

AN ANALYSIS ON TRENDS IN SUGARCANE, SUGAR AND JAGGERY PRODUCTION IN KARNATAKA STATE AND MANDYA DISTRICT

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ABSTRACT

Sugarcane is important commercial crop of Karnataka. Sugarcane plays a vital role for the overall socio-economic development of farming community in Karnataka State and Mandya District. Karnataka is one of the leading producers of sugarcane in India. Mandya district has been selected as study area. The main objective of present research work is to examine the trends of sugarcane, Sugar and Jaggery production in Karnataka state and Mandya district. The present research study is based on secondary data for the period covering from 2001-02 to 2018-19. The study reveals that the area under Sugarcane and yield in Karnataka has significantly increased during the study period. However, the area under sugarcane and yield in Mandya district has declined. It is found that the production of Sugarcane shown a positive growth of 3.02 percent in Karnataka, but it has negative growth of 0.24 percent in Mandya District. The value of output of Sugar in Karnataka has positive growth of 15.87 percent over the study period. But in Mandya district the production of Sugar has negative growth by 3.86 percent. Further, it revealed that the value of output of Jaggery in Karnataka is increased by 1.10 percent whereas in Mandya district it has negative growth by 3.48 percent during the study period.

Key Words: Sugarcane, Sugar and Jaggery.

1. Introduction

The production of Sugarcane, Sugar and Jaggery are playing vital role in Karnataka economy by employing large numbers of labour and contributing to the livelihood of people. However,

Sugarcane producing farmers are facing issues like low productivity, scarcity of labour during peak harvesting time and lack of mechanization in harvesting and loading of sugarcane. Due to these problems sugar industry incurs loss directly and farmers indirectly. A competitive balance of sugar and jaggery production, marketing and consumption will be an ideal option to resolve above mentioned issues. Therefore, if farmers start preparing jaggery or start supplying sugarcane for preparation of jaggery these issues can be reduced to some extent. Since preparation of jaggery is less expensive and has higher returns than sugar (Dwivedi Amit Kumar and Mishra Amodkant, 2009)¹, jaggery production is gaining more importance. Due to the changes in the consumption habits, the people have been showing interest in consumption of jaggery than sugar in recent years (Dwivedi Amit Kumar and Mishra Amodkant, 2009).

The temporal fluctuations were observed in sugarcane prices, factory supplies of sugarcane, sugar prices and sugarcane production in Karnataka state. The fluctuations were due to cyclical nature of sugarcane production which happens once in 2-3 years (Patil Ganesh Gouda, Mahajanashetti S B and Patil Somanagowda, 2016)².

2. Objectives of the Study

The main objectives of the study are

- To analyze the trends in Sugarcane, Sugar and Jaggery production in Karnataka State.
- To examine the trends in Sugarcane, Sugar and Jaggery production in Mandya District.

3. Hypotheses of the Study

- There is a significant difference in the area under sugarcane, production of sugarcane and sugarcane yield between northern and southern Karnataka.
- There is a significant increase in Sugarcane, Sugar and Jaggery production in Karnataka and Mandya district.

¹Dwivedi Amit Kumar and Mishra Amodkant, (2009), "A Study on Gur (Jaggery) Industry in India", [http://www.panelamonitor.org/media/docrepo/document/files/a-study-on-gur-\(jaggery\)-industry-in-india-\(research-outline\).pdf](http://www.panelamonitor.org/media/docrepo/document/files/a-study-on-gur-(jaggery)-industry-in-india-(research-outline).pdf)

²Patil Ganesh Gouda, Mahajanashetti S B and Patil Somanagowda, (2016) "Trend and Fuctional Analysis of sugarcane and sugar in Karnataka", *International journal of Agriculture sciences*, Vol 8 issue 61, 2016, pp 3423-3427.

4. Methodology

The study is based on secondary data for the period covering from 2001-02 to 2018-19. The secondary sources of data collected from Directorate of Economics and Statistics, Department of Agriculture, Govt. of India, MOSPI, Zonal Agricultural Research Station, VC Farm Mandya, Mandya District at a glance 2019-20 and APMC Mandya. The econometric and Statistical tools such as Log-Lin model, Independent Sample t Test, averages, charts, graphs and tables have been used to draw meaningful inferences.

