Shikshan Prasarak Sanstha's

S.N.ARTS, D.J.M. COMMERCE & B.N.S. SCIENCE COLLEGE, SANGAMNER

DEPARTMENT OF MATHEMATICS AND STATISTICS

2019-2020

A PROJECT REPORT ON

"STATISTICAL ANALYSIS OF PRODUCTON OF CROPS IN INDIA"

Submitted By :

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DEPARTMENT OF MATHEMATICS AND STATISTICS

CERTIFICATE

This is to certify that the _____ of

Class T.Y.BSc has completed all assigned project of the **"Statistical Analysis of Production of Crops in India"** As laid down by the "Savitribai Phule Pune University" for the acadmic year 2019- 2020.

Project Guide

Head of Department

Internal Examiner External Examiner

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ACKNOWLEDGEMENT

We are thankful to **Prof**. **Kurhe S.V., Prof. Chaure K.O. & Prof. Shete P.S.** for their support and guidance for this project .

We are thankful for this opportunity to express our deepsence of gratitude and hold hearted thanks to our best guide **"Team stat"** giving their priceless guidance inspiration and encouragement to embark this project .

Also we would like to thank all our statistician friends to help us directly or indirectly in our endeavor and infused their help for the success of our project.

INTRODUCTION

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 % of world population from 2.3 % of world geographical area and 4.2 % of world's water resources. The economic reforms, initiated in the country during the early 1990s, have put the economy on a higher growth trajectory. Annual growth rate in GDP has accelerated from below 6 % during the initial years of reforms to more than 8 % in recent years. This happened mainly due to rapid growth in non-agriculture sector. The workforce engaged in agriculture between 1980-81 and 2006-07 witnessed a very small decline; from 60.5 % to 52 %.

Indian agriculture is characterized by agro-ecological diversities in soil, rainfall, temperature, and cropping system. Besides favorable solar energy, the country receives about 3 trillion m cube of rainwater, 14 major, 44 medium and 55 minor rivers share about 83 % of the drainage basin. About 210 billion m3 water is estimated to be available as ground water. Irrigation water is becoming a scarce commodity. Thus proper harvesting and efficient utilization of water is of great importance.

The constraints of low productivity in agriculture were realized and thus, central and state governments emphasized the need for accelerated development of agriculture. Adoption of high yielding varieties by farmers coupled with the use of higher doses of fertilizer and assured irrigation through tube wells accelerated the pace of progress in agriculture. As a result of adoption of improved inputs and management practices, the total food grain production increased from a mere million tonnes in 2005-06, to 212 million tonnes in 2006-07 and productivity increased from 522 kg/ha to more than 1707 kg/ha (Table 2). The productivity of wheat, rice and oilseeds increased to a greater extent than other crops. The increase in production of food grain was possible as a result of adoption of quality seeds, higher dose of fertilizer and plant protection chemicals, coupled with assured irrigation.

OBJECTIVE

- To study the Linear trend of Production of Crops .
- To study and compare all production of crops.
- To Forecast the Production of Crops for year 2019-2020 .
- To handling the different software .

(in million tonne's)

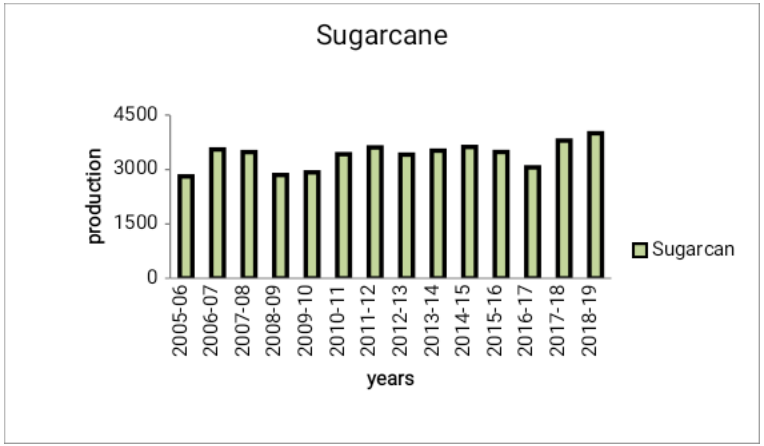
Data :

years	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Sugarcane	2811.72	3555.2	3481.88	2850.29	2923.02	3423.82	3610.37	3412	3521.42	3623.33	3484.48	3060.69	3799.05	4001.57
cotton	184.99	226.32	258.84	222.76	240.22	330	352	342.2	359.02	348.05	300.05	325.77	328.85	287.08
Cereals	195.22	203.08	216.01	219.9	203.45	226.25	242.2	238.78	245.79	234.87	235.22	251.98	259.6	261.55
Soyabean	82.74	88.51	109.68	99.05	99.64	127.36	122.14	146.66	118.61	103.74	85.7	131.59	109.33	137.86
Jute	99.7	103.17	102.2	96.34	112.3	100.09	107.36	103.4	110.83	106.18	99.4	104.32	95.91	93.49
Rice	91.79	93.36	96.69	99.18	89.09	95.98	105.3	105.23	106.65	105.48	104.41	109.7	112.76	116.42
Wheat	69.35	75.81	78.57	80.68	80.8	86.87	94.88	93.51	95.85	86.53	92.29	98.51	99.87	102.19
Mustord	81.31	74.38	58.34	72.01	66.08	81.79	66.04	80.29	78.77	62.82	67.97	79.17	84.3	93.39
Groundnut	79.93	48.64	91.83	71.68	54.28	82.65	69.65	46.95	97.14	74.02	67.33	74.62	92.53	66.95
Nutri	34.07	33.92	40.75	40.04	33.55	43.4	42.01	40.04	43.3	42.86	38.52	43.77	46.97	42.95
Maize	14.71	15.1	18.96	19.73	16.72	21.73	21.76	22.26	24.26	24.17	22.57	25.9	28.75	27.23
Nutri cereals	18.14	17.5	20.6	18.62	15.47	20.01	18.64	16.03	17.03	17.08	14.52	16.12	16.44	11.95
Castorseed	9.91	7.62	10.54	11.71	10.09	13.5	22.95	19.64	17.25	18.7	17.52	13.76	15.68	12.15
Bajara	7.68	8.42	9.97	8.89	6.51	10.37	10.28	8.74	9.25	9.18	8.07	9.73	9.21	8.61
Gram	5.6	6.33	5.75	7.06	7.48	8.22	7.7	8.83	9.53	7.33	7.06	9.38	11.38	10.13

