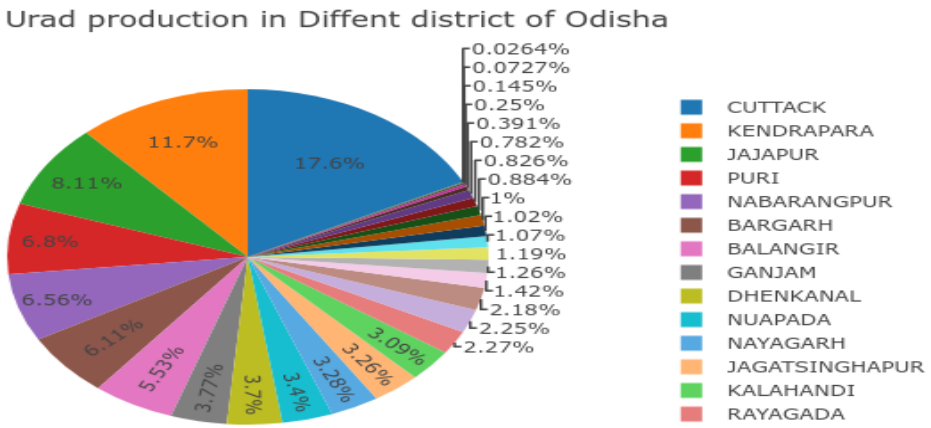
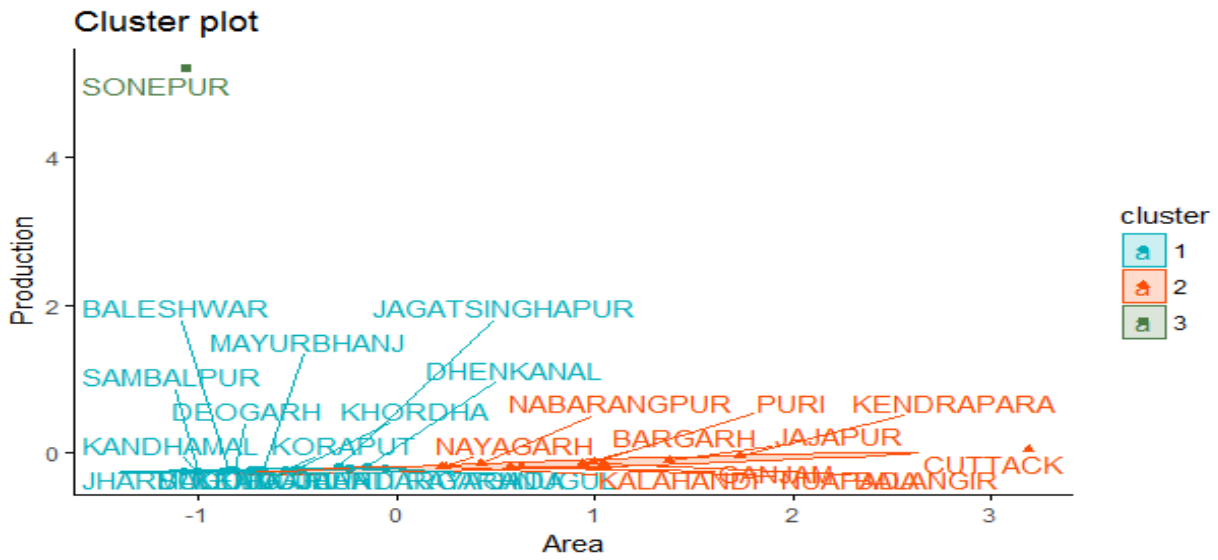


Fig. 6.16

Pie chart of Urad Production of different district



(Fig. 6.17)

Output of PAM

Low-moderate production	High production	Moderate-high production
Anugul,Baleshwar,Boudh,Deogarh,Dhenkanal,Gajapati,Jagatsinghapur,Jharsuguda,Kandhamal,Mayurbhanj, Rayagard,Sambalpur, Sundargard	Sonepur	Nayagard,Nabangapur,Puri,Baragarh,Jajpur, Kendrapada,Kalahandi,Balangir,Baleshwar, Ganjam,

Table 5

Result of PAM

Sugarcane crop production

Study and analysis of Sugarcane crop production in different districts of Odisha.

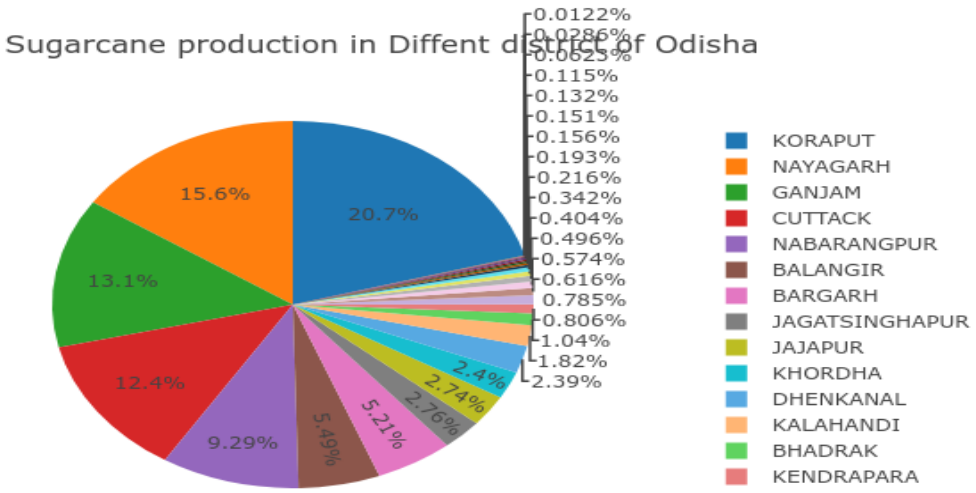


Fig. 6.18

Pie Chart of sugarcane production of different district

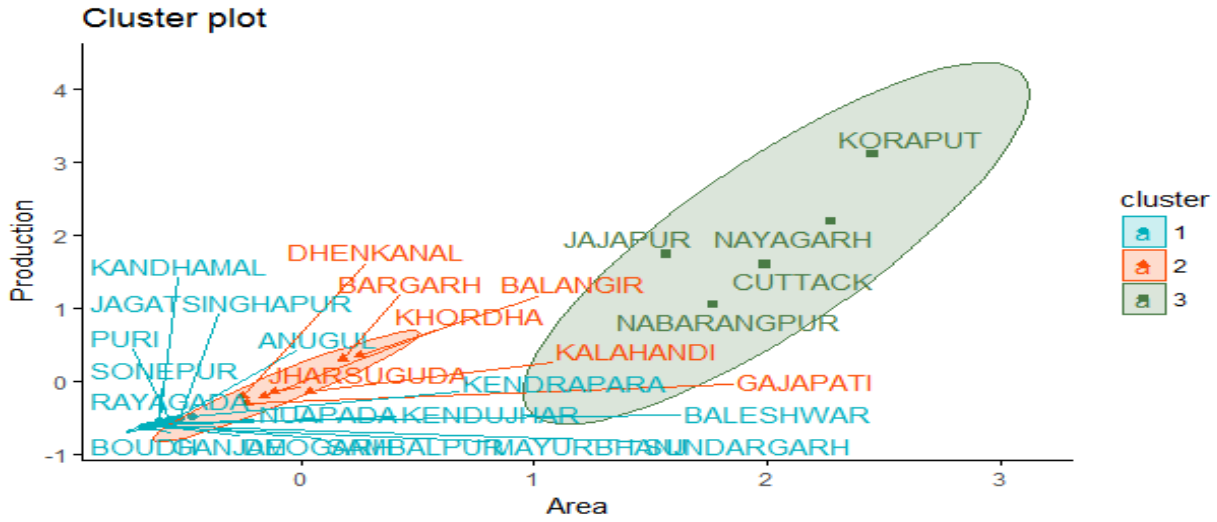


Fig.6.19

Output of PAM

Result of Pam:

Low-moderate production	High production	Moderate-high production
Anugul,Baleshwar,Boudh,Deogard,Jagatsinghapur,Kandhamal,Ganjam,Kendrapara,Kendujhar,Mayurrbhanj,Nuapada,Puri,Rayagada,Sambalpur,Sonepur,Sundargarh	Cuttack,Jajpur,Koraput,Nayagarh,Nabarangpur	Balangir,Bargarh,Dhenkanal,Jharsuguda,Kalahandi,Gajapati,Khordha,

Table 6

6.4 CLARA

Districts in the dataset are clustered into 3 clusters using CLARA algorithm. It represents the districts which are having similar factors like area, production, rainfall and temperature.

Rice

Study and analysis of temperature and Rice crop production in different districts of Odisha

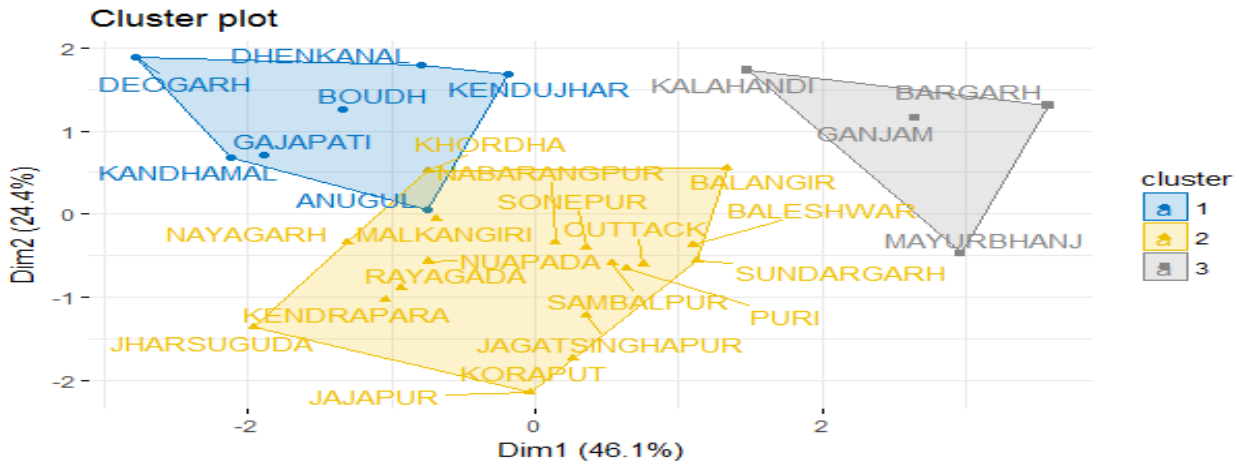


Fig. 6.20

Output of CLARA

Result of Clara :

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
Deogard,Dhenkanal,Boudh,Kendujhar,Gajapati,Anugul,Kandhamal	Khordha,Nabarangapur, Sonepur,Balangir,Baleshwar,Nayagard,Malgangiri Cuttack,Nuapada,Rayagada,Sundargarh,Sambalpur,Puri,Jagatsingpur,Jharsuguda,Koraput,Jajpur	Gangam,Kalandi,Bargah ,Mayurbhanj

Table 7

Plot of temperature vs. Rice production

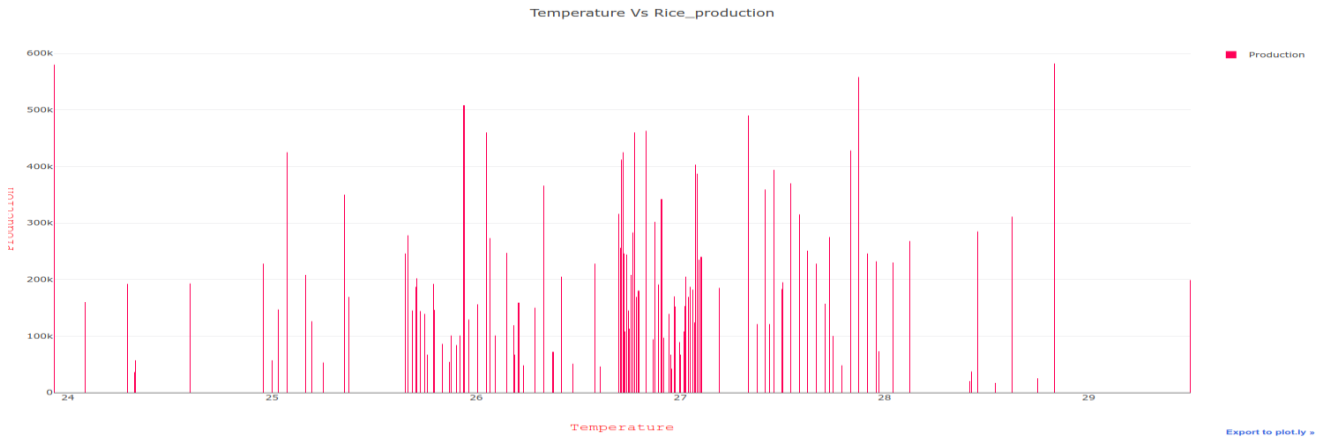


Fig.6.21

Plot Rainfall vs.Rice Production

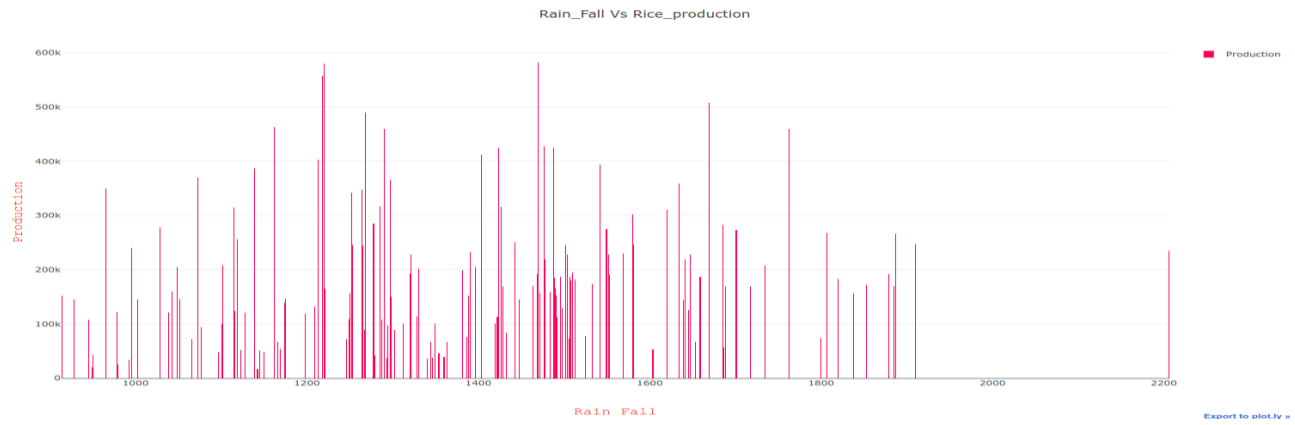


Fig. 6.22

Plot Humidity vs.Rice Production

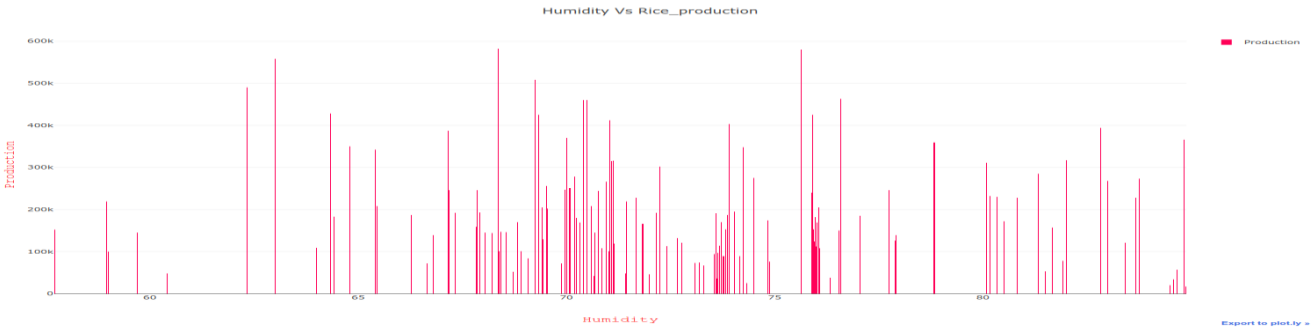


Fig. 6.23

Plot Soil vs.Rice Production

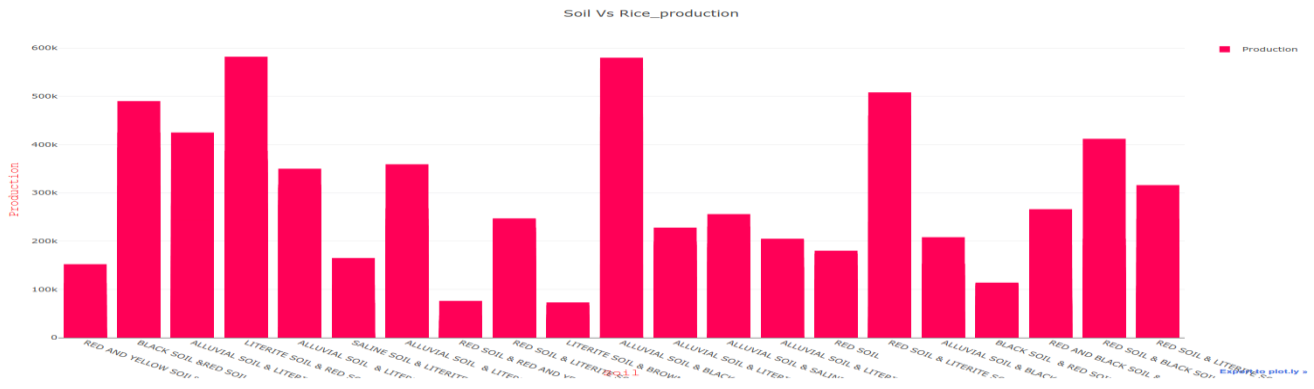


Fig.6.24

Optimal parameters to achieve higher Rice production

Optimal temp	28-29
Worst temp	31
Rainfall	1200-1500
Humidity	68-76
Soil	Literite , red ,red and black ,Alluvial, Brown forest,Saline Soil