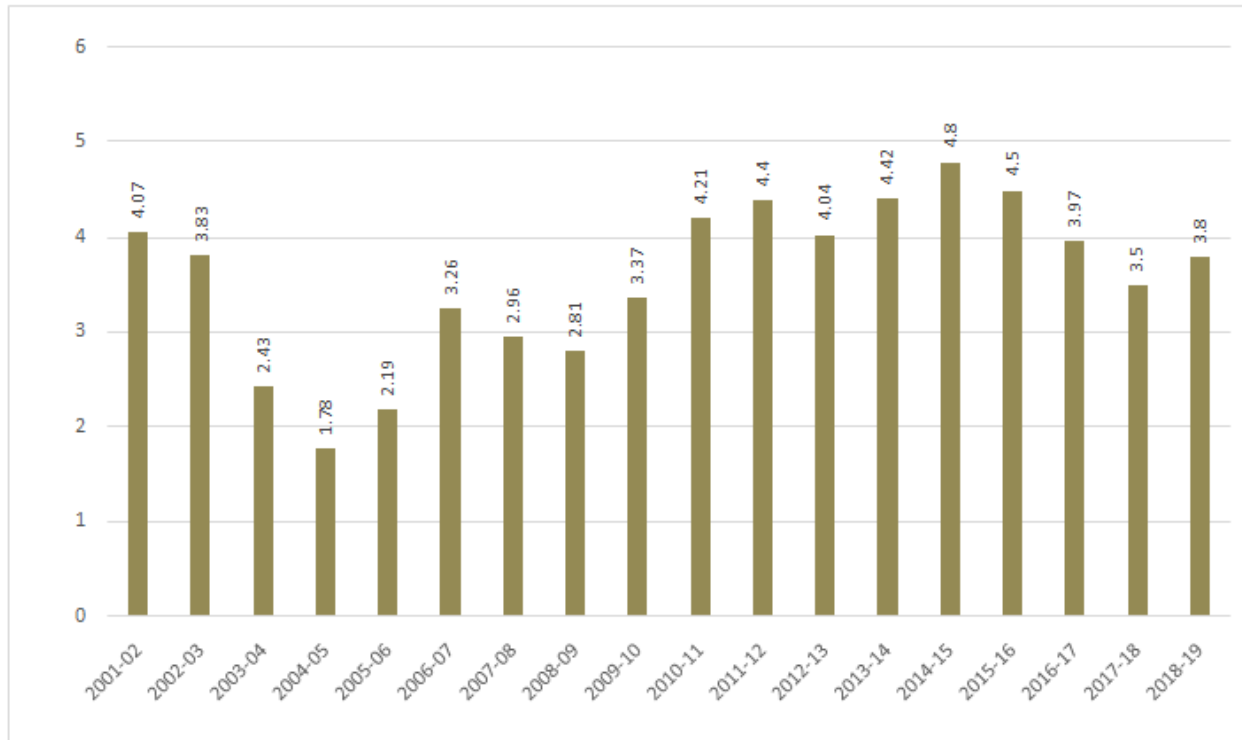
5. Results and Discussion

Keeping in view the objectives of the study, this section discusses the results of the study pertaining to the trends and pattern of sugarcane, sugar and Jaggery in Karnataka and Mandya.

5.1. Area Under Sugarcane, Production and Yield in Karnataka

Karnataka stands 3rd in Sugarcane production next to Uttar Pradesh in India and Maharashtra 2nd with respect to sugar recovery after Maharashtra. Sugarcane is grown in 16 districts of the state. Belgaum, Bagalkot, Bijapur, Mandya, Mysore, Chamrajnagar and Bidar are the major sugarcane producing districts. Karnataka is bestowed with favourable agro-climatic conditions duly supplemented with suitable soils for sugarcane cultivation. There are number of rivers with dams, reservoirs, bore-wells and open-wells to supply water for sugarcane cultivation. The following headings provides information about sugarcane in Karnataka.

Figure1:Area under Sugarcane in Karnataka(Lakh hectare)



Source: VC Form Mandya [Zonal Agricultural Research Station, Mandya (ZARSM)]

The figure 1 exhibits the area under Sugarcane in Karnataka. It shows the area under Sugarcane from 2001-02 to 2018-19. In 2001-02 the area under Sugarcane was 4.07 lakh hectares. Then it increased to 4.80 lakh hectares in 2014-15. Then it started to decrease from 2015-16 and finally reached to 3.8 lakh hectares in 2018-19.