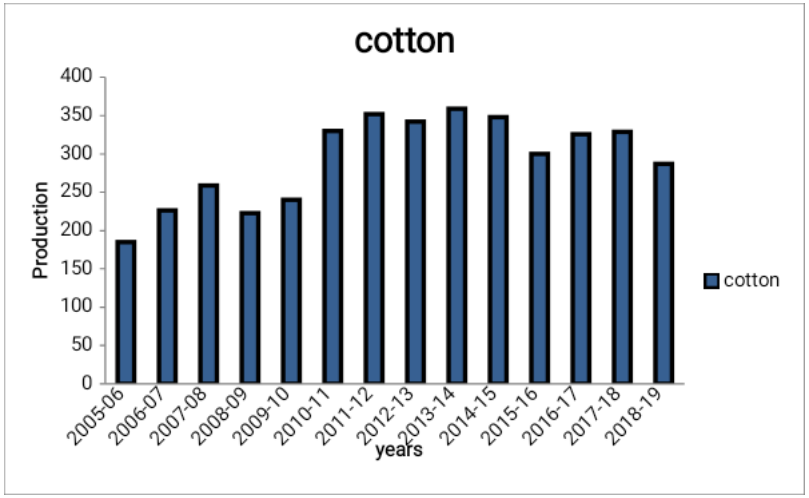
years	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Seasum	6.41	6.18	7.57	6.4	5.88	8.93	8.1	6.85	7.15	8.28	8.5	7.47	7.55	7.55
Sunflower	14.39	12.28	14.63	11.58	8.51	6.51	5.17	5.44	5.01	4.34	2.96	2.51	2.22	2.19
Mesta	8.7	9.56	9.9	7.31	5.87	6.11	6.63	5.9	6.07	5.08	5.83	5.3	4.43	4.19
Jowar	7.63	7.15	7.93	7.25	7.7	7	5.98	5.28	5.54	5.45	4.24	4.57	4.8	3.76
Tur	2.74	2.31	3.08	2.27	2.46	2.86	2.65	3.02	3.17	2.81	2.56	4.87	4.29	3.59
Urad	1.25	1.44	1.46	1.17	1.24	1.76	1.77	1.97	1.7	1.96	1.95	2.83	3.49	3.26
Ragi	2.35	1.44	2.15	2.04	1.89	2.19	1.93	1.57	1.98	2.06	1.82	1.39	1.22	0.37
Linseed	1.73	1.68	1.63	1.69	1.54	1.47	1.52	1.49	1.42	1.55	1.26	1.84	1.74	1.59
Barley	1.22	1.33	1.2	1.69	1.35	1.66	1.62	1.75	1.83	1.61	1.44	1.75	1.78	1.75
Moong	0.95	1.12	1.52	1.03	0.69	1.8	1.63	1.19	1.61	1.5	1.59	2.17	2.02	2.35
Safflower	2.29	2.4	2.25	1.89	1.79	1.5	1.45	1.09	1.13	0.9	0.53	0.94	0.55	0.24
Lentil	0.95	0.91	0.81	0.95	1.03	0.94	1.06	1.13	1.02	1.04	0.98	1.22	1.62	1.56
Nigerseed	1.08	1.21	1.1	1.17	1	1.08	0.98	1.01	0.98	0.76	0.74	0.85	0.7	0.65
Small millets	0.47	0.48	0.55	0.44	0.38	0.44	0.45	0.44	0.43	0.39	0.39	0.44	0.44	0.37

Graphical representation :

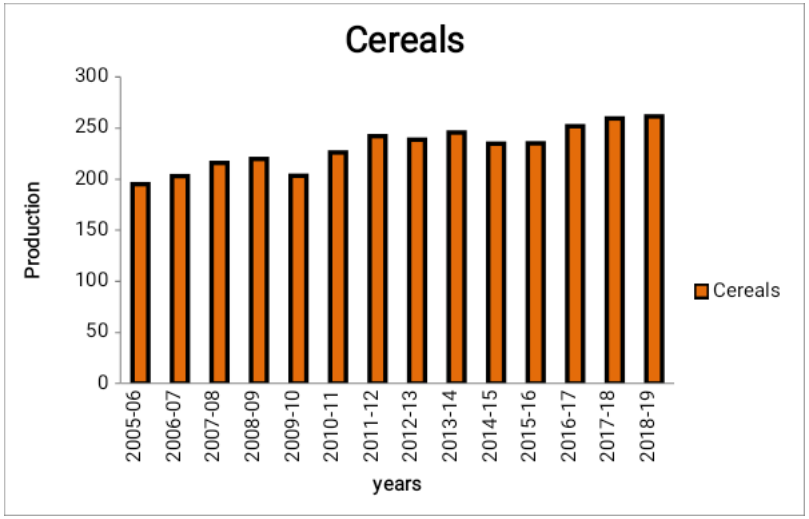
Graphical representation is another way of analysing numerical data. A graph is a sort of chart through which statistical data are representation in the form of lines or curve drawn across the coordinated point plotted on its surface.



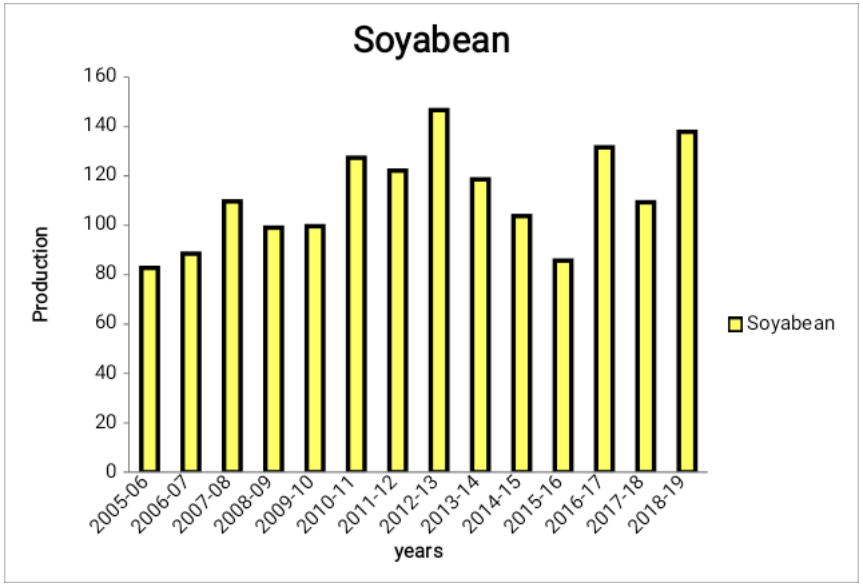
From the above graph we observe that production of crop sugarcane is approximately same for all the years. It increases linearly from 2012-13 except for the year 2016-17.