Table 8

Wheat

Study and analysis of temperature and Wheat crop production in different districts of Odisha

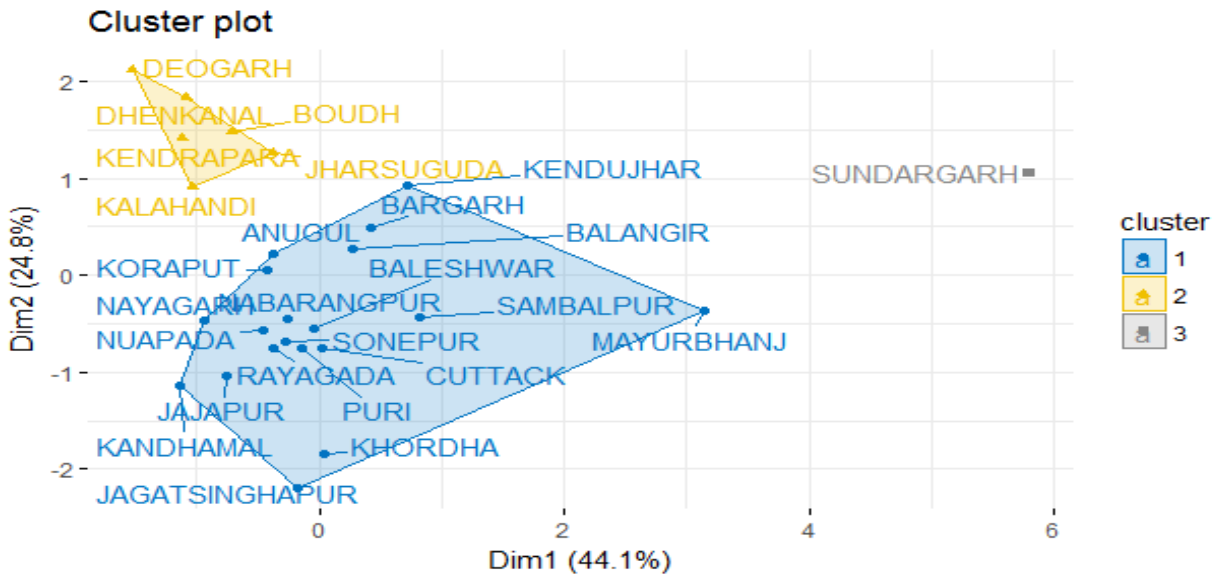


Fig. 6.25

Output of CLARA

Result of Clara

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
Deogard,Dhenkanal,Boudh,Kendrapara,Kalahandi,Jharsunguda	Kendujhar,Bargarh,Anugul,BaleshwarKoraput,Nayagard,Nabarangpur,Sonepur,Nuapada,Rayagada,puri,jajpur,Kandhamal,Jagatsinggpur	sundargard

Table 9

Plot temperature vs. Wheat production

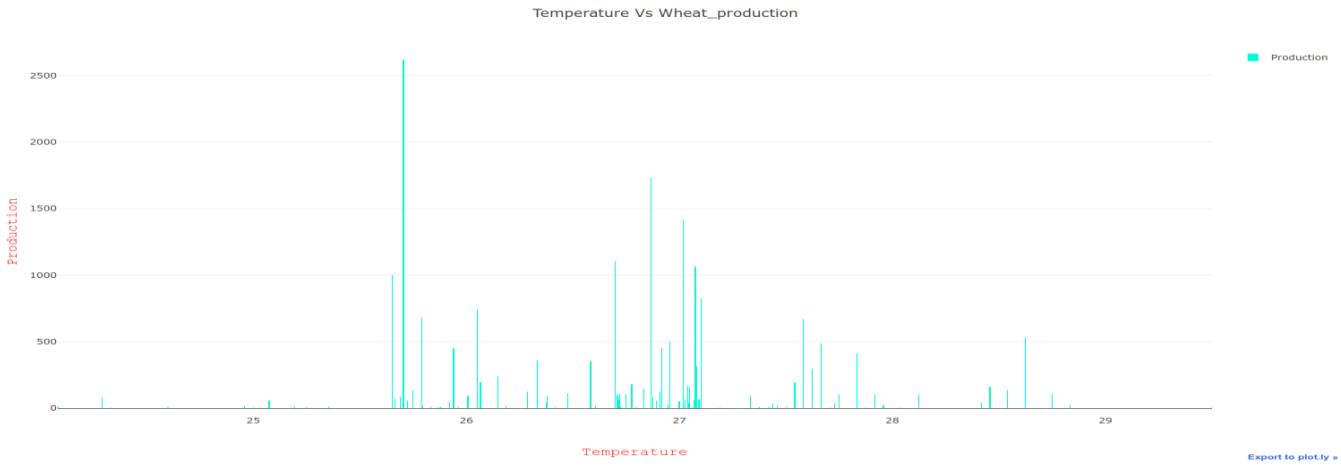


Fig.6.26

Plot Rainfall vs. Wheat Production

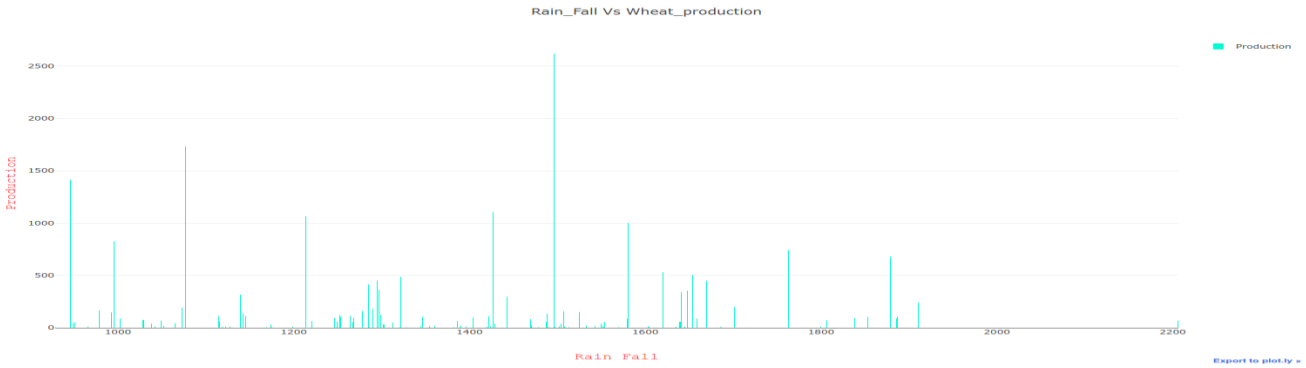


Fig. 6.27

Plot Humidity vs. Wheat production

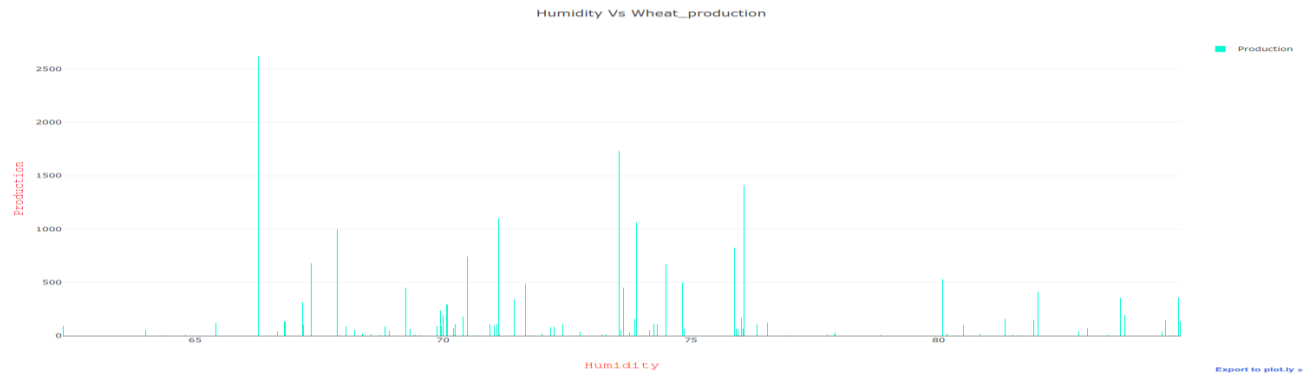


Fig.6.28

Plot Soil vs.Wheat Production

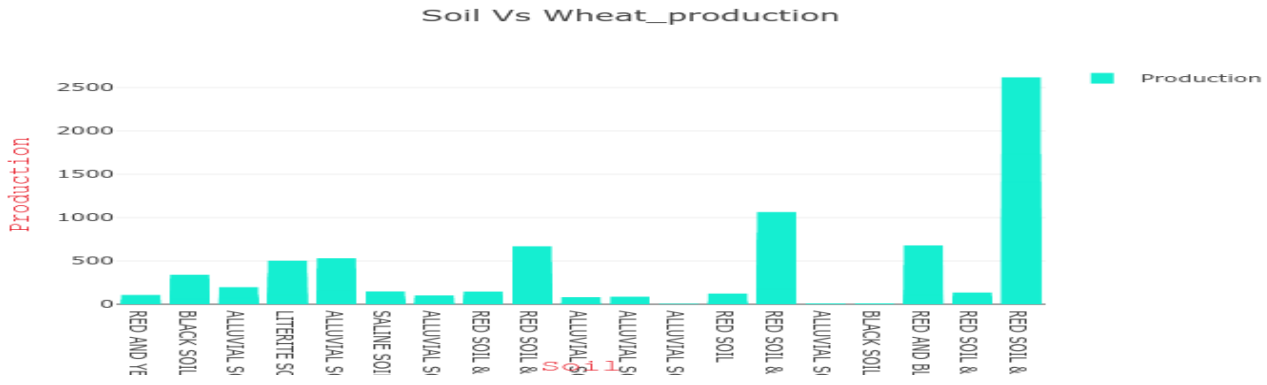


Fig.6.29

Optimal parameters to achieve higher Wheat production

Optimal temp	**25-27**
Worst temp	29
Rainfall	1400-1500
Humidity	65-70
Soil	Red , Literite ,Red And yellow Soil

Table 10

Groundnut

Study and analysis of temperature and Groundnut crop production in different districts of Odisha

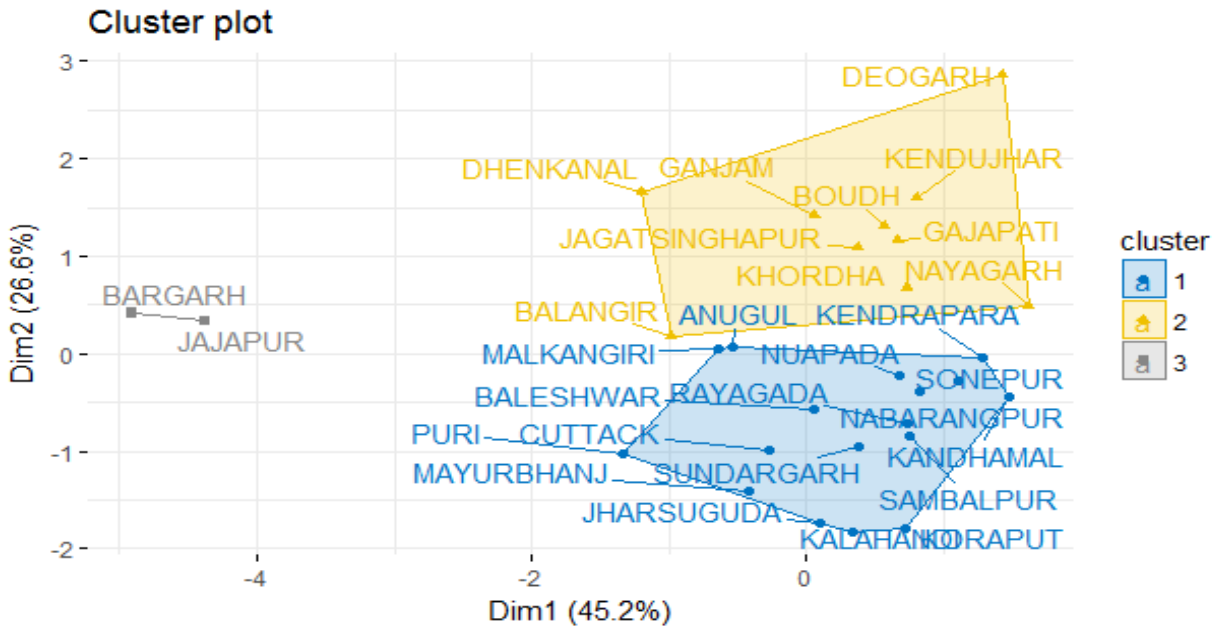


Fig.6.30

Output of CLARA

Result of Clara

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
Anugul,Nuapada,malkangiri,Sonepur,Nabarangpur,Kalahandi,Koraput,Mayurbhanj,Puri,Cuttack,Baleshwar,Sundargarh	Deogard,Ganjam,dhenkanal,Kendujhar,Boudh,Jagatsingapur,Gajapati,NayagarhBalangir	Bargarh,jajpur