Table1: Results of Growth Model of Area under Sugarcane in Karnataka

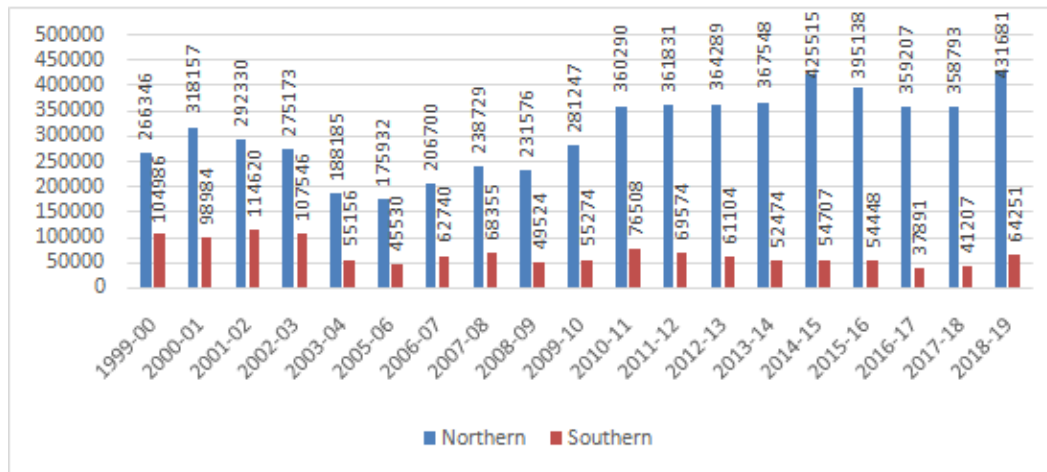
Variable	Coefficient	Std. Error	t-ratio	p-value
constant	0.983059	0.117250	8.384	0.0001***
time	0.0272254	0.0108321	2.513	0.0230**

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance
 ** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

The growth of area under Sugarcane in Karnataka is presented in the table 1 for the period from 2001-02 to 2018-19. It is found that the area under Sugarcane has positive growth of 2.72 percent over the study period. The growth is statistically significant at 5 percent level of significance.

Figure 2: Area under Sugarcane in Northern and Southern Karnataka (Hectare)



Source: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The region wise area under Sugarcane in Karnataka has been reported in the figure 2. It is observed that the area under Sugarcane in Northern districts is very high compare to Southern districts during the study period due to large number of sugar factories located in the region. In the year 1999-2000 area under Sugarcane in Northern districts was 266346 hectares and Southern districts has only 104986 hectares during the same period. It is increased to 431681 hectares in Northern districts and decreased to 64251 hectares in Southern districts during 2018-19. The area under Sugarcane in Southern districts is only 14.88 percent of area under Sugarcane in Northern districts during 2018-19.

Table 2: Results of Growth model of Area under Sugarcane in Northern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	12.2806	0.0972276	126.3	0.0001***
time	0.0331945	0.00852742	3.893	0.0012***

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

Table 3: Results of Growth model of Area under Sugarcane in Southern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	11.4547	0.115693	99.01	0.0001***
time	-0.0392009	0.0101469	-3.863	0.0012***

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The results from table 2 and 3 depict the growth rate of area under Sugarcane in Northern and Southern districts of Karnataka. The growth rate of area under Sugarcane in Northern districts is positive by an amount of 3.31 percent but Southern districts have negative growth by an amount of 3.92 percent. This clearly shows that the growth rate is high in Northern districts than Southern districts.

Table 4: Results of Independent Samples Test of area under Sugarcane between Northern and Southern Districts

Group	N	Mean	Std. Deviation	Std. Error Mean
Northern district	19	310456.1579	78425.18762	17991.97197
Southern district	19	67098.8947	23109.80909	5301.75381

Table 5: Results of Independent Samples ‘t’ Test

Mean Difference	Std. Error Difference	Degree of Freedom	t value	Significance
243357.26316	18756.85605	21.103	12.974	0.000***

Source: Values Computed by Researcher.