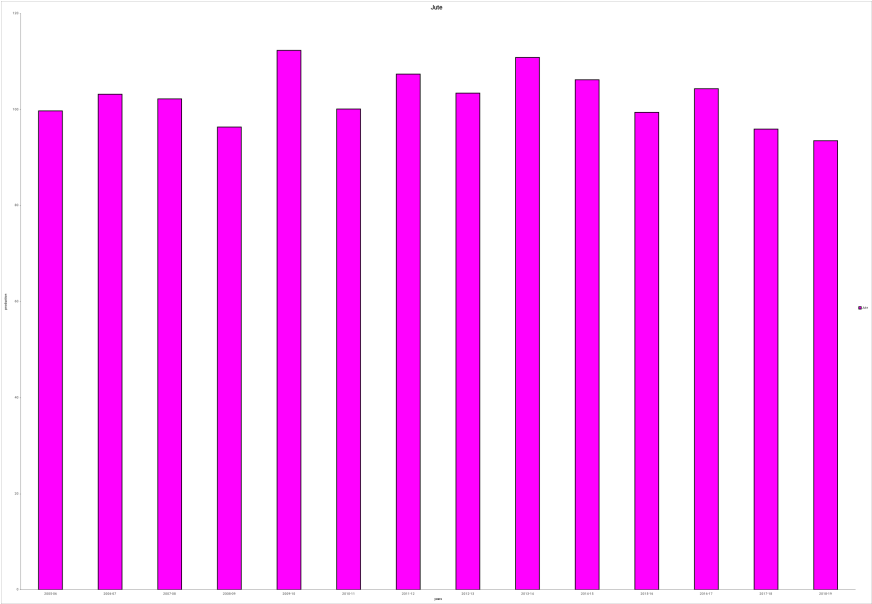
From the above graph we observe that production of cotton is maximum from years 2010-11 to 2014-15 and it is at average level for other years.



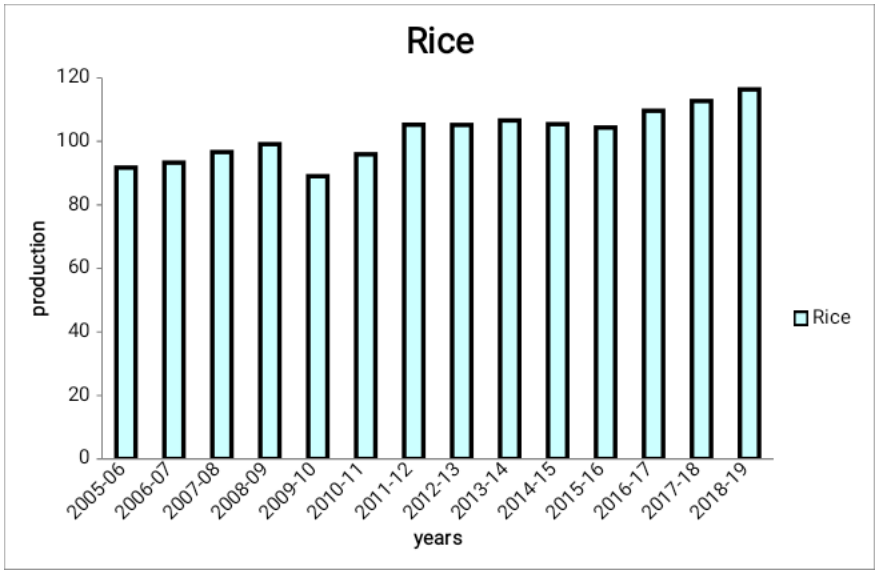
From the above graph we observe that there is a slightly increasing trend in production of cereals.



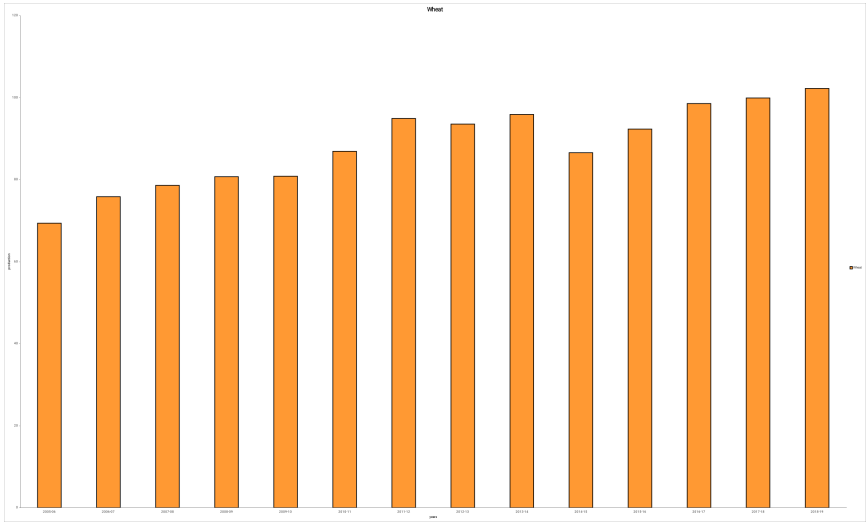
From the above graph we observe that there is a great fluctuation in the production of soyabean.



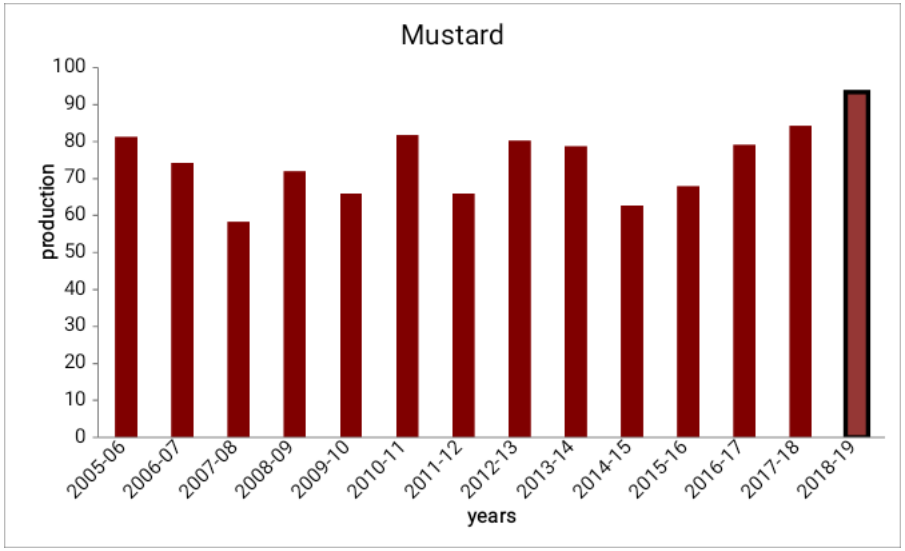
From the above graph there is a slight variation seen in the production of jute in all the years.



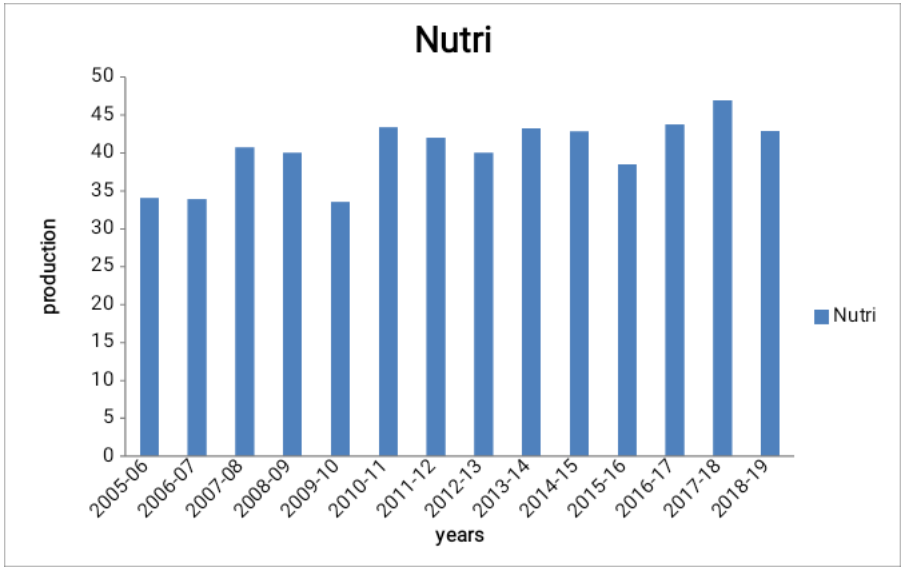
From the above graph there is a slight variation seen in the production of Rice in all the years.