Table 11

Plot temperature vs. Groundnut production

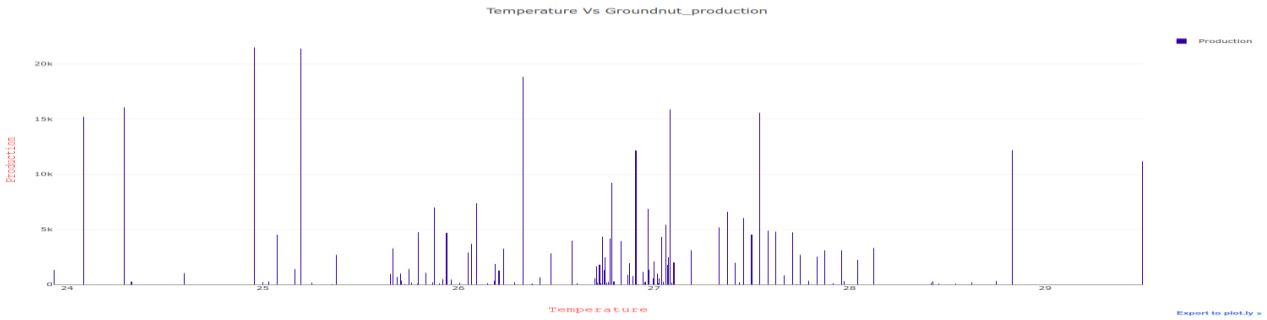


Fig.6.31

Plot Rainfall vs. Groundnut production

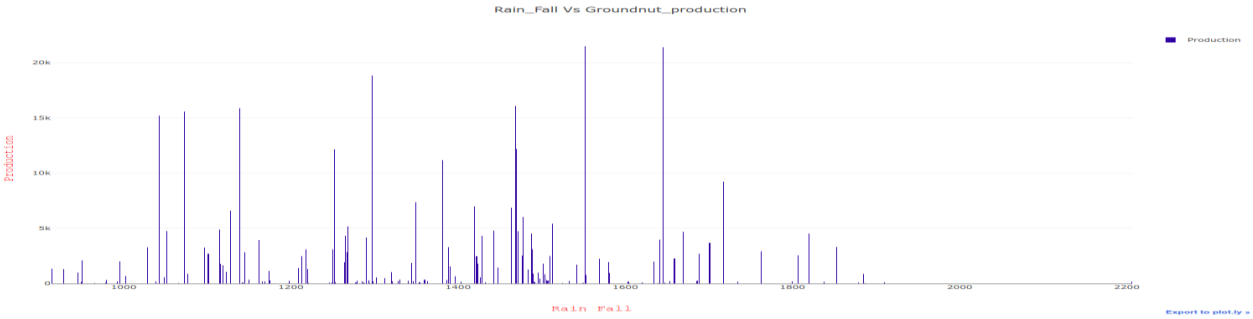


Fig.6.32

Plot Humidity vs. Groundnut production

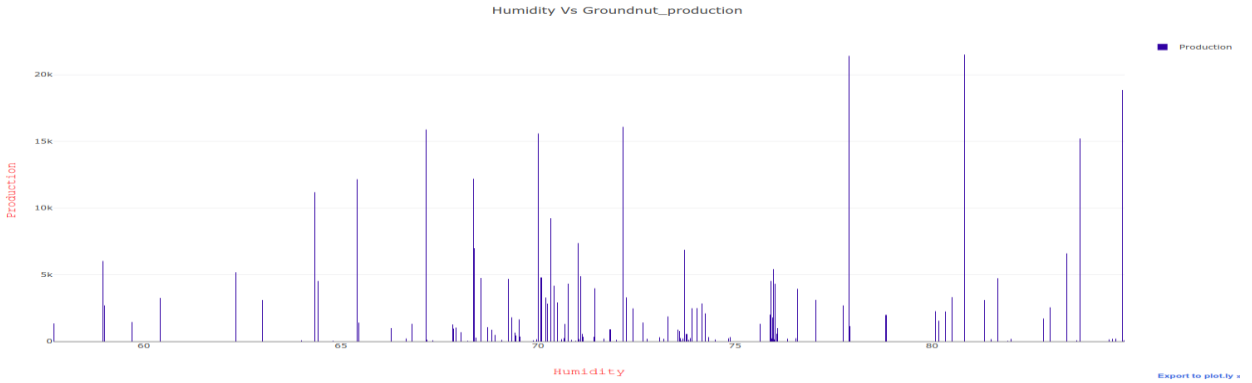


Fig.6.33

Plot Soil vs. Groundnut production

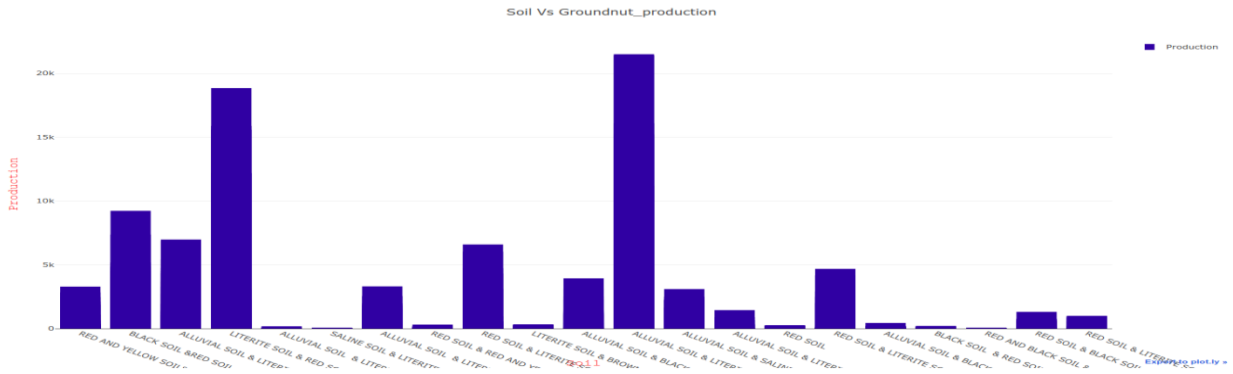


Fig.6.34

Optimal parameters to achieve higher Groundnut production

Optimal temp	**25-27**
Worst temp	28
Rainfall	1300-1600
Humidity	75-90
Soil	Aluuvial , Literite soil

Table 12

Ragi

Study and analysis of temperature and Ragi crop production in different districts of Odisha

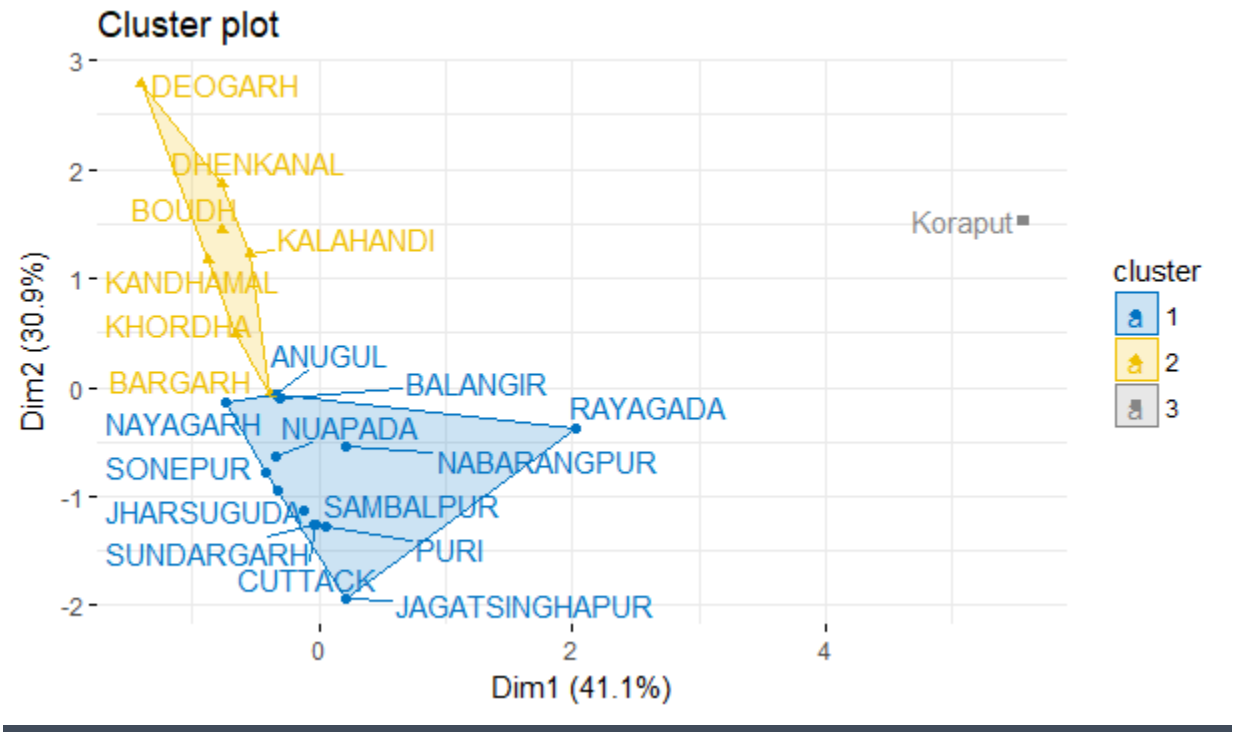


Fig.6.35

Output of CLARA

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
ANUGUL,BALANGIR,RAYAGADA, NUAPADA,NAYAGARH,PURI, CUTTACK,JAGATSINGHPUR, SUNDARGARH,SONEPUR, NABARANGPUR,JHARSUGUDA, SAMBHALPUR	DEOGARH,DHENKANAL,BOUDH, KALAHANDI,KANDHAMAL, KHORDHA,BARGHA	KORAPUT

Table 13

Plot temperature vs. Ragi production

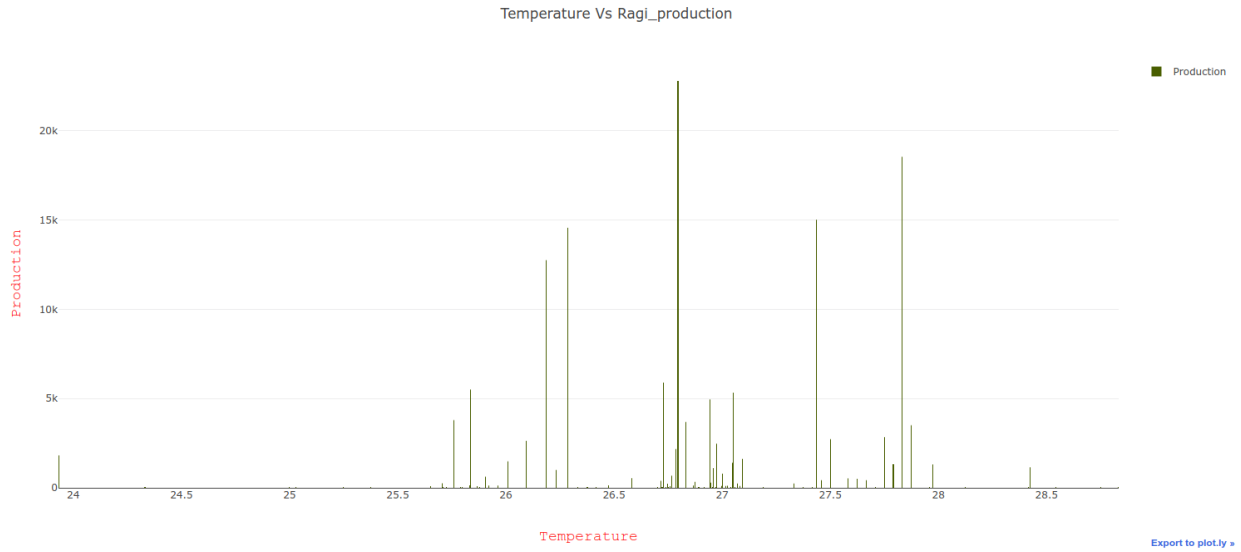


Fig.6.36

Plot Rainfall vs.Ragi Production

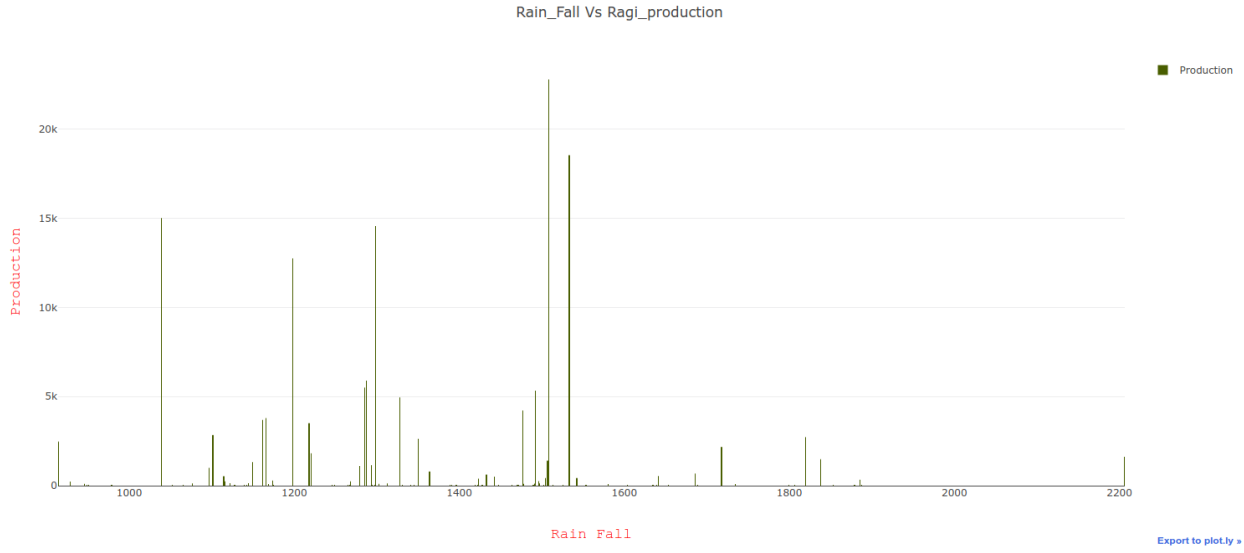


Fig.6.37

Plot of Humidity vs Ragi. Production

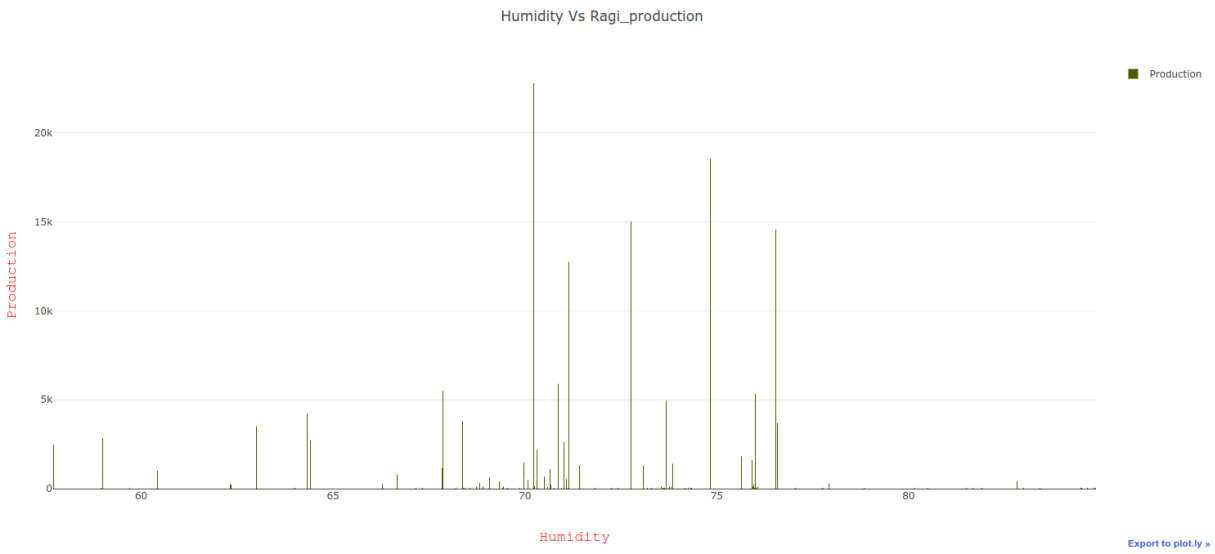


Fig.6.38

Plot of Soil vs Ragi Production

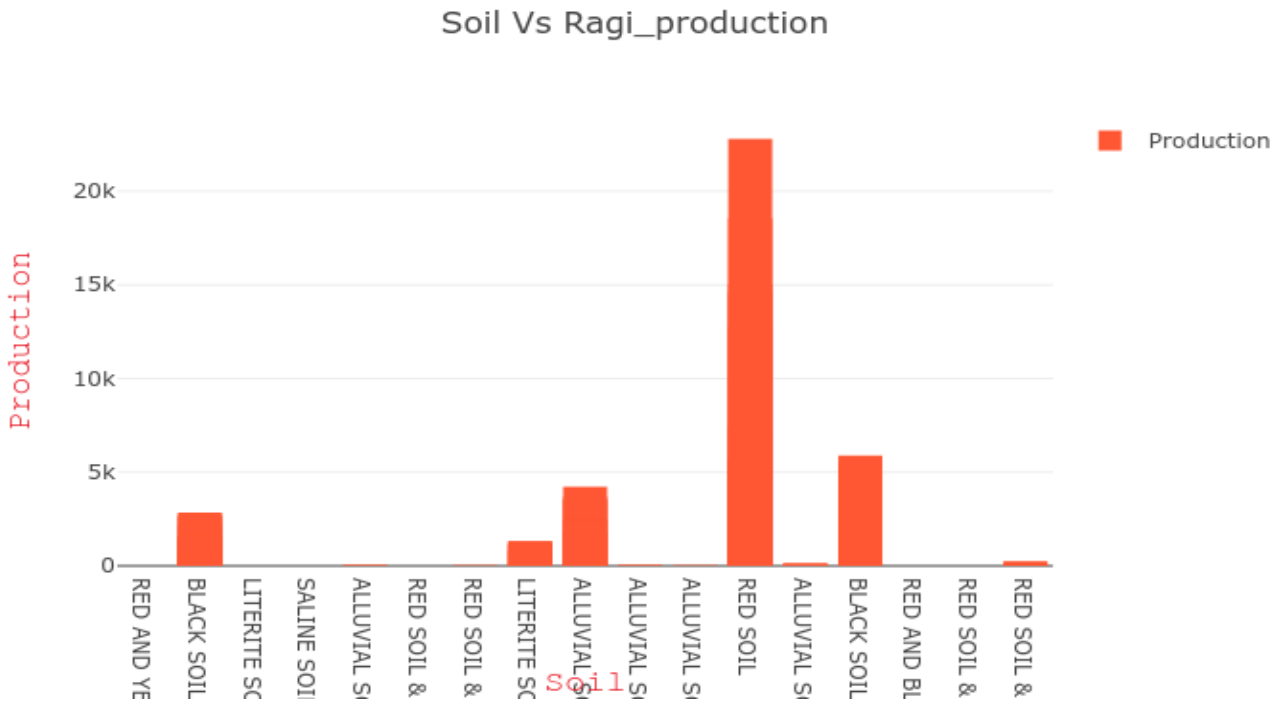


Fig.6.39

Optimal parameters to achieve higher Ragi production

Optimal temp	**22-25**
Worst temp	28
Rainfall	1400-1500
Humidity	70-73
Soil	Red Soil

Table 14

Urad:

Study and analysis of temperature and Urad crop production in different districts of Odisha.