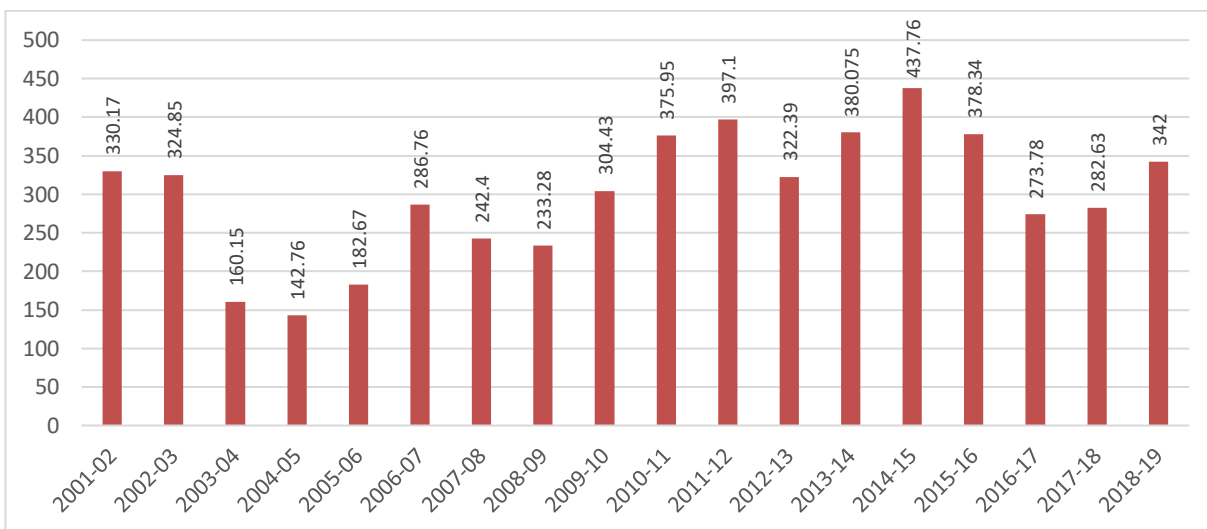
Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The table 4 and 5 shows the results of independent sample t test for area under Sugarcane between Northern and Southern Districts in Karnataka. The average value of area under Sugarcane in Northern districts is 310456.15 hectares whereas Southern districts has only 67098.89 hectares. The calculate value of 't' is 12.97 and the 'p' value is 0.0001. Which indicates that there is significance difference in area under sugarcane between Northern and Southern districts and it is statistically significance at 1 percent level of significance. Hence the hypothesis is accepted.

Figure 3: Sugarcane Production in Karnataka (Lakh tonnes)



Source: VC Form Mandya Zonal Agricultural Research Station, Mandya (ZARSM)

The Sugarcane production in Karnataka is reported in the figure 3 for the period from 2001-02 to 2018-19. Starting with the sugarcane production of 330.17 lakh tonnes during 2001-02 the production of sugarcane increased to 437.76 lakh tonnes during 2014-15 and it is 342 lakh tonnes in 2018-19. But it is reported that production of Sugarcane has reduced during 2003-04, 2004-05, 2007-08, 2008-09, 2016-17 and 2017-18. Hence it can be concluded that the production of Sugarcane in Karnataka is highly fluctuating.

Table 6: Results of Growth model of Sugarcane Production in Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	5.37337	0.137913	38.96	0.0001***
time	0.0302089	0.0127409	2.371	0.0306**