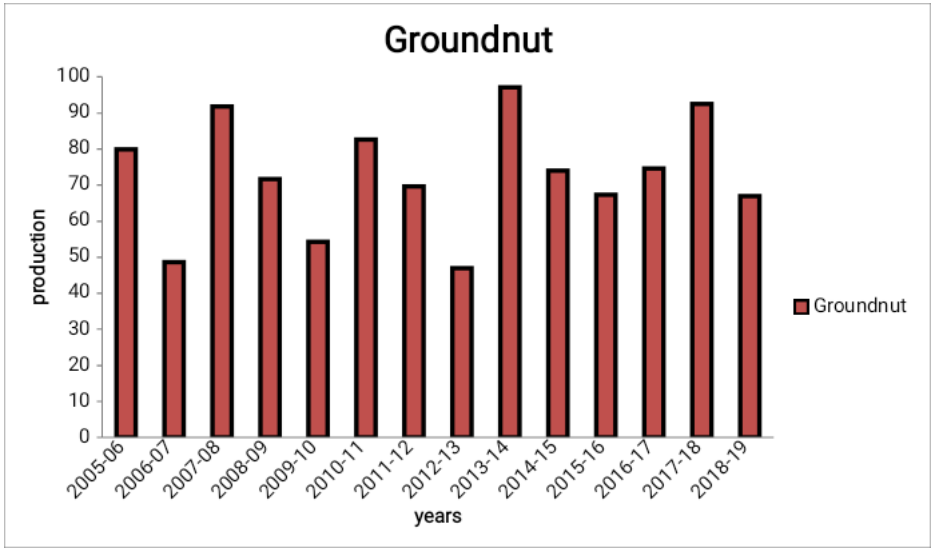
From the above graph we can see that there iss a slight increase in the production of wheat



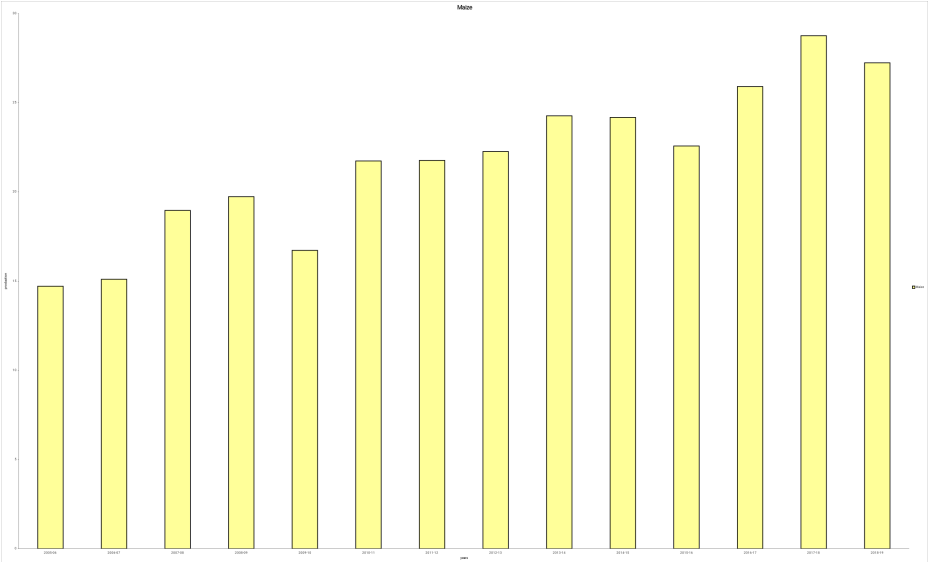
From the above graph we can observe that there is a great variation seen from years 2005-6 to 2013-14 and there is a continuous increasing trend from years 2014-15



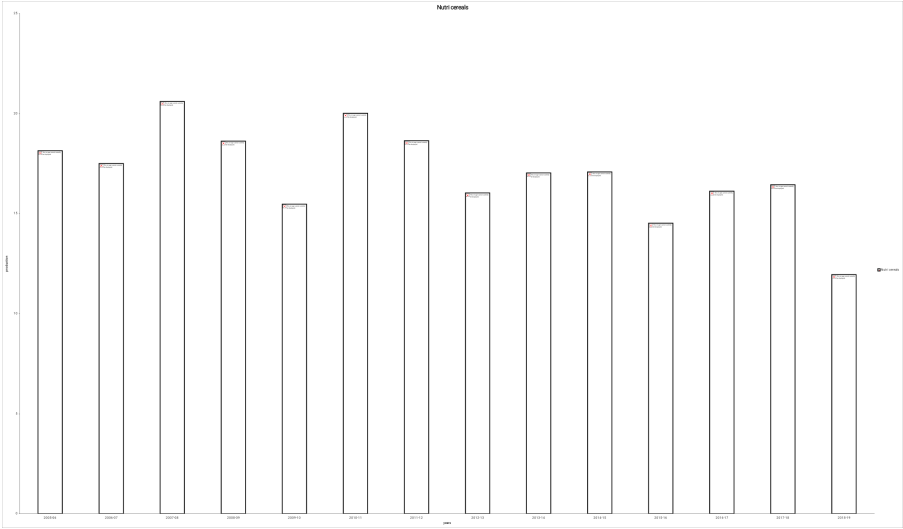
From the above graph we can conclude that there is a slight variation seen in the production of nutri in all the years.



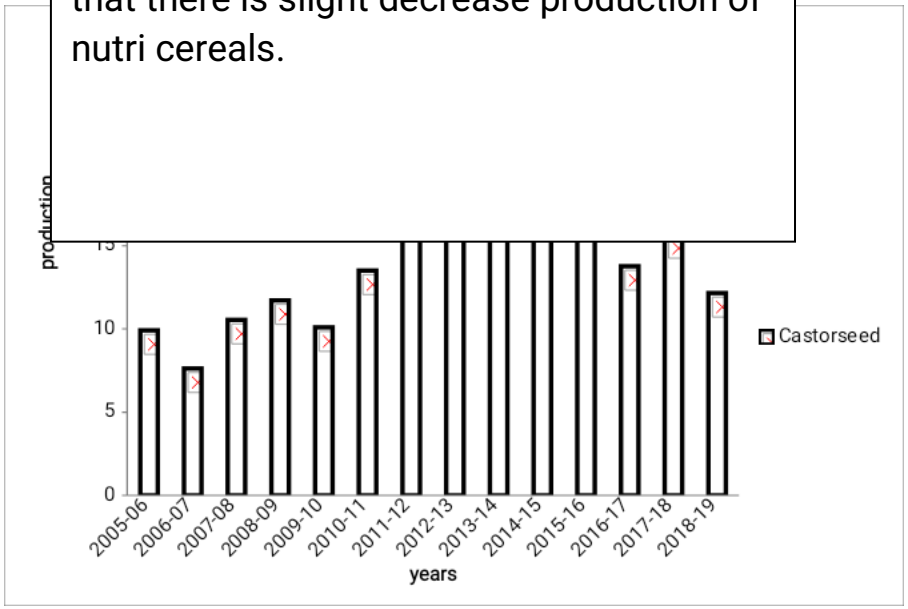
From the above graph we can conclude that there is a great variation in production of groundnut.