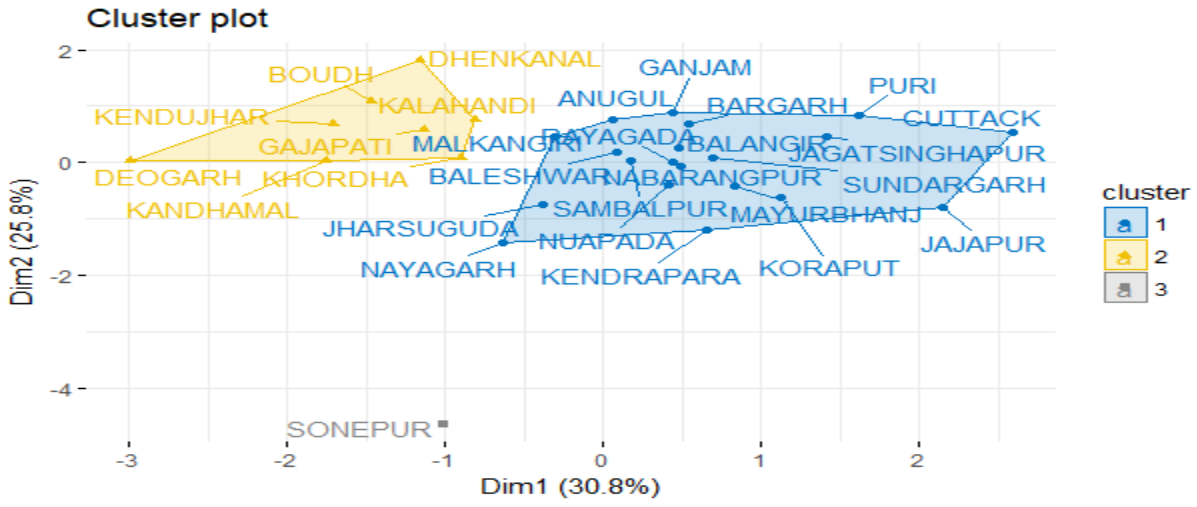


Fig.6.40

Output of CLARA

Result of Clara

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
GANJAM,PURI,ANUGUL, BARGARH,CUTTACK,MALKANGRI ,BALANGIR,JADATSINGHPUR, NABARANGPUR,JHARSUGUDA, NUAPADA,JAJAPUR,KORAPUT, KENDRAPARA,NAYAGARH, RAYAGADA,SUNDARGARH	DHENKANAL,BOUDH, KALHANDI,KENDUJHAR, GAJAPATI,DEOGARH, KHORDHA,KANDHAMAL	SONEPUR

Table 15

Plot temperature vs. Urad production

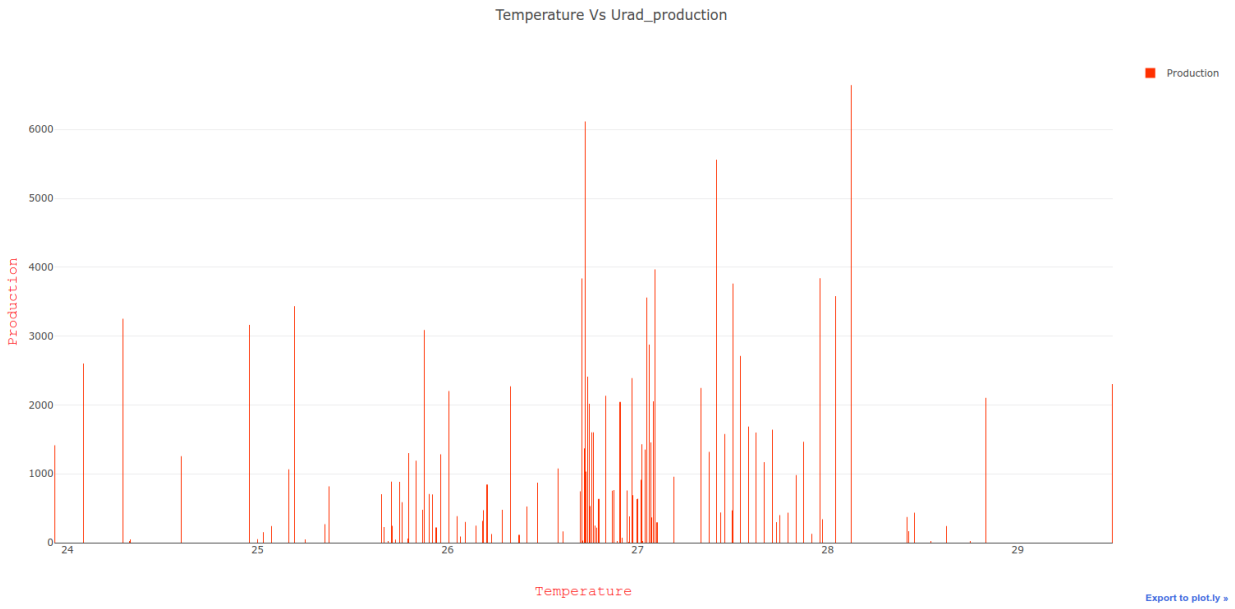


Fig 6.41

Plot Rainfall vs. Urad production

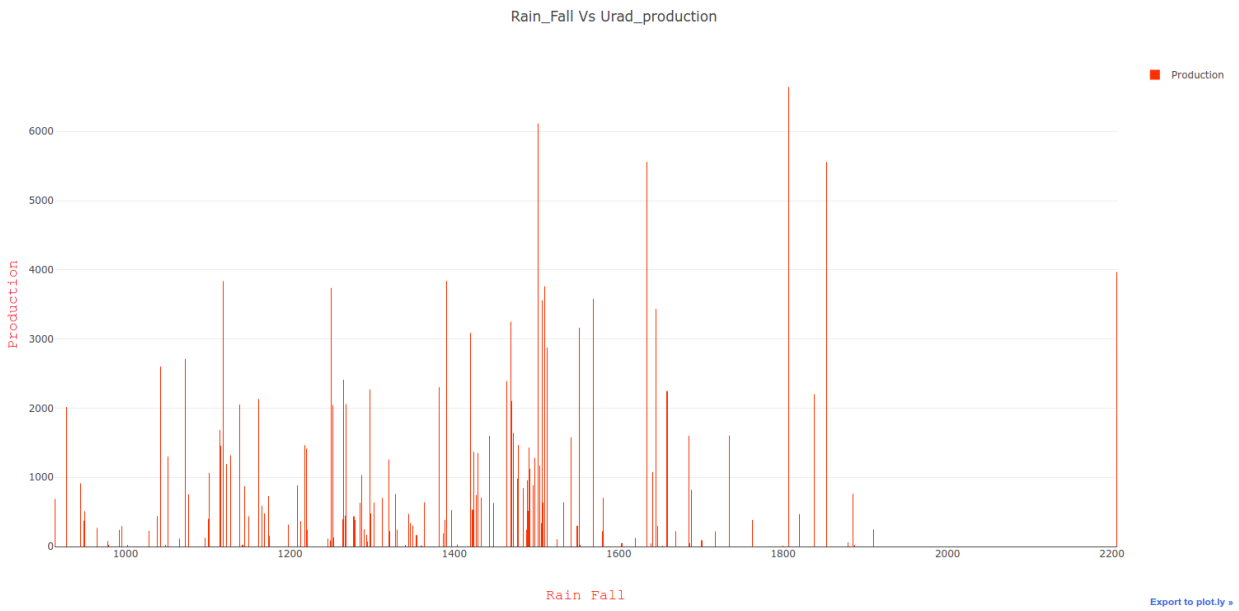


Fig.6.42

Plot Humidity vs. Urad production

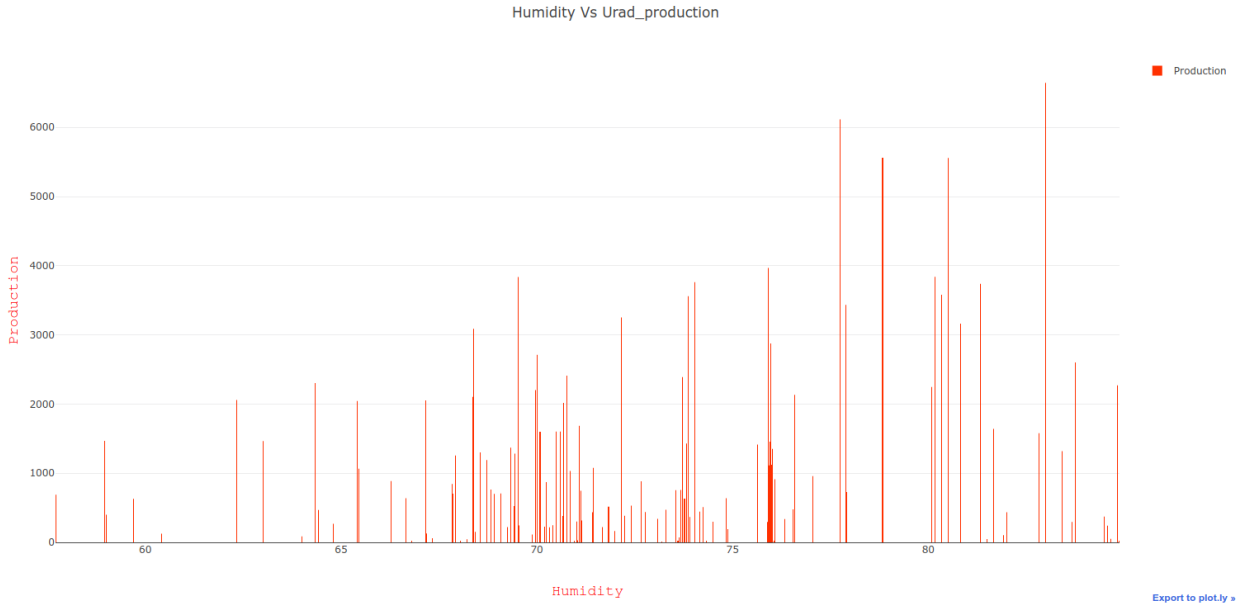


Fig. 6.43

Plot Soil vs. Urad production

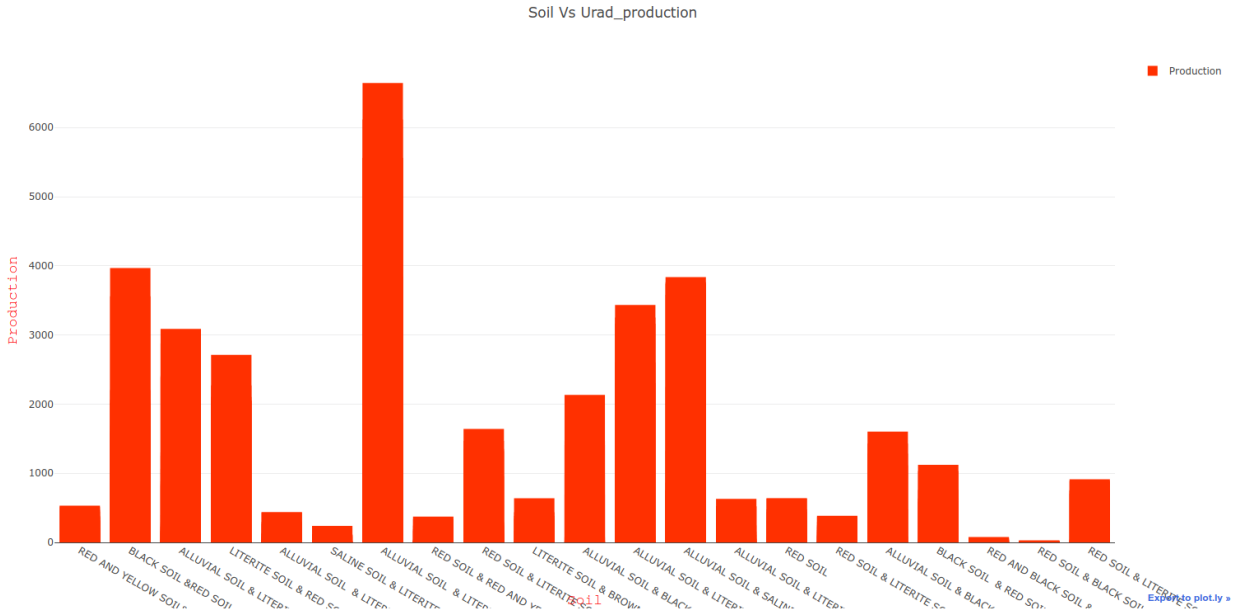


Fig.6.44

Optimal parameters to achieve higher Urad production

Optimal temp	**26-27**
Worst temp	29
Rainfall	1400-1500
Humidity	75-95
Soil	ALLUVIAL SOIL &LITERITE SOIL &BLACK

Table 16

SUGERCANE:

Study and analysis of temperature and Sugercane crop production in different districts of Odisha.

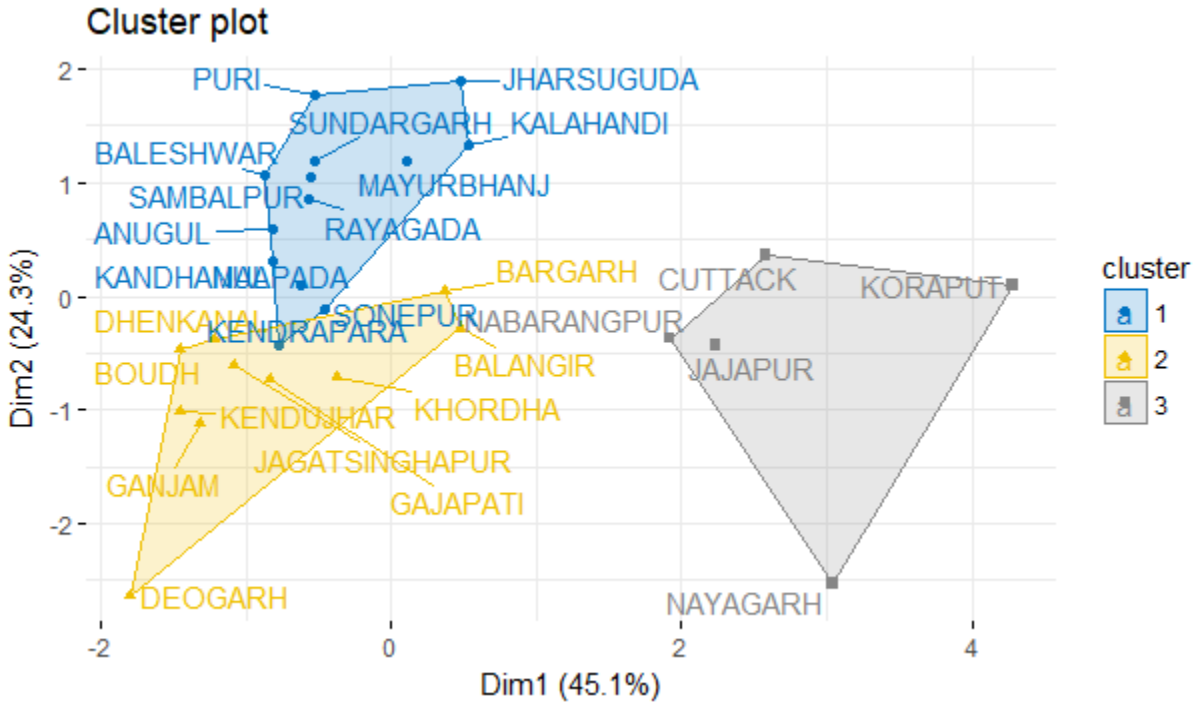


Fig.6.45

Output of CLARA

Result of Clara

Large area, production and moderate rainfall, temperature (24–26)	Moderate area, production and high rainfall, temperature (27–29)	Low area, production moderate rainfall, temperature (29–30)
PURI,JHARSUGUDA,ANUGUL, SUBDARGARH,KALAHANDI, BALESHWAR,KENDRAPARA, MAYURBHANJ,SONEPUR, RAYAGADA,SHAMBHALPUR	BARGARH,BALABGIR,KHORDHA, BOUDH,DHENKANAL,GANJAM, GAJAPATI,JAGATSINGHPUR, KENDUJHAR,DEOGARH	CUTTACK,KORAPUT,JAJAPUR, NABARANGPUR,NAYAGARH