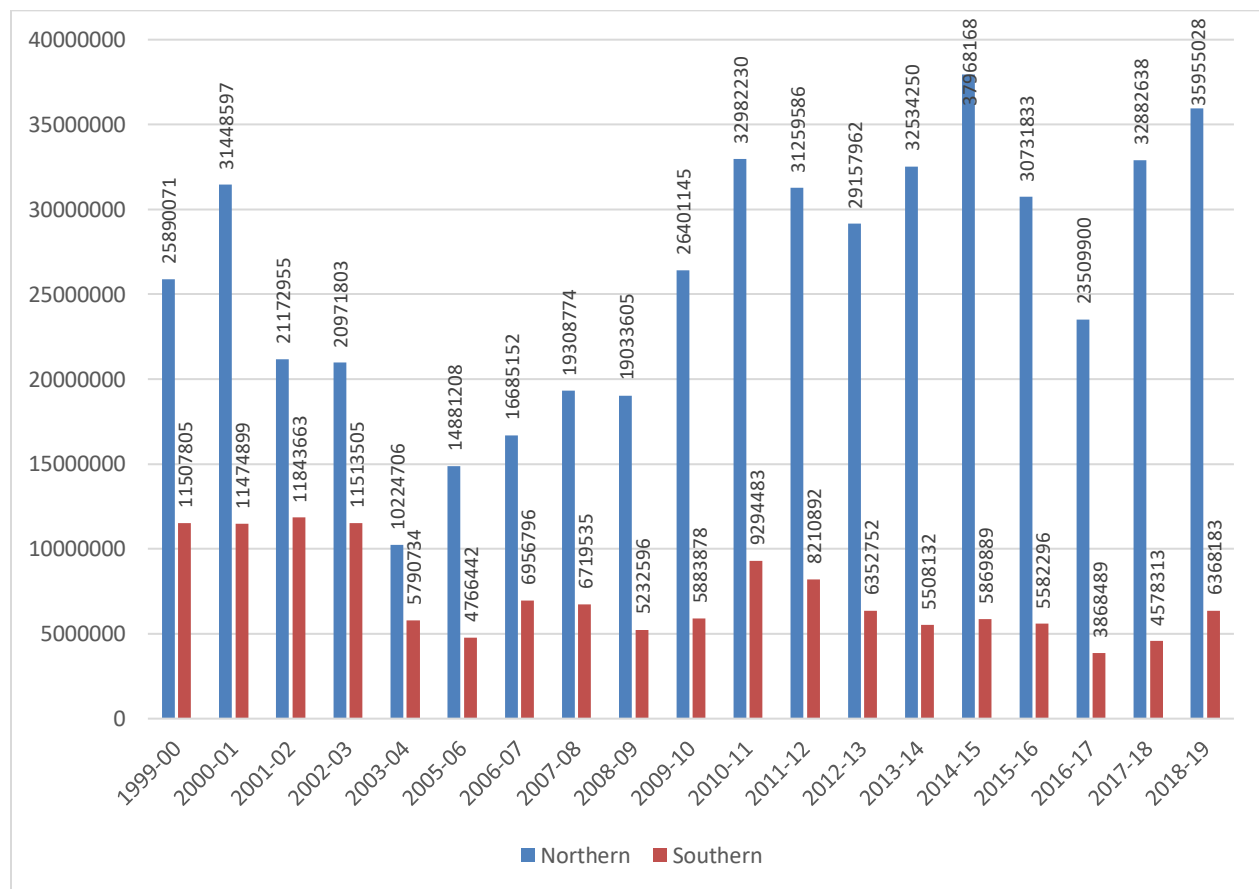
Source: Values Computed by Researcher using data from VC Form Mandya.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

The growth of production of Sugarcane in Karnataka is presented in table 6 for the period 2001-02 to 2018-19. It is found that the production of Sugarcane has shown a positive growth of 3.02 percent during the study period 2001-02 to 2018-19 which is significant at 5percentlevel of significance.

Figure 4:Sugarcane Production in Northern and Southern Karnataka(Tonnes)



Source: Directorate of Economics and Statistics, Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The region wise production of Sugarcane in Karnataka has been reported the figure 4. It is observed that the production of Sugarcane in Northern districts is very high compare to Southern districts during the study period due to large area under production in the region. In the year

1999-2000 production of Sugarcane in Northern districts is 2,58,90,071 tonnes and Southern districts has only 1,15,07,805 tonnes during the same period. It is increased to 3,59,55,028 tonnes in Northern districts, but in Southern districts it is decreased to 63,68,183 tonnes during 2018-19. The area under Sugarcane in Southern districts is only 14.88 percent of area under Sugarcane in Northern districts during 2018-19. The production of Sugarcane in Southern districts is only 17.71 percent of production of Sugarcane in Northern districts during 2018-19.