From the above graph we can conclude that there is a slight increase production of Maize.



From the above graph we can conclude that there is slight decrease production of nutri cereals.



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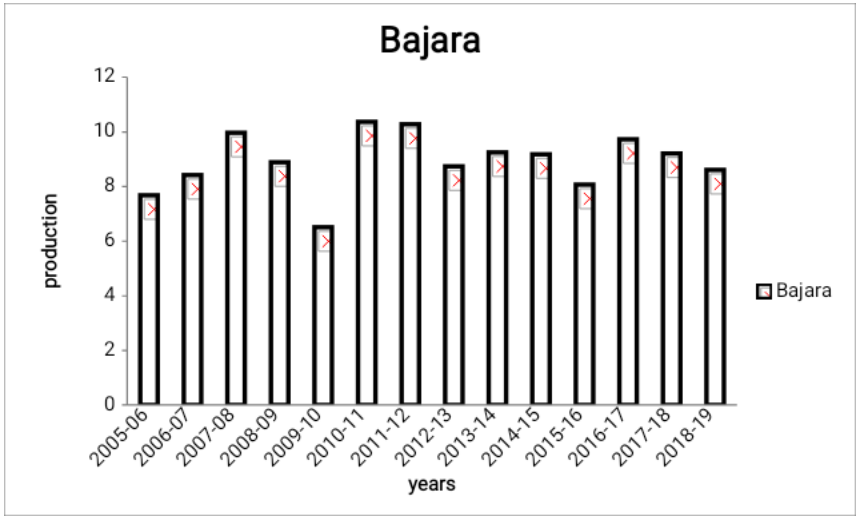
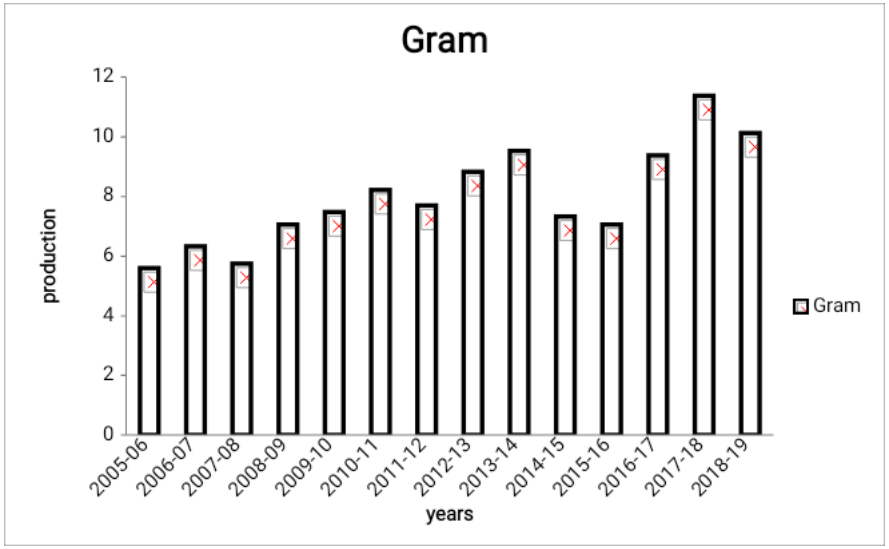


From the above graph we can observe that the production of bajara do not show much variation except for year 2009-10 when there is a major drop.



From the above graph we can conclude that there is a continuously increasing trend except for years 2014-16 where there is a major drop.

Pie Chart :

We draw pie chart by usig R-software . The R command required is as follow –

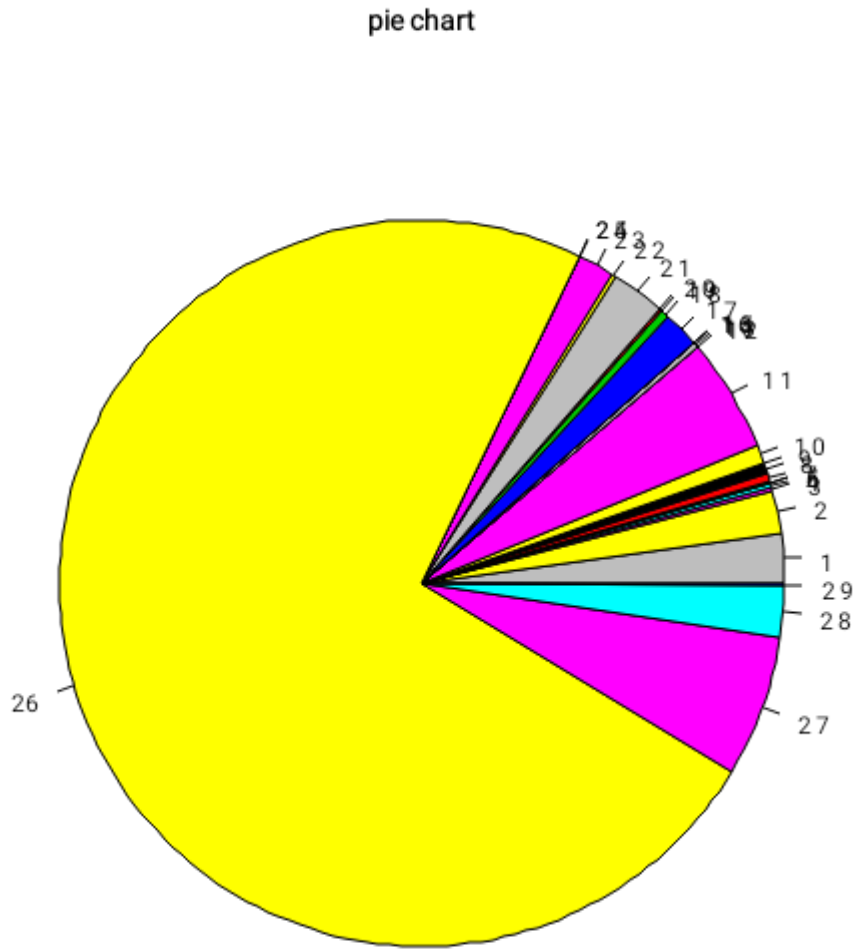
R-command :

```
> x=scan("clipboard");x
Read 29 items
 [1]  102.2885714   88.2650000    6.0200000    8.9221429    1.7428571
 [6]    0.4364286   17.0107143   21.7035714    1.5700000   40.4392857
[11]  230.9928571    3.0485714    7.9842857    1.9464286    1.5121429
```

```
[16]   1.0871429   72.7285714   14.3585714    7.3442857    0.9507143
[21]  111.6150000    6.9814286   74.7614286    1.5821429    1.3535714
[26] 3397.0600000  293.2964286  102.4778571    6.4914286

> y=seq(1:29);y
 [1]  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] 26 27 28 29

> pie(x,main="pie chart",col=16:05,name.arg=y)
```


pie chart
11
2
1
29
28
27
26

Time Series :

A time series is a series of data points indexed in time order. Most commonly,a time series is a sequence taken at successive equally spaced points in time. Thus it is a sequence of discrete-time data.