(Table 17)

Result of CLARA

Plot temperature vs. Sugarcane production

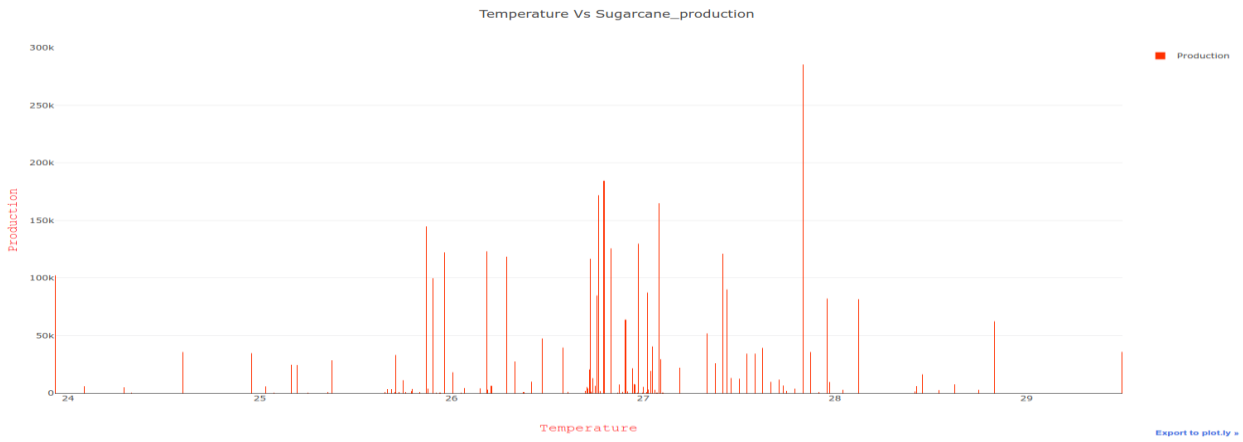


Fig.6.46

Plot Rainfall vs. sugarcane production

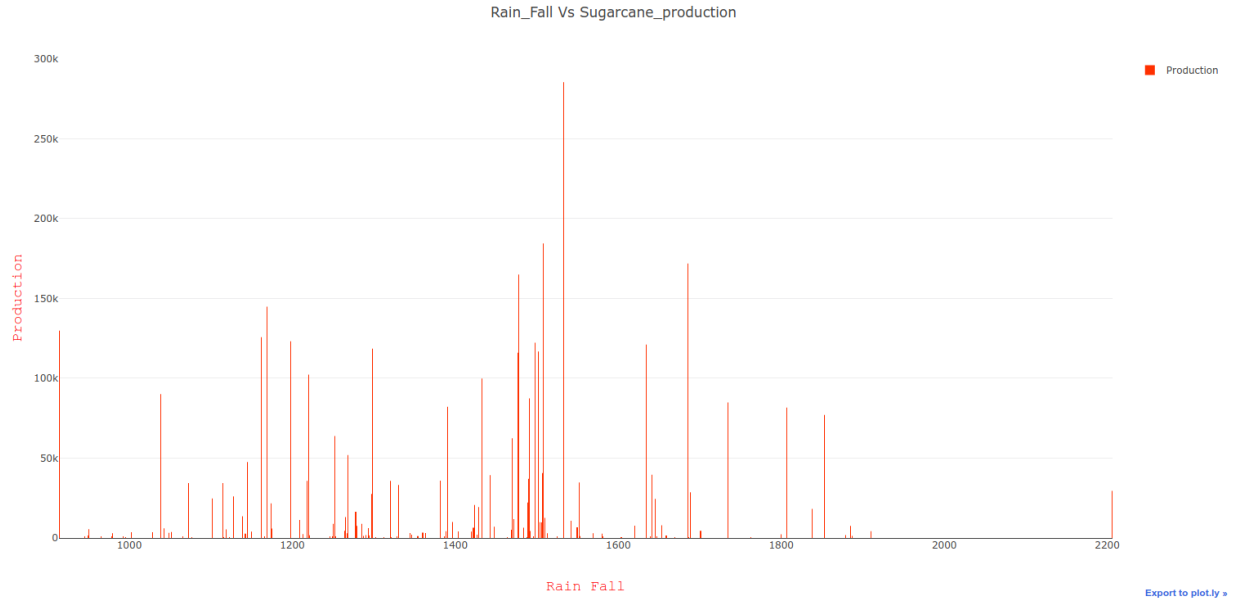


Fig.6.47

Plot Humidity vs. Sugarcane production

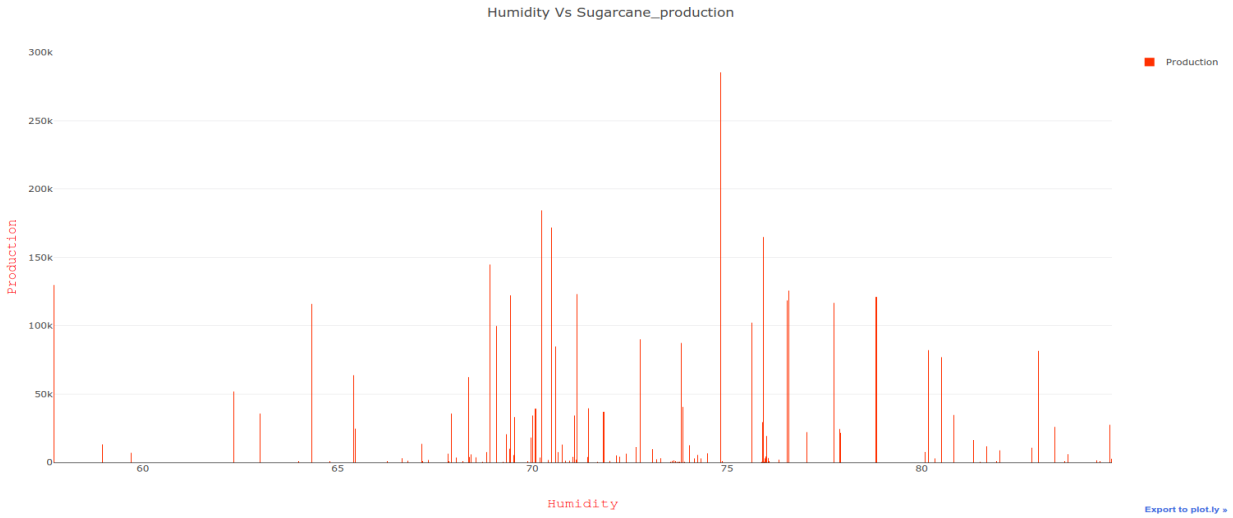


Fig.6.48

Plot Soil vs. Sugarcane production

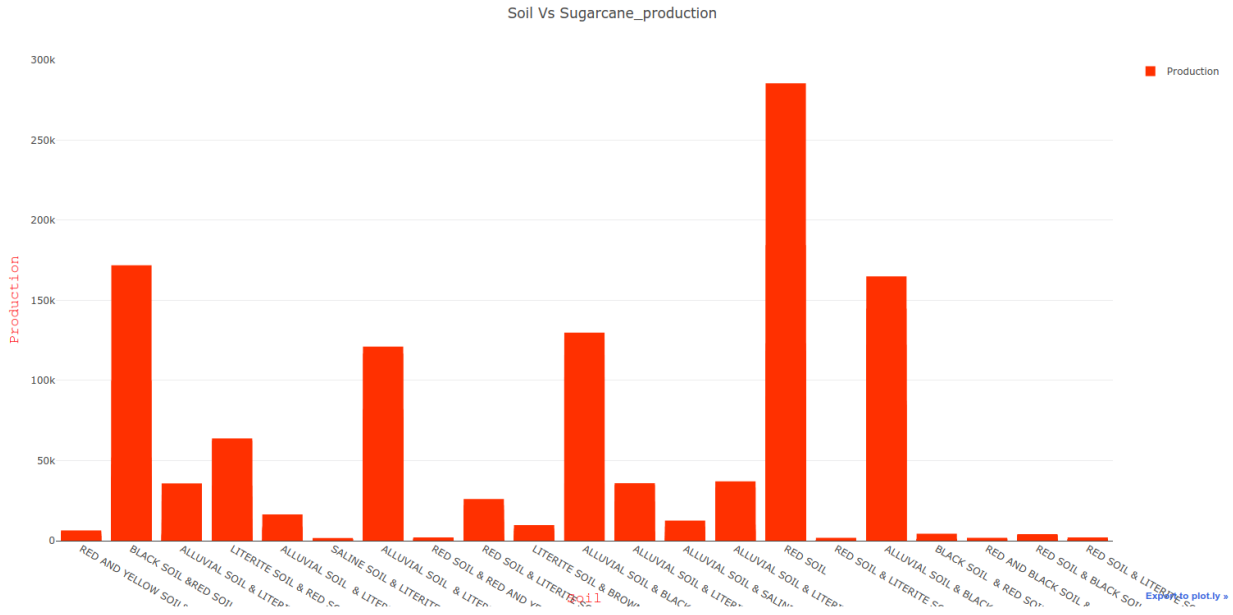


Fig.6.49

Optimal parameters to achieve higher sugarcane production

Optimal temp	**27.5-28**
Worst temp	30
Rainfall	1200-1500
Humidity	68-76
Soil	Red Soil

Table 18

6.5 Multiple Linear Regression:

Before applying the multiple linear regression, the "p value test" is performed on the dataset to determine the significant attributes. Table 3 depicts the significant values. An independent variable which has a "p value" of less than 0.05, specifies that the "null-hypothesis" can be rejected means it will have effect on regression analysis. So these independent values can be added to the model. Whereas if the p value is more than common alpha level i.e. 0.05, the variable will said to be not significant to the model.

*****Our dataset contend character data as soil type First we have to convert the character data to number

Soil type	Nunber
RED AND YELLOW SOIL&RED SOIL	1
BLACK SOIL &RED SOIL	2
ALLUVIAL SOIL & LITERITE SOIL & SALINE SOIL	3
LITERITE SOIL & RED SOIL & RED AND BLACK SOIL	4
ALLUVIAL SOIL & LITERITE SOIL &SALINE SOIL	5
SALINE SOIL & LITERITE SOIL & ALLUVIAL SOIL	6
ALLUVIAL SOIL & LITERITE SOIL & BLACK	7
RED SOIL & RED AND YELLOW SOIL	8
RED SOIL & LITERITE SOIL	9
LITERITE SOIL & BROWN FOREST	10
ALLUVIAL SOIL & BLACK & BROWN FOREST & SALINE SOIL	11

ALLUVIAL SOIL & LITERITE SOIL	12
ALLUVIAL SOIL & SALINE SOIL	13
ALLUVIAL SOIL & LITERITE SOIL & RED SOIL	14
RED SOIL	15
RED SOIL & LITERITE SOIL & ALLUVIAL SOIL	16
ALLUVIAL SOIL & BLACK& RED SOIL	17
BLACK SOIL & RED SOIL	18
RED AND BLACK SOIL & RED AND YELLOW SOIL	19
RED SOIL & BLACK SOIL & BROWN FOREST	20
RED SOIL & LITERITE SOIL & RED AND YELLOW SOIL	21

Table 19

P value test: significant attributes

Rice:

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.123e+05  1.709e+05  -0.657   0.5116
Area         5.972e-01  5.337e-02  11.190   <2e-16 ***
Avg_temp     4.457e+01  5.671e+03   0.008   0.9937
Rainfall     2.799e+01  2.102e+01   1.332   0.1838
Humidity     1.180e+03  9.711e+02   1.215   0.2251
Soil2        2.907e+04  2.875e+04   1.011   0.3125
Soil3        4.610e+04  3.093e+04   1.490   0.1370
Soil4        7.137e+04  3.182e+04   2.243   0.0255 *
Soil5        7.082e+04  4.080e+04   1.736   0.0834 .
Soil6        9.119e+03  3.697e+04   0.247   0.8053
Soil7        1.994e+04  3.764e+04   0.530   0.5966
Soil8       -4.474e+03  3.973e+04  -0.113   0.9104
Soil9        9.478e+03  3.031e+04   0.313   0.7547
Soil10       5.590e+03  4.185e+04   0.134   0.8938
Soil11       1.184e+05  3.824e+04   3.096   0.0021 **
Soil12       1.354e+04  3.726e+04   0.363   0.7166
Soil13       1.391e+04  3.658e+04   0.380   0.7040
Soil14       3.879e+04  4.105e+04   0.945   0.3453
Soil15       2.431e+04  3.620e+04   0.671   0.5024
Soil16       5.971e+04  3.667e+04   1.628   0.1043
Soil17       1.534e+04  3.959e+04   0.388   0.6985
Soil18       9.470e+03  3.638e+04   0.260   0.7948
Soil19       3.535e+04  3.675e+04   0.962   0.3368
Soil20       6.133e+04  3.643e+04   1.683   0.0931 .
Soil21       2.684e+04  3.722e+04   0.721   0.4713
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Fig.6.50