Table 7: Results of Growth model of Sugarcane Production in Northern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	16.6840	0.141160	118.2	0.0001***
time	0.0337095	0.0123806	2.723	0.0145**

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

Table 8: Results of Growth model of Sugarcane Production in Southern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	16.1485	0.123151	131.1	0.0001***
time	-0.0412330	0.0108011	-3.817	0.0014***

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The results from table 7 and 8 depicts the growth rate of production of Sugarcane in Northern and Southern districts of Karnataka. The Northern districts have positive growth rate of production of Sugarcane of 3.37 percent but in Southern districts the growth rate is negative (-4.12 percent). This clearly shows that the growth rate of sugarcane production is high in Northern districts than Southern districts. The growth is statistically significant at 1 percent level of significance.

Table 9: Results of Independent Samples ‘t’ Test for Sugarcane Production between Northern and Southern Districts

	group	N	Mean	Std. Deviation	Std. Error Mean
district	Northern	19	25947347.9474	7739985.51559	1775674.45721
	Southern	19	7227541.1579	2612234.54916	599287.70614

Table 10: Results of Independent Samples Test

Mean Difference	Std. Error Difference	Degree of Freedom	t value	Significance
18719806.78947	1874077.24833	22.048	9.989	0.000***

Source: Values Computed by Researcher.

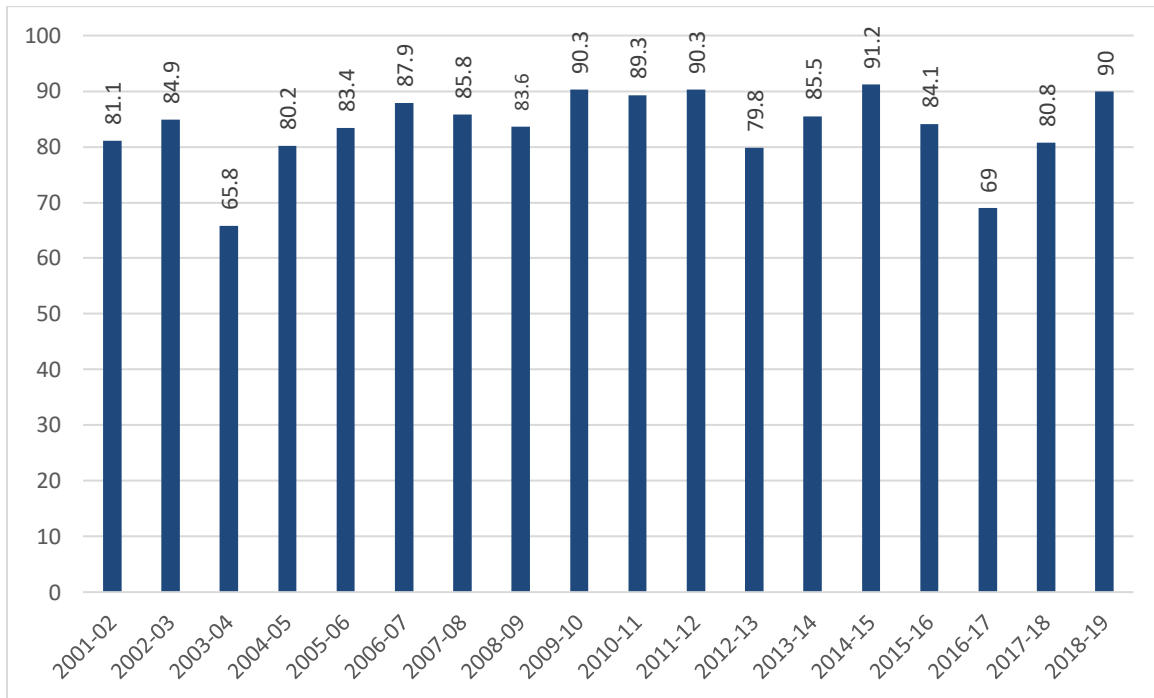
Note: *** Indicates 1% Level of Significance

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* Indicates 10% Level of Significance

The table 9 and 10 shows the results of independent sample test for Sugarcane production between Northern and Southern Districts in Karnataka. The result is statistically significant at 1 percent level of significance. Hence it can be concluded that there is a significant difference in the Sugarcane production between Northern and Southern districts. The average value of Sugarcane production in Northern districts is 2,59,47,347.94 tonnes whereas Southern districts has only 72,27,541.15 tonnes.