The techniques / methods in time series :

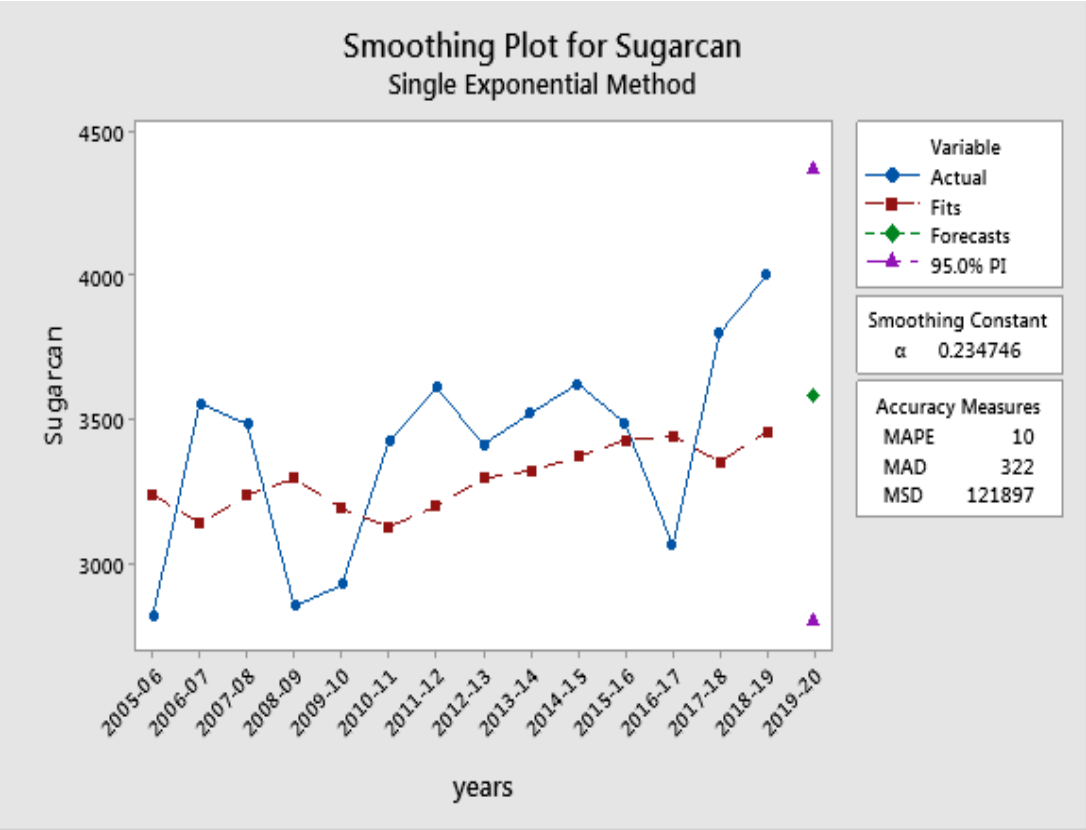
1) Graphical method
2) Method of moving average
3) Least square
4) Exponential method
5) Double exponential method

Exponential smoothing :

It is a technique used for smoothing time series data .It is an easily learned and easily applied procedure for making some determination based on previous observations.

Forecasts

Period	Forecast	Lower	Upper
15	3584.84	2795.36	4374.33

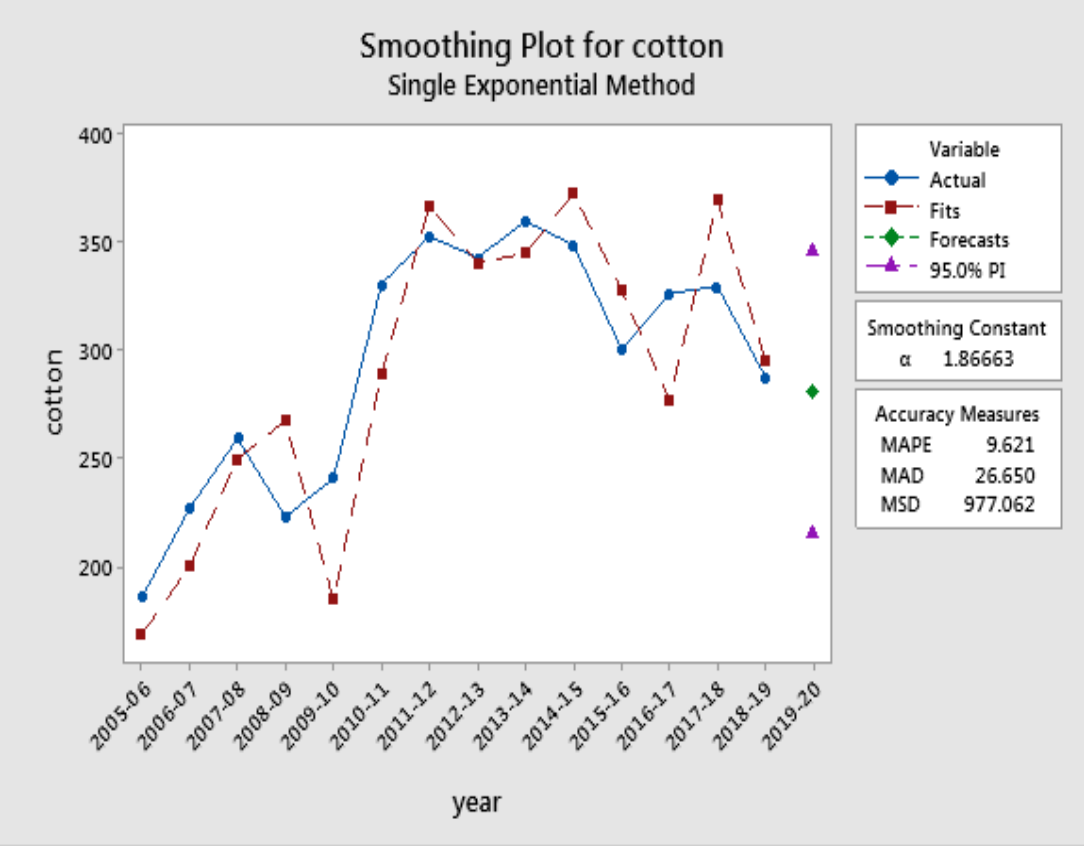


From the above graph we conclude the forecasted value for year 2019-20 of sugarcane will be **3584.84 million tonne.**