Wheat

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  346.45932  197.83296   1.751 0.083060 .
Area           1.37073    0.04534  30.231  < 2e-16 ***
Avg_temp      -5.09696    6.87228  -0.742 0.460079
Rainfall       0.01046    0.02367   0.442 0.659616
Humidity      -2.95921    1.19805  -2.470 0.015257 *
Soil2         -5.35819   30.75746  -0.174 0.862065
Soil3        -40.84025   34.75260  -1.175 0.242803
Soil4         15.15774   33.53237   0.452 0.652254
Soil5       -159.41174   40.23395  -3.962 0.000142 ***
Soil6         -6.66899   38.61440  -0.173 0.863241
Soil7         11.39256   40.26178   0.283 0.777809
Soil8         19.41335   39.04194   0.497 0.620143
Soil9         15.12834   32.69785   0.463 0.644637
Soil12       -11.12140   39.87988  -0.279 0.780936
Soil13        -3.01006   38.88510  -0.077 0.938458
Soil14       -22.32050   44.84823  -0.498 0.619829
Soil15        -1.86366   38.37956  -0.049 0.961371
Soil16       -26.62574   43.94131  -0.606 0.545971
Soil17       -14.48694   40.96483  -0.354 0.724374
Soil18       -17.73805   50.97662  -0.348 0.728621
Soil19        45.28650   39.61640   1.143 0.255800
Soil20         7.50412   38.65292   0.194 0.846471
Soil21       370.52019   54.64022   6.781 9.38e-10 ***
```

Fig.6.51

Ragi

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.265e+03  1.312e+03  -1.726   0.0861 .
Area         7.019e-01  1.142e-02  61.485   <2e-16 ***
Avg_temp     7.535e+01  4.374e+01   1.723   0.0867 .
Rainfall     2.233e-01  1.552e-01   1.439   0.1520
Humidity    -7.856e-01  7.047e+00  -0.111   0.9114
Soil2       -2.704e+02  2.307e+02  -1.172   0.2427
Soil3        1.620e+01  2.713e+02   0.060   0.9524
Soil4       -4.901e+01  2.716e+02  -0.180   0.8570
Soil6        1.369e+01  2.829e+02   0.048   0.9615
Soil7       -1.237e+02  3.145e+02  -0.393   0.6947
Soil8       -2.234e+01  5.400e+02  -0.041   0.9670
Soil9        2.670e+01  2.547e+02   0.105   0.9166
Soil10      -1.957e+01  2.518e+02  -0.078   0.9381
Soil11       3.455e+02  2.546e+02   1.357   0.1766
Soil14       4.888e+01  2.677e+02   0.183   0.8553
Soil15       6.318e+00  2.768e+02   0.023   0.9818
Soil17      -2.374e+01  2.713e+02  -0.087   0.9304
Soil18      -3.711e+02  2.552e+02  -1.454   0.1477
Soil19      -1.852e+01  2.729e+02  -0.068   0.9460
Soil20      -5.155e+01  5.300e+02  -0.097   0.9226
Soil21       3.042e+01  2.661e+02   0.114   0.9091
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Fig.6.52

Udar

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -7.686e+02  4.535e+02  -1.695   0.0911 .
Area         3.156e-01  5.085e-03  62.050  < 2e-16 ***
Avg_temp     2.058e+01  1.530e+01   1.345   0.1794
Rainfall     1.576e-01  5.888e-02   2.677   0.0078 **
Humidity    -1.894e+00  2.532e+00  -0.748   0.4550
Soil2       -3.308e+01  7.331e+01  -0.451   0.6521
Soil3        1.921e+02  7.714e+01   2.491   0.0132 *
Soil4        8.862e+01  8.184e+01   1.083   0.2796
Soil5        1.527e+02  9.311e+01   1.640   0.1020
Soil6        1.174e+02  9.301e+01   1.262   0.2078
Soil7        4.969e+02  9.591e+01   5.181 3.83e-07 ***
Soil8        1.441e+02  9.077e+01   1.587   0.1134
Soil9        1.353e+02  7.521e+01   1.799   0.0730 .
Soil10      -5.484e+01  1.005e+02  -0.546   0.5858
Soil11      -1.002e+02  9.374e+01  -1.069   0.2860
Soil12       1.391e+02  9.402e+01   1.479   0.1400
Soil13       5.461e+02  1.028e+02   5.312 1.99e-07 ***
Soil14       2.882e+01  1.016e+02   0.284   0.7768
Soil15       1.021e+02  9.248e+01   1.104   0.2706
Soil16       1.197e+02  8.964e+01   1.335   0.1827
Soil17      -7.125e+01  1.005e+02  -0.709   0.4788
Soil18       8.416e+01  8.957e+01   0.940   0.3481
Soil19       1.117e+02  9.286e+01   1.203   0.2298
Soil20       1.578e+02  1.037e+02   1.523   0.1288