Figure5: Sugarcane yield in Karnataka (Lakh tonne)(tonne/hectare)



Source: VC Form Mandya- Zonal Agricultural Research Station, Mandya (ZARSM)

The figure 5 presents the trends in Sugarcane yield in Karnataka. The trends shows that yield is more or less stable during the study period. Further it is found that during 2003-04, 2012-13 and 2016-17 the yield of Sugarcane in Karnataka was slightly low.

Table 11: Results of Growth model of Sugarcane Yield in Karnataka

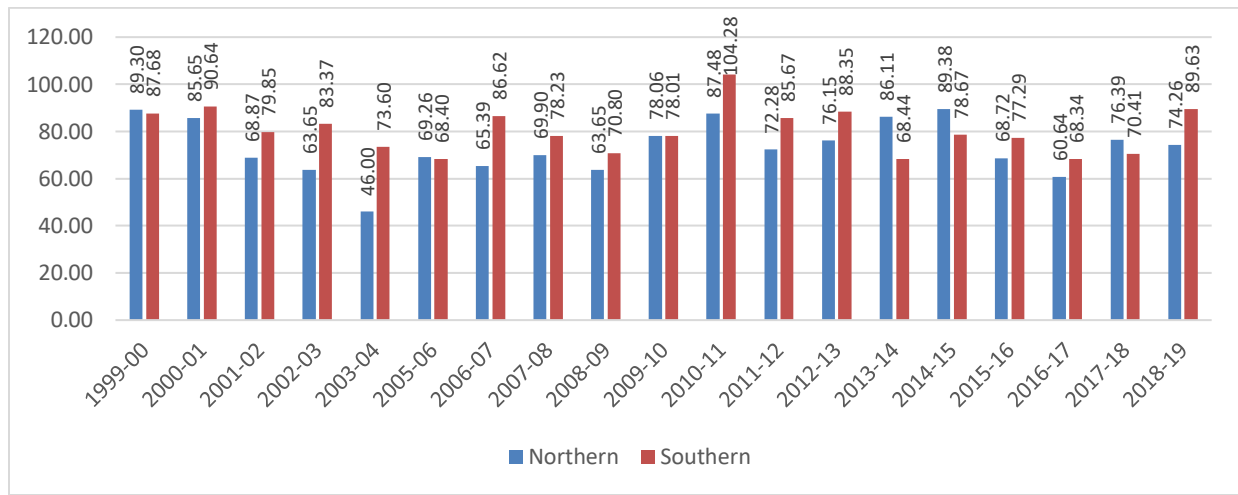
Variable	Coefficient	Std. Error	t-ratio	p-value
constant	4.39546	0.0442192	99.40	0.0001***
time	0.00272021	0.00408515	0.6659	0.5150

Source: Values Computed by Researcher using data from VC Form Mandya.

Note: *** Indicates 1% Level of Significance
 ** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

The growth of Sugarcane yield in Karnataka is reported in the table 11 for the period from 2001-02 to 2018-19. It has positive growth of 0.27 percent during the study period, but the result is statistically insignificant. The result showed that the yield of Sugarcane is almost insignificant.

Figure 6: Sugarcane Yield in Northern and Southern Karnataka (Tonnes/Hectare)



Source: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The region wise Sugarcane yield in Karnataka has been reported the figure 6. It is observed that the Sugarcane yield in Northern districts is high compare to Southern districts during 1999-2000. In the year 1999-2000 Sugarcane yield in Northern districts is 89.30 tonnes per hectare and Southern districts has 87.68 tonnes per hectare during the same period. It is decreased to 87.48 tonnes in Northern districts and increased to 104.28 tonnes in Southern districts during 2010-11, again it is decreased to 74.26 tonnes in Northern districts and 89.63 tonnes in Southern districts during 2018-19.

Table 12: Results of Growth model of Sugarcane Yield in Northern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	4.24570	0.0799356	53.11	0.0001***
time	0.00355681	0.00701082	0.5073	0.6184

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance
 ** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

Table 13: Results of Growth model of Sugarcane Yield in Southern Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	4.42310	0.0560404	78.93	0.0001***
time	-0.00421572	0.00491506	-0.8577	0.4030

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The results from table 12 and 13 depicts the growth rate of Sugarcane yield in Northern and Southern districts of Karnataka. The Northern districts have positive growth rate of Sugarcane yield by 0.35 percent but in Southern districts the growth rate is negative(-0.42 percent). But the result is statistically insignificant.