Forecasts cotton

Period	Forecast	Lower	Upper
15	280.723	215.43	346.01

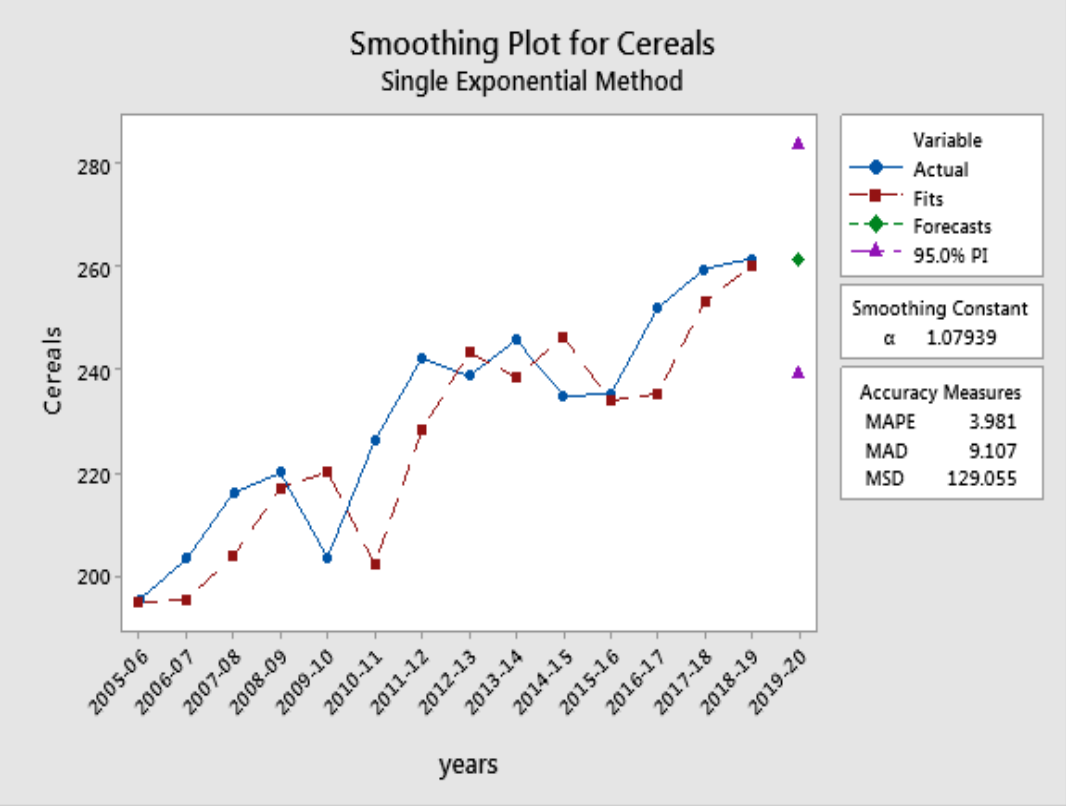
2 5



From the above graph we conclude the forecasted value for year 2019-20 of sugarcane will be **280.723 million tonne.**

Forecasts cereals

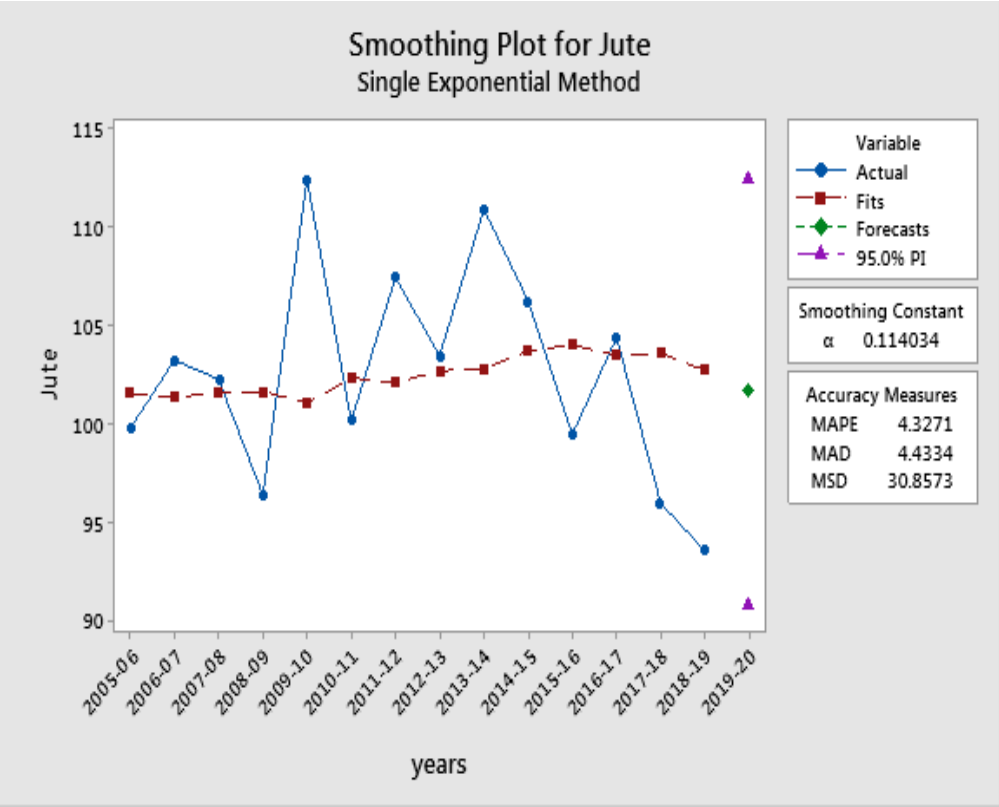
Period	Forecast	Lower	Upper
15	261.665	239.352	283.978



From the above graph we conclude the forecasted value for year 2019-20 of sugarcane will be **261.665 million tonne.**

Forecasts jute

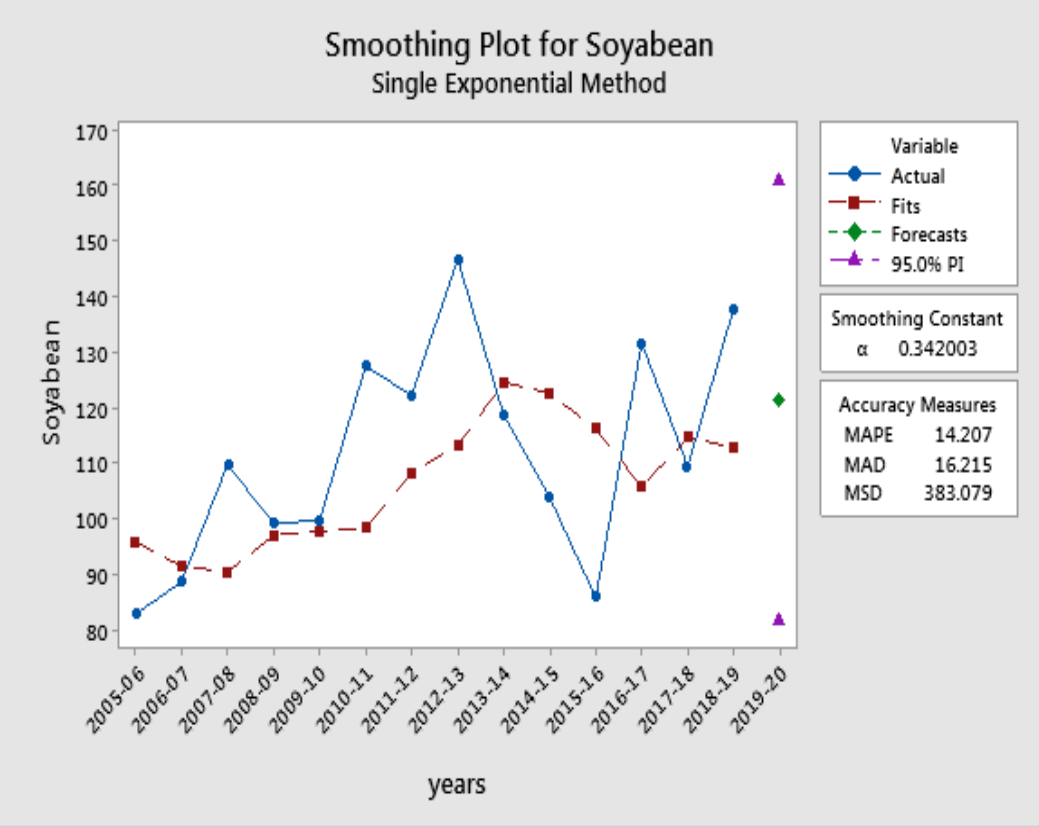
Period	Forecast	Lower	Upper
15	101.608	90.7466	112.470



From the above graph we conclude the forecasted value for year 2019-20 of jute will be **101.608 million tonne.**

Forecast soyabean

Period	Forecast	Lower	Upper
15	121.347	81.6200	161.074



From the above graph we conclude the forecasted value for year 2019-20 of soyabean will be **121.347 million tonne.**

FUTURE PREDICTION :

The other forecast values for the year 2019-20 of different crops are represent as follows :

crops	sugarcane	cotton	cereals	soyabean	jute	rice	wheat	mustered	Ground.n	nutric	maize	Nutric cereal
Predicted	3584.84	28.723	261.665	121.347	101.608	116.526	102.391	76.5384	74.3456	43.4044	27.3959	14.79449

crops	Castorseeds	bajra	gram	seasum	sunflower	mesta	jawar	tur	urad	ragi
Predicted	12.7816	9.05305	10.1135	705218	2.19174	4.17166	3.8897	3.7641	3.1993	0.672

crops	linseed	barley	mug	safflower	lentin	nigerseed	smallmillet
Predicted	1.589	1.7287	2.1276	0.2385	1.4471	0.6767	0.4103

Descriptive statistics :

In this we calculate the number of count ,their sum , average and variance with respect to row as well as column (i.e for yearly and cropwise).

Average = sum of all observations **/** number of observations

Variance =(sum of square of all observations /number of observation)- $(\text{average})^2$

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
Row 1	14	52.16	3.725714	16.55724
Row 2	14	49.49	3.535	13.85933
Row 3	14	55.78	3.984286	18.4517
Row 4	14	46.88	3.348571	11.35135
Row 5	14	41.33	2.952143	7.690018
Row 6	14	44.25	3.160714	7.486069
Row 7	14	40.94	2.924286	6.015149
Row 8	14	38.13	2.723571	4.707563
Row 9	14	39.04	2.788571	4.859429
Row 10	14	37.73	2.695	5.159058
Row 11	14	34.79	2.485	5.255673
Row 12	14	38.15	2.725	4.247704
Row 13	14	36.85	2.632143	4.120064
Row 14	14	33.42	2.387143	3.963868
Column 1	14	102.82	7.344286	0.845734
Column 2	14	97.74	6.981429	20.26797
Column 3	14	90.88	6.491429	3.158136
Column 4	14	84.28	6.02	1.9834
Column 5	14	42.68	3.048571	0.557829
Column 6	14	27.25	1.946429	0.545855
Column 7	14	24.4	1.742857	0.265099
Column 8	14	22.15	1.582143	0.022664
Column 9	14	21.98	1.57	0.047523
Column 10	14	21.17	1.512143	0.229787
Column 11	14	18.95	1.353571	0.488055
Column 12	14	15.22	1.087143	0.05513
Column 13	14	13.31	0.950714	0.03253
Column 14	14	6.11	0.436429	0.002163

Analysis of variance (ANOVA) :

It's is a technique to compare mean of more than two samples at a time. It is a collection of statistical models used to analyze the differences between group means and their associated procedures .

ANOVA has three main types –

1) CRD(completely randomized design)
2) RBD(randomized block design)
3) LSD(least square design)
4) Factorial design

Here we fit randomized block design since we have two factors into consideration. We have two main factor in our data that is years and different crops . we consider row as years and columns as crops in equal number (number of rows =number of columns) .

We construct RBD with the help of MS-EXCEL the result obtain is as follow,

Hypotheses:

1) H_{01}: Average production for each year is significant.

VS

H_{11}: Average production for each year is insignificant.

2) H_{02}: Average production of individual crop is significant.

VS

H_{12}: Average production of individual crop is insignificant.

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	42.03695	13	3.233611	1.663626	0.072889	1.778459
Columns	1149.928	13	88.45596	45.50877	2.72E-48	1.778459
Error	328.4874	169	1.943712			
Total	1520.452	195				

From above table we observe that

$(F_R)_{calculate}$ =1.6636 $(F_R)_{table}$ =1.7784

$(F_c)_{calculate}$=45.5088 $(F_c)_{table}$=1.7784

Decision rule :

If $(F)_{calculate} > (F)_{table}$, then we reject H_0 at α % level of significance, accept otherwise.

For row, $(F_R)_{calculate} < (F_R)_{table}$, we accept H_0 at 5 % level of significance .

For column, $(F_c)_{calculate} > (F_c)_{table}$, we reject H_0 at 5 % level of significance .

Conclusion:

1) Average production for each year is significant.
2) Average production of individual crop is insignificant

CONCLUSION

- We conclude that the total production of an agriculture crop increases chronologically. This happens due to increase in human population and their requirement of feeds such as grains, vegetables etc.

- The production of all crops for year 2005-06 is 3839.02M.T and that of for year 2018-19 is 5306.94M.T, so the total production within 13 years is increased by 1467.92M.T.

- The production of year 2019-2020 will increase.
- Future forecasting helps government agencies to maintain their managements, so our future forecasted values are helpful for it.
- It is observe that the production of sugarcane increases largely and corresponding production of nutri goes on

decreasing.

- Average production for all years are significant.
- Average production of individual crop is insignificant.

References

- Fundamental of applied statistics.
- Fundamental of applied mathematical and statistics.

- Software – MS-EXCEL , R-SOFTWARE ,MINI TAB,
- Agriculture wealfare department.

THANK YOU