Soil21       5.006e+01  1.002e+02   0.500   0.6176
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Fig.6.53

Sugarcane

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -16842.294  25363.359  -0.664  0.50797
Area            57.889      1.863  31.076  < 2e-16 ***
Avg_temp       928.170    867.645   1.070  0.28693
Rainfall        -1.588      3.216  -0.494  0.62231
Humidity       -89.278    145.617  -0.613  0.54100
Soil2        -2460.328   4384.246  -0.561  0.57575
Soil3         1583.561   4451.721   0.356  0.72269
Soil4         5118.506   4639.827   1.103  0.27222
Soil5          512.618   5369.532   0.095  0.92411
Soil6          465.722   5353.291   0.087  0.93082
Soil7        -1476.616   6281.392  -0.235  0.81456
Soil8         -171.357   5408.388  -0.032  0.97478
Soil9         1968.623   4481.042   0.439  0.66124
Soil10        -192.073   5381.759  -0.036  0.97159
Soil11       19443.452   5936.853   3.275  0.00139 **
Soil12       -2988.323   5543.895  -0.539  0.59089
Soil13        -810.099   5385.861  -0.150  0.88070
Soil14         377.099   5455.816   0.069  0.94501
Soil15       45702.586   6394.854   7.147 8.21e-11 ***
Soil16         684.368   5354.519   0.128  0.89852
Soil17       13328.725   6290.828   2.119  0.03623 *
Soil18         611.420   5354.468   0.114  0.90928
Soil19        1123.173   5420.763   0.207  0.83622
Soil20        1224.495   5358.930   0.228  0.81966
Soil21         995.145   5363.221   0.186  0.85312
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Fig.6.54

Groundnut:

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 1352.3531  1412.3219   0.958    0.339
Area           1.1457     0.0186  61.594   < 2e-16 ***
Avg_temp     -77.1117    46.8808  -1.645    0.101
Rainfall       0.2065     0.1691   1.221    0.223
Humidity       4.3046     7.6013   0.566    0.572
Soil2        170.0260   206.9050   0.822    0.412
Soil3         57.2742   264.1762   0.217    0.828
Soil4       -318.1476   247.9800  -1.283    0.200
Soil5        138.5260   349.1975   0.397    0.692
Soil6        124.6981   263.3080   0.474    0.636
Soil7         83.6738   279.1648   0.300    0.765
Soil8        185.3340   288.7881   0.642    0.521
Soil9        183.5617   220.1503   0.834    0.405
Soil10       203.0975   264.6932   0.767    0.443
Soil11       348.4226   265.3468   1.313    0.190
Soil12      1618.4513   315.2728   5.133 4.88e-07 ***
Soil13      -149.6681   372.3013  -0.402    0.688
Soil14       163.3745   320.2033   0.510    0.610
Soil15       101.0348   261.6306   0.386    0.700
Soil16       235.9675   262.4783   0.899    0.369
Soil17        87.0629   264.6499   0.329    0.742
Soil18        71.2239   263.2429   0.271    0.787
Soil19        70.2229   281.4394   0.250    0.803
Soil20       211.1136   273.4305   0.772    0.441
Soil21        58.6343   273.8180   0.214    0.831
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Fig.6.55

Multiple linear regression equation for different crop yield.

Crop	Yield forecast equation
Rice	(6.993e+04)+(7.267e01)Area+(2.672e+01)Rainfall+(7.258e+04)Soil4+(3.395e+04)Soil14
Wheat	(3.522e+02)+(1.526e+00)Area+(-7.197e-01)Humidity+(-1.134e+02)Soil5+(2.557e+02)Soil21
Udar	(-650.6966)+(0.3210)Area+(0.1647)Rainfall+(223.2627)Soil3+(510.5025)Soil7+(557.6675)Soil13
Sugarcane	(-16842.294)+(57.889)Area+(-1.588)Rainfall+(-192.073)Soil10+(-810.099)Soil13+(13328.725)Soil17
Groundnut	(1352.3531)+(1.1457)Area+(0.2065)Rainfall+(170.0260)Soil12
Ragi	(-2264.7111)+(0.7019)Area+(75.3498)Avg_temp+(0.2233)Rainfall

Table 20

Rice Production in odisha in Different Season

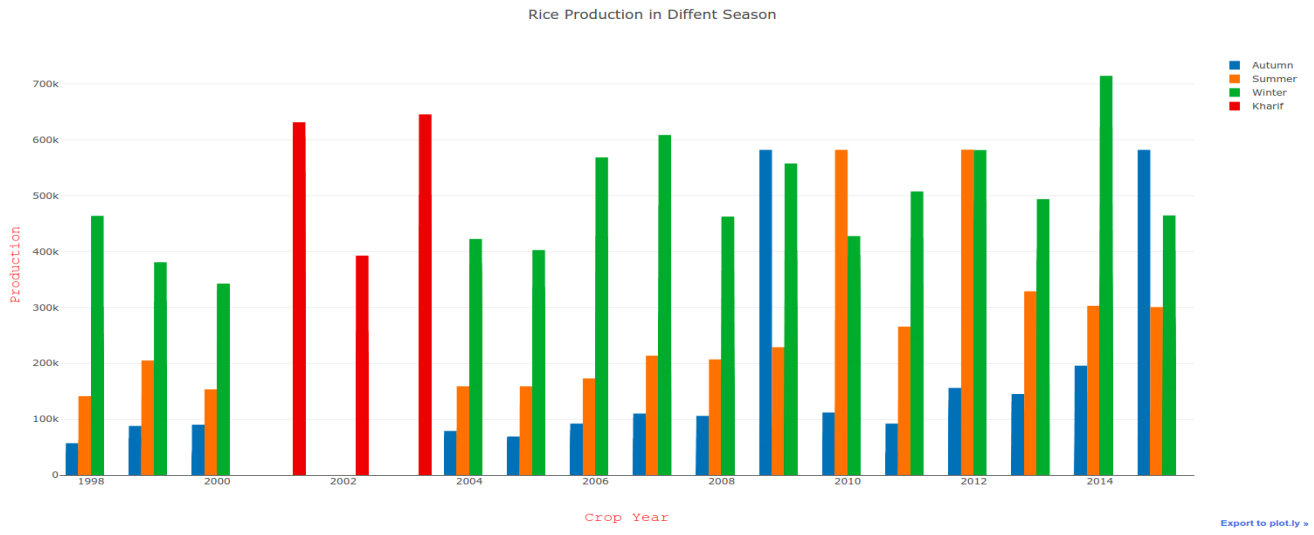


Fig.6.56

Rice Production Vs Season

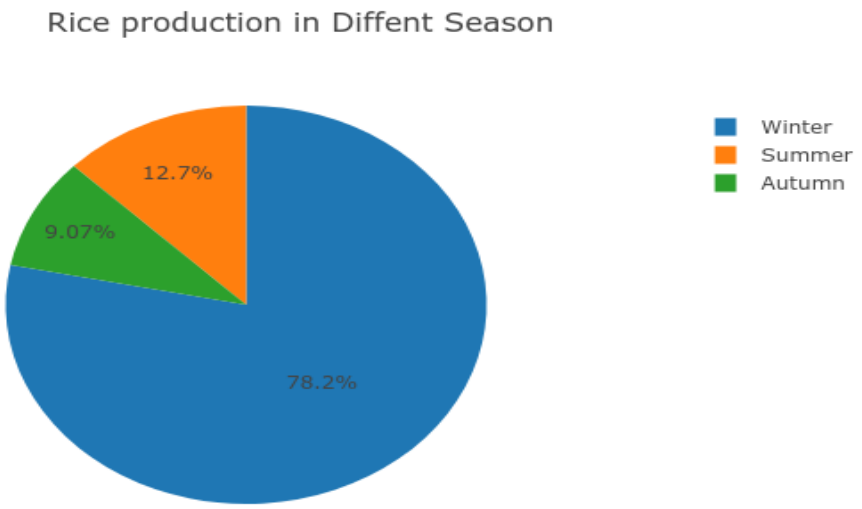


Fig.6.57