Table 14: Results of Independent Sample ‘t’ Test of Sugarcane Yield between Northern and Southern Districts

group		N	Mean	Std. Deviation	Std. Error Mean
district	Northern	19	73.2179	11.29720	2.59176
	Southern	19	80.4358	9.56219	2.19372
Mean Difference		Std. Error Difference	Degree of Freedom	t value	Significance
-7.21789		3.39552	35.044	-2.126	0.561

Source: Values Computed by Researcher.

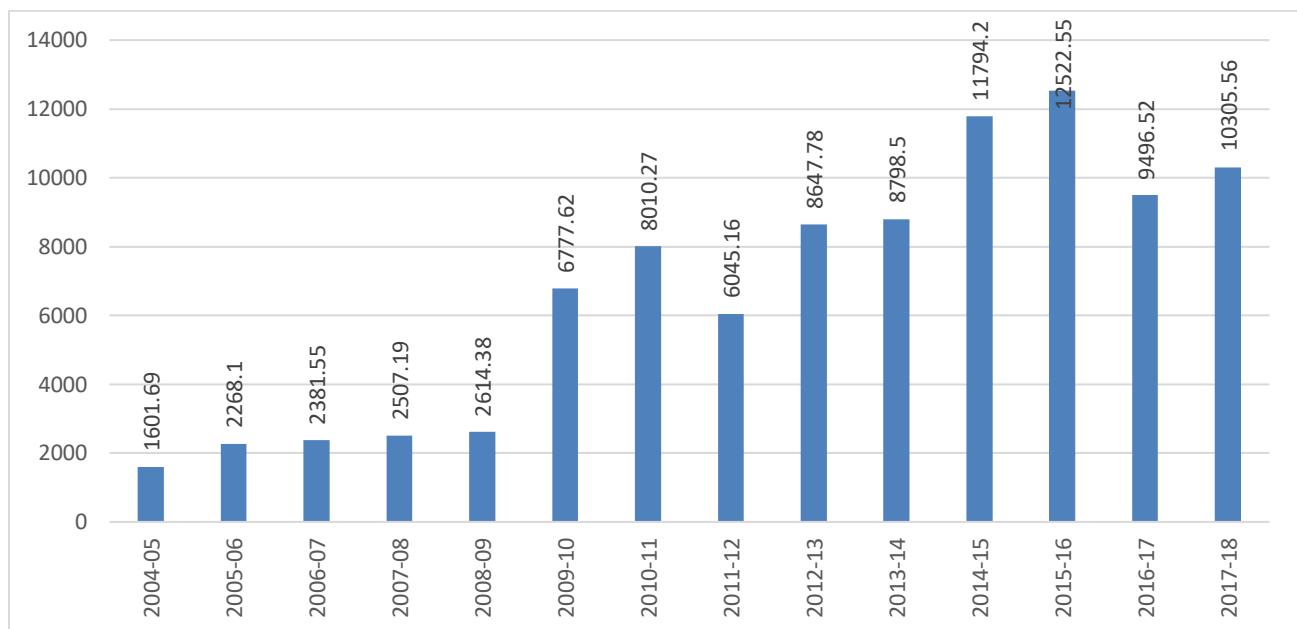
The table14 shows the results of independent sample ‘t’ test for Sugarcane yield between Northern and Southern Districts in Karnataka. The result is statistically insignificant. Hence it can be concluded that there is no difference in the Sugarcane yield between Northern and Southern districts. The average value of Sugarcane production in Northern districts is 73.21 tonnes per hectare whereas Southern districts has 80.43tonnes per hectare.

5.2. Sugar Production in Karnataka

Karnataka State ranks third in production and fourth in respect of area under sugarcane with fairly balanced spread of sugar factories in southern and northern parts where large tracts of land are put under sugarcane cultivation, especially in the irrigation command areas with assured

irrigation facilities. As in the case of rest of the country, Karnataka also has been witnessing fluctuating trends in area, production and productivity. There are 71 sugar factories across the State which can again be classified into, State owned (2 units), Co-operative sector (20 units), and Private companies (49 units). There is predominance of Private Sugar