As you can se we are getting 78.2% in Winter Season ,so That means the agriculture Condition in Winter Season is More Suitable for Rice Production Then Other.

Wheat Production in odisha In Different Season

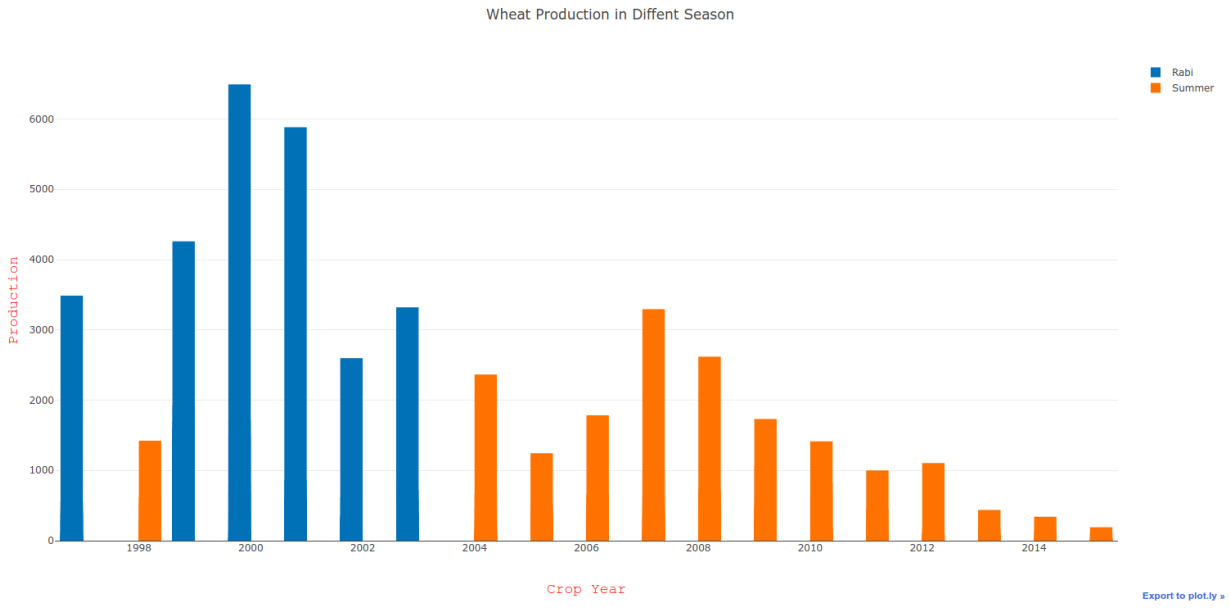


Fig.6.58

Wheat Production Vs Season

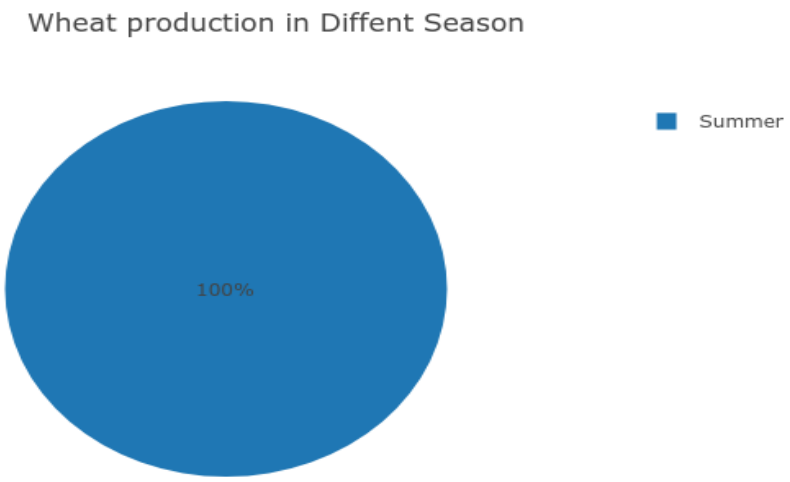


Fig.6.59

As you can se we are getting 100% in Summe Season ,so That means the agriculture Condistion in Summer Season is More Suiteble for Wheat Production Then Other

Groundgnut Production In Odisha In Different Season

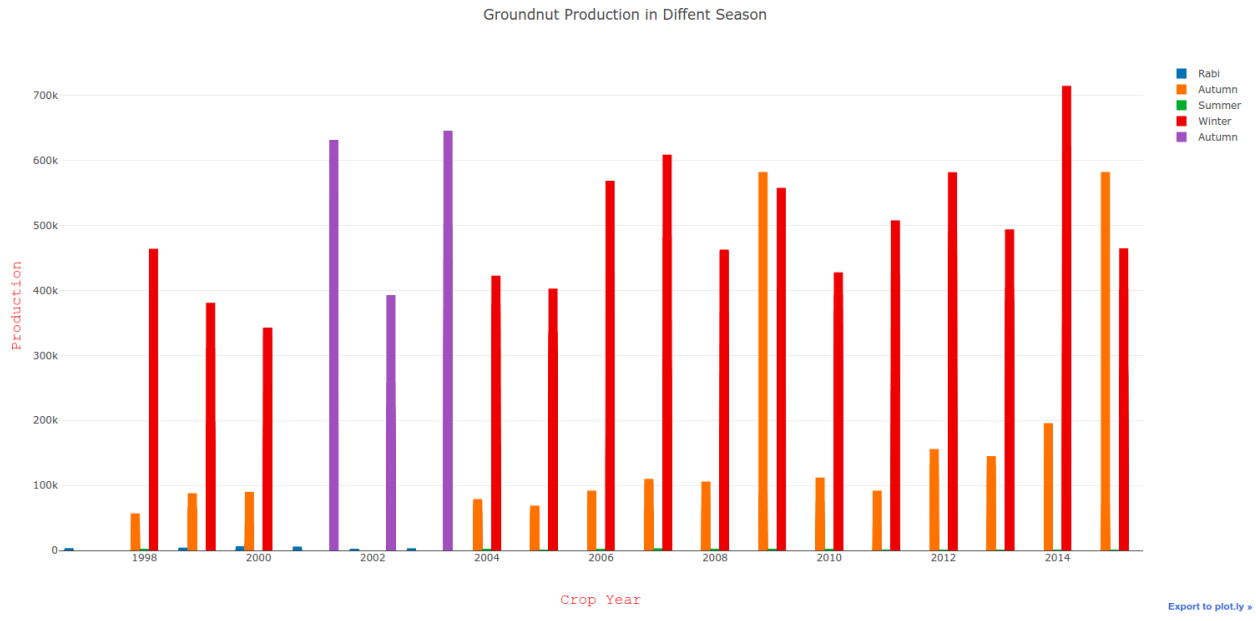


Fig.6.60

Groundnut Production vs. Season

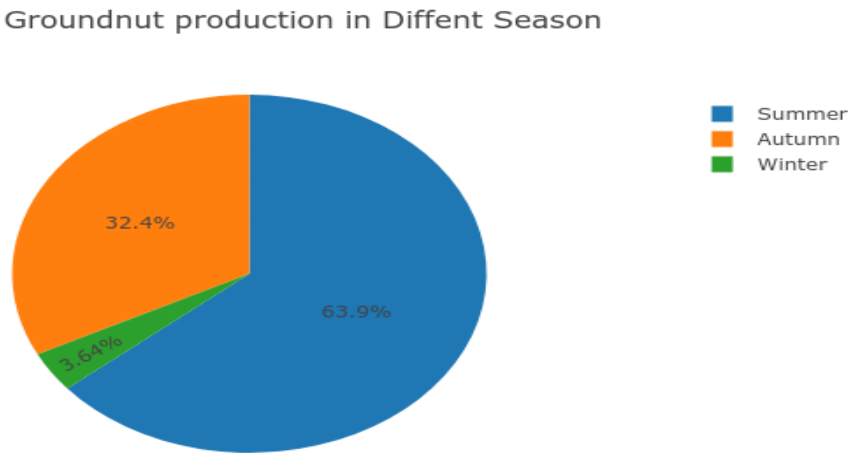


Fig.6.61

As you can se we are getting 63.9% in Summer Season ,so That means the agriculture Condistion in Summer Season is More Suiteble for Groundnut Production Then Other.

Ragi Production In odisha in Different Season

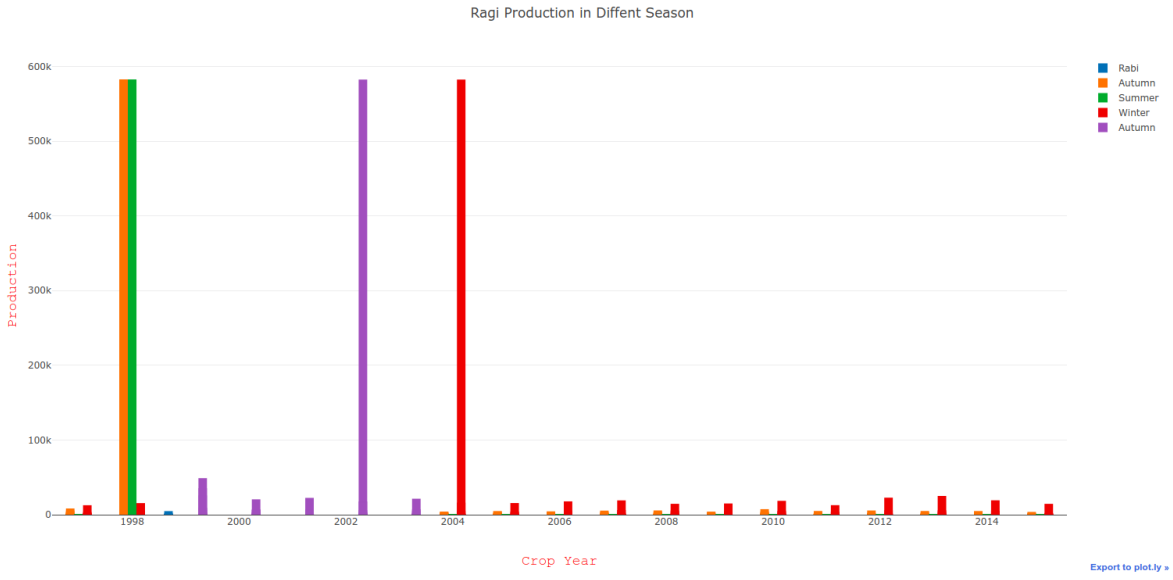


Fig.6.62

Ragi Production Vs Season

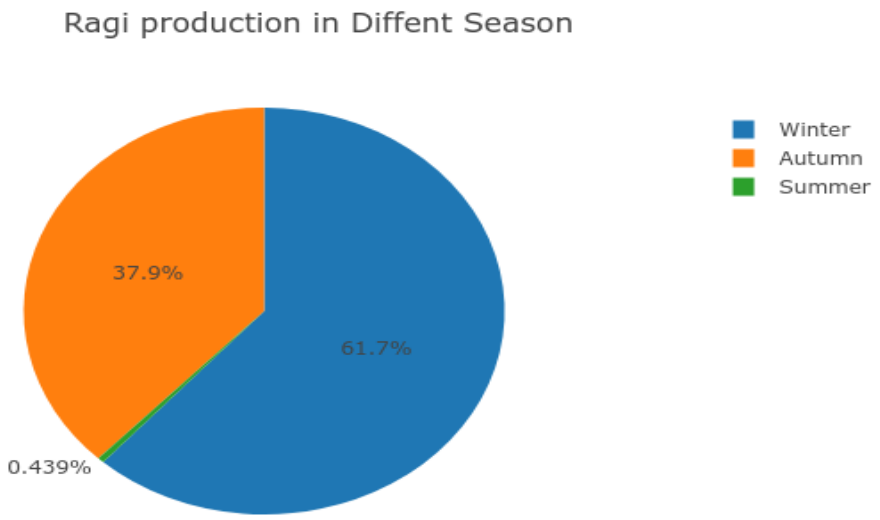


Fig.6.63

As you can se we are getting 61.7% in Winter Season ,so That means the agriculture Condistion in Winter Season is More Suiteble for Ragi Production Then Other.

Urad Production in odisha in Different Season

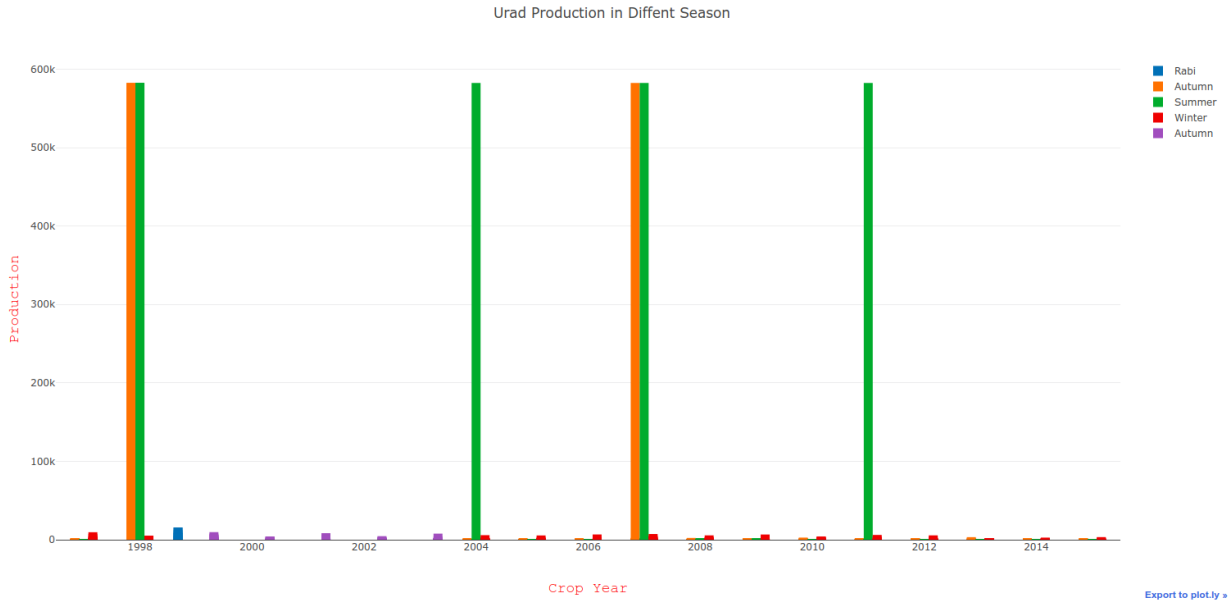


Fig.6.64

UradProduction Vs. Season

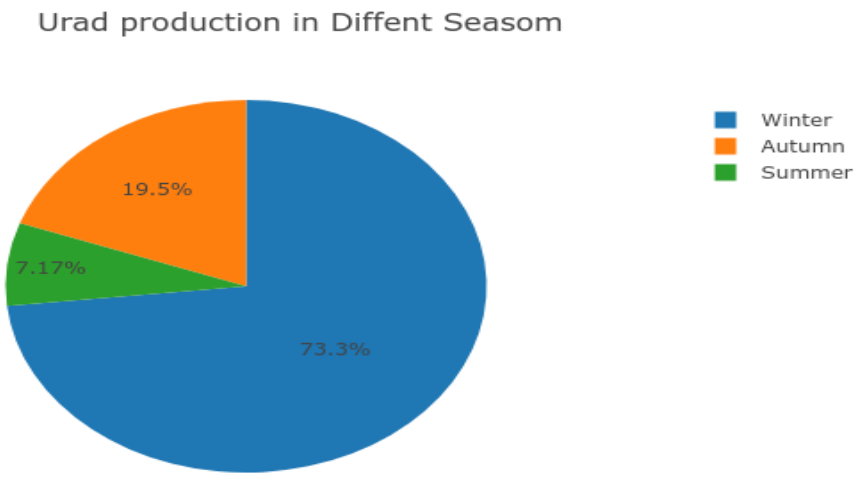


Fig.6.65

As you can se we are getting 73.3% in Winter Season ,so That means the agriculture Condistion in Winter Season is More Suiteble for Urad Production Then Other.

Sugercane Production in Odisha in Different Season

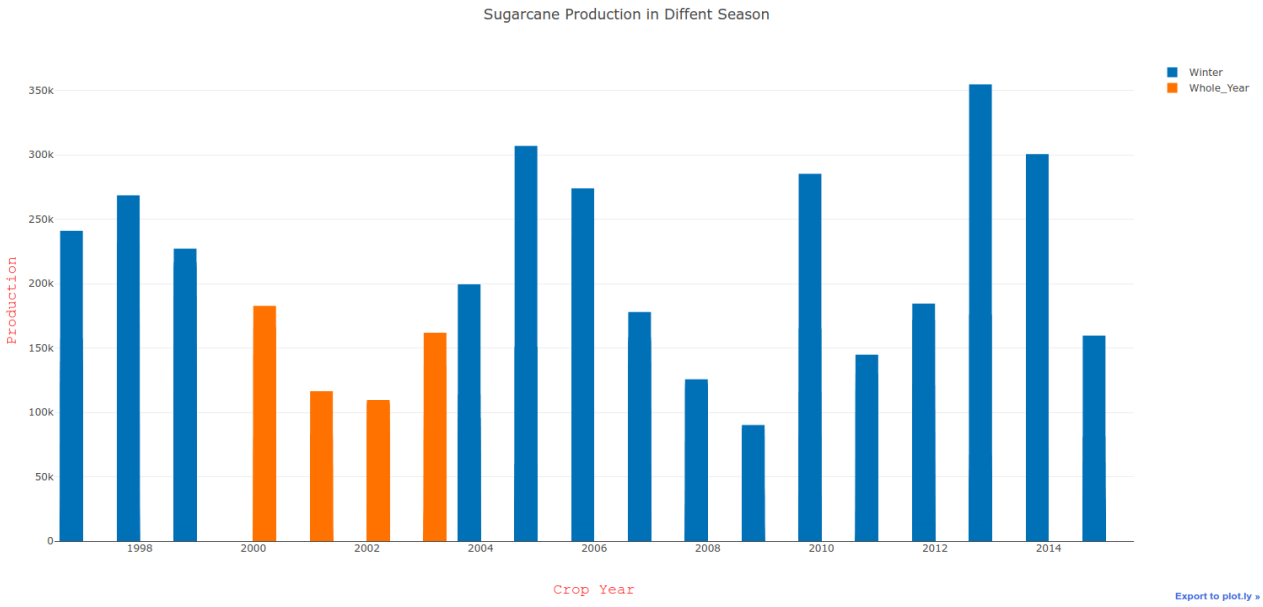


Fig.6.66

SugarcaneProduction Vs. Production

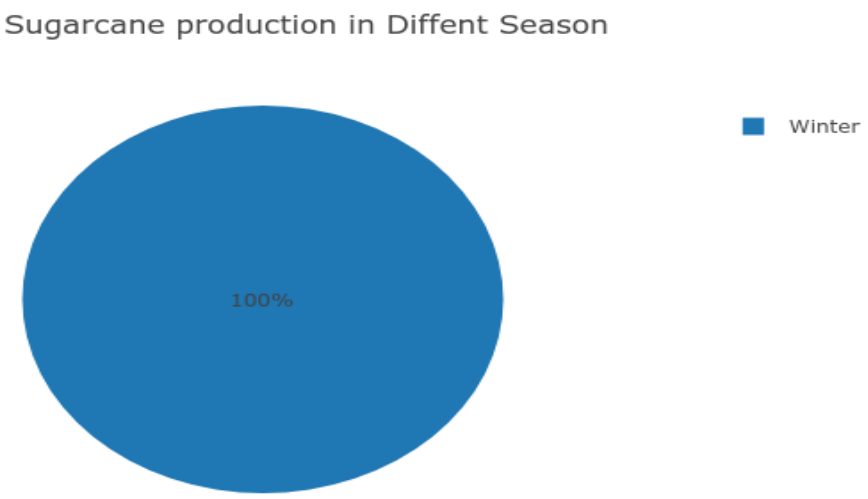


Fig.6.67

As you can se we are getting 100% in Winter Season ,so That means the agriculture Condistion in Winter Season is More Suiteble for Sugarcane Production Then Other.

Crop Production in Different Season Of Odisha

Autumn Season

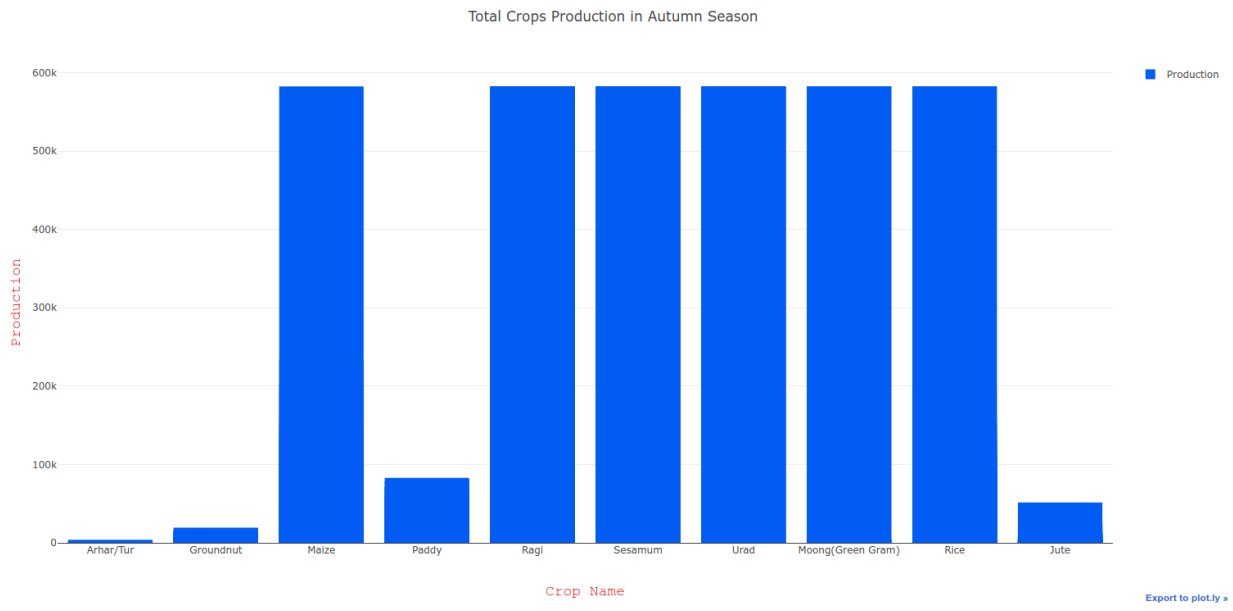


Fig.6.68

Crop production in Autumn Season

Summer Season

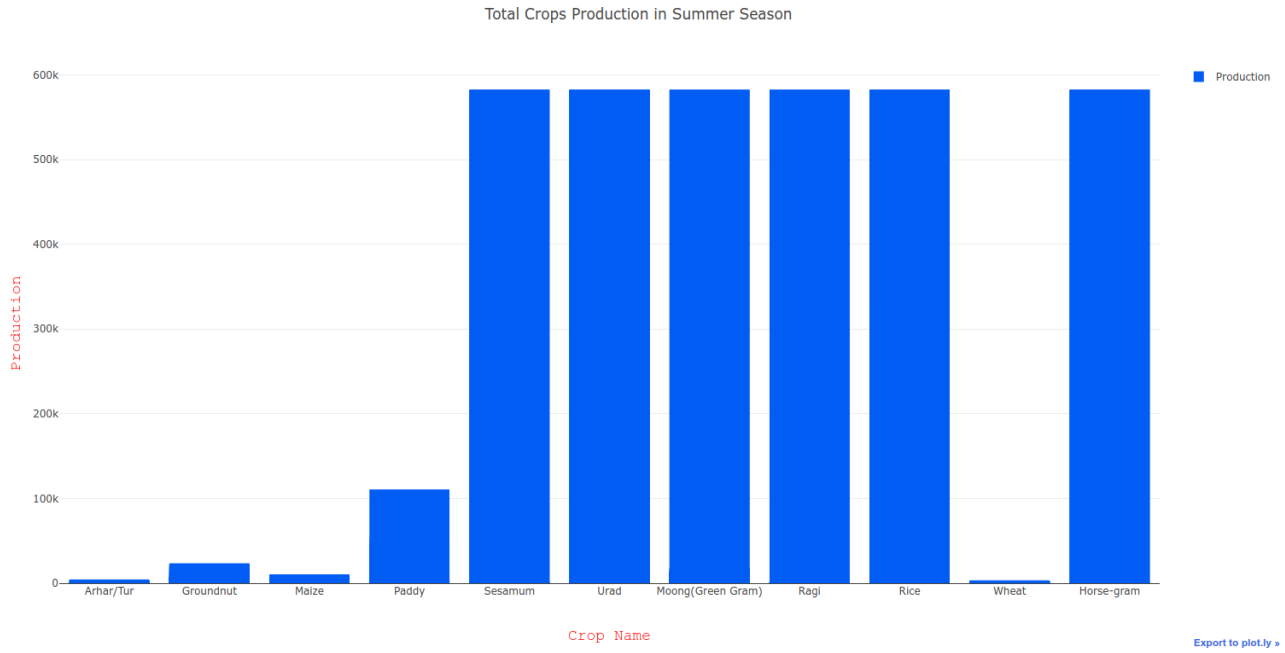


Fig.6.69

Crop Production in Summer Season

Rabi Season

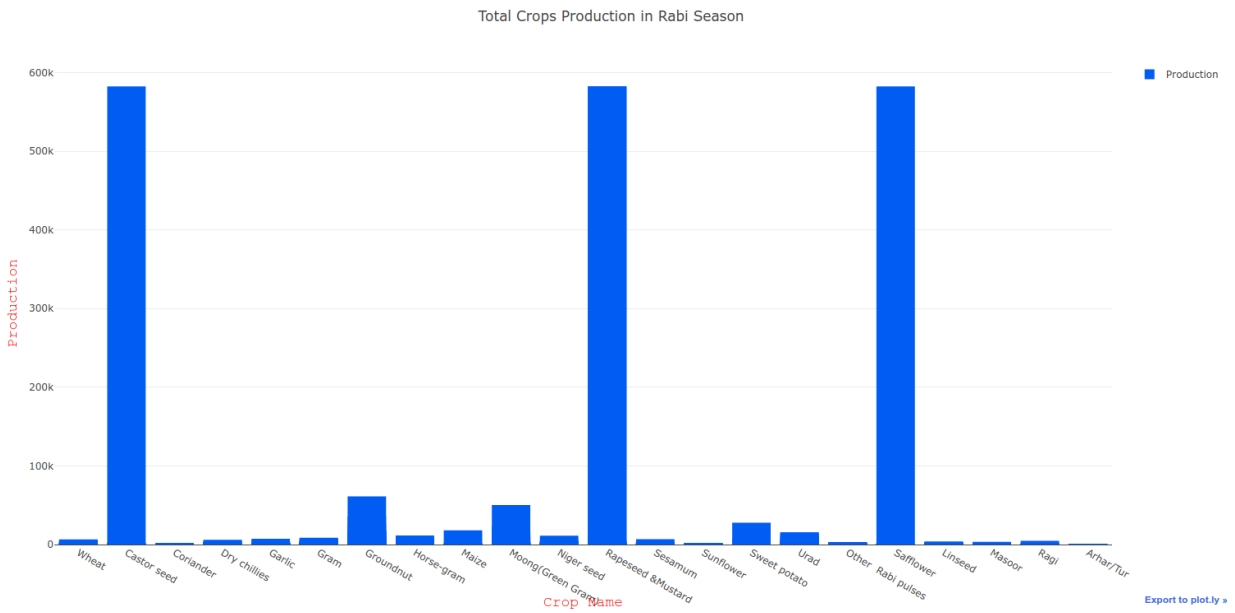


Fig.6.70

Crop Production in Rabi Season

Winter Season

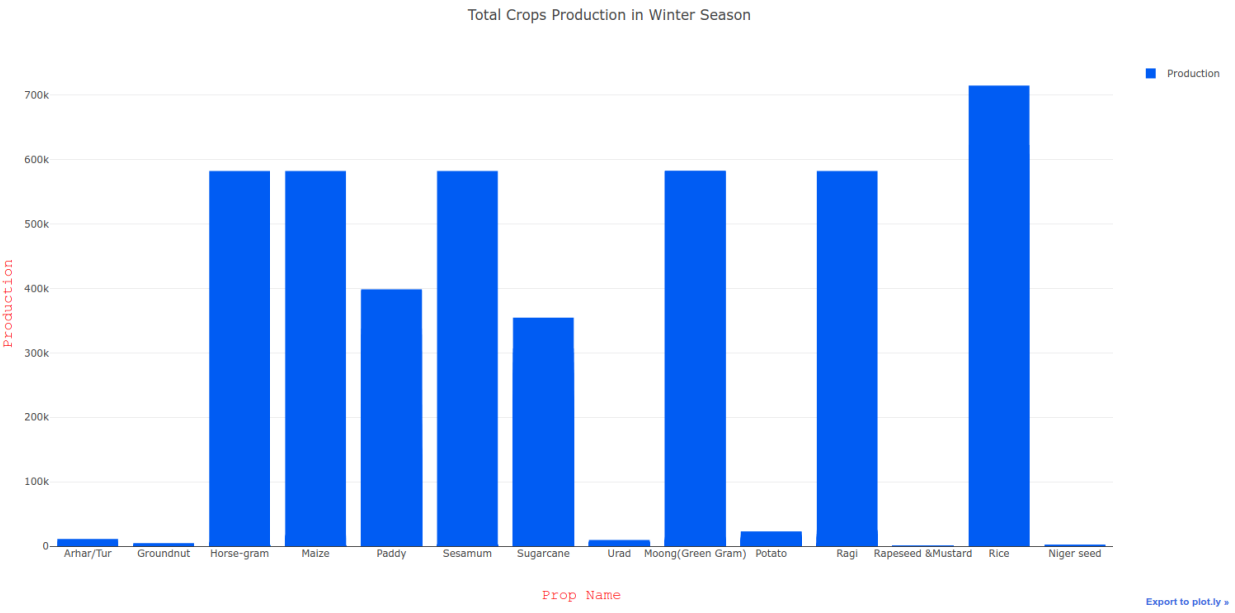


Fig.6.71

Crop Production in Winter Season

Kharif Season

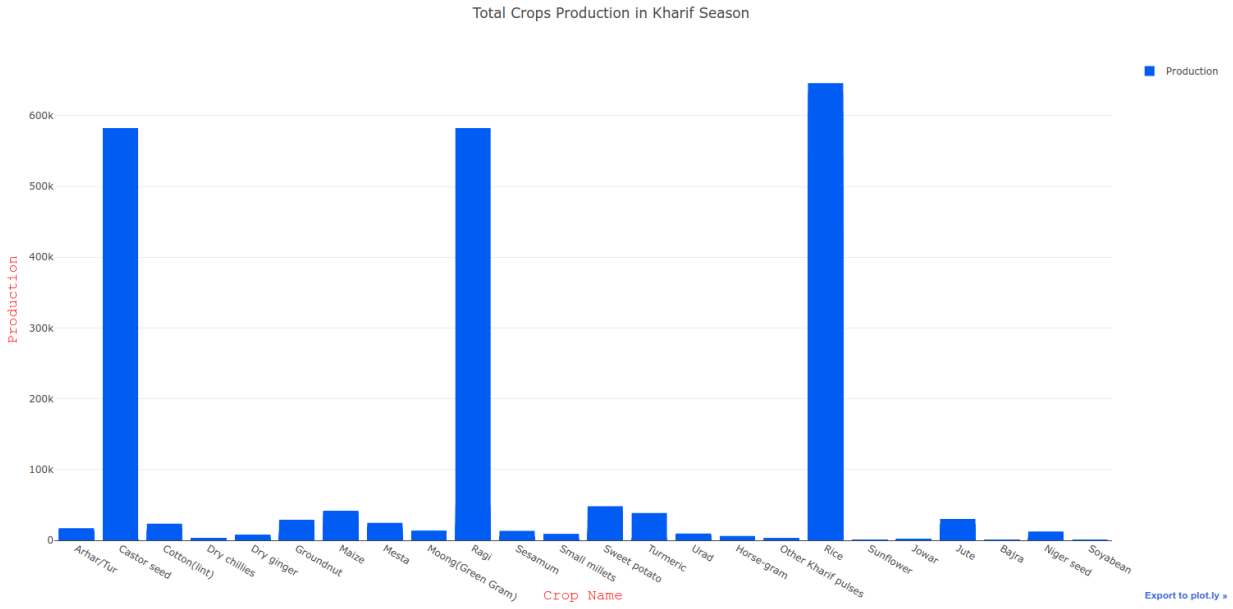


Fig.6.72

Crop Production in Kharif Season

Whole Year Season

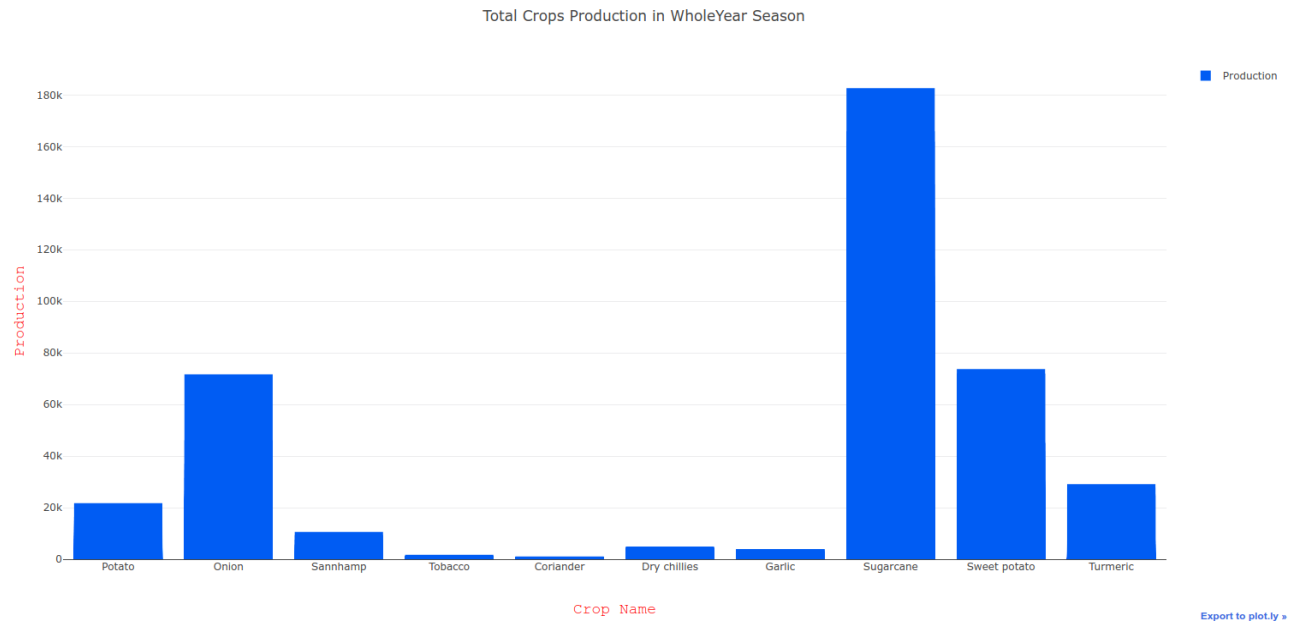


Fig.6.73

Crop Production in Whole yearSeason

There are so many crops are planting in different Season But Some Crops Are Producing more In one Season over the Year

And Those are represent in bellow table

Season	Crops
Autumn	Maiza,Ragi,Sesamun,Urad,Moong,Rice
Summer	Sesamum,Urad,Moong,Ragi,Rice,Horse-gram
Rabi	Castor Seed,Rapeseed&Mustard,Safflowe
Winter	Rice,Maizw,Ragi,Moong
Kharif	Rice,Ragi,CastarSeed
WholeYear	Sugarcane

Table 21

*Year Wise Crops Production Of Different State of India

(Table 22)

State Name	Crop
Andaman and nicobar	Coconut
Andra Pradesh	Coconut
arunachal Pradesh	Turmeric
Assam	Coconut
Bihar	Sugar cane
Chandigarh	Arhar and Tur
Chatisgarh	Suger cane
Dadra and Nager Haveli	Sugar Cane
Goa	Coconut
Gujrat	Sugarcane
Haryana	Sugarcane
himachal Pradesh	Arhar Tur, horse gram
Jammu and Kashmir	Moong
Jharkhand	Rice
Karnataka	Sugarcane
Kerala	Coconut
Madhya Pradesh	Coconut and Banana
Maharashtra	Sugar cane

Manipur	Peas and Beans
Meghalaya	Potato
Mizoram	Peas and Beans and Sugarcane
Nagaland	Rice and Moong
Odisha	Rice
Pondicherry	Coconut
Punjab	Wheat
Rajasthan	Wheat
Sikkim	Maize
Tamil Nadu	Coconut
Telengana	Coconut
Tripura	Rice
Utterpradesh	Sugar cane
Utrakhand	Sugarcane
West bengal	Coconut

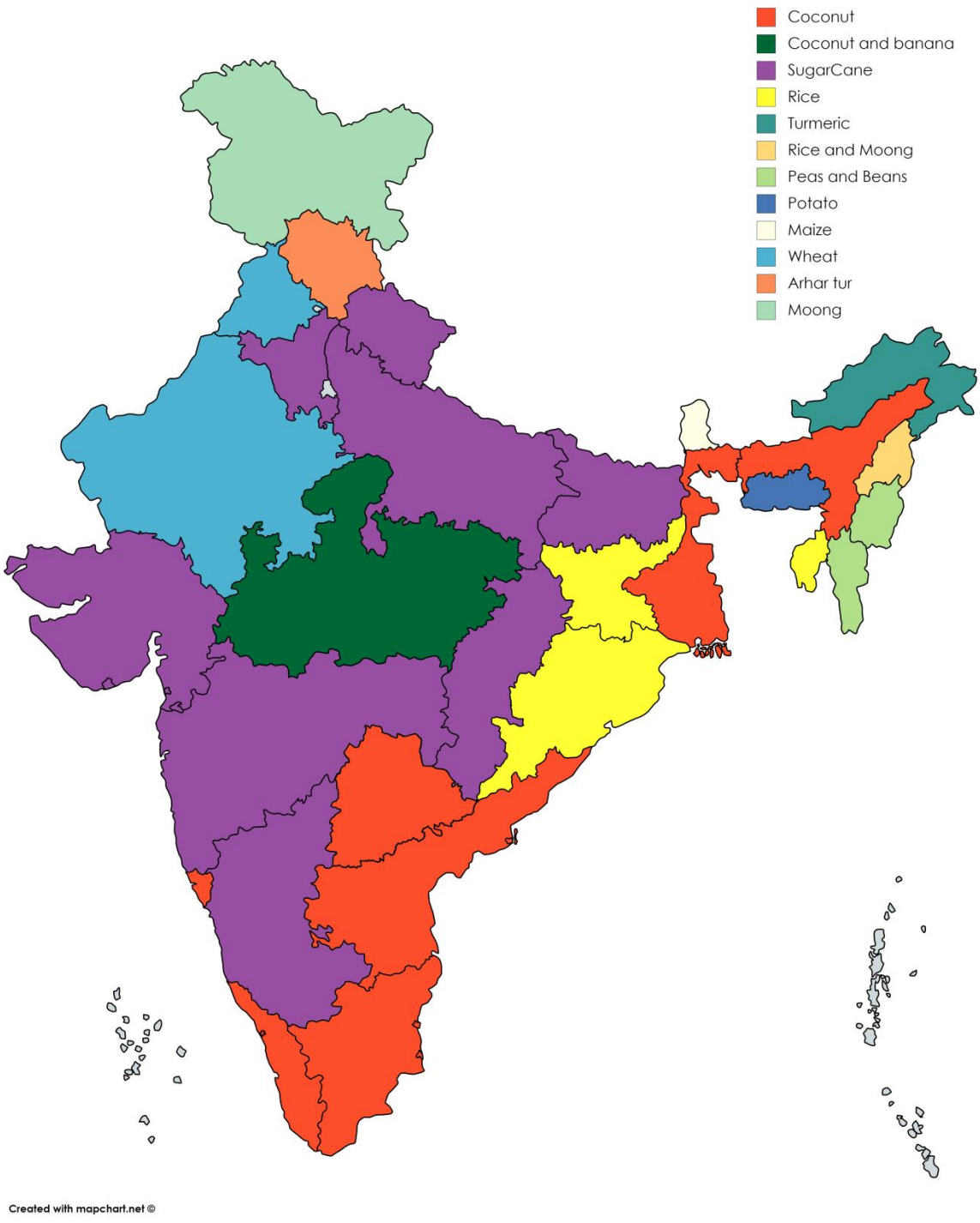


Fig 6.74

State Wise Higher Crop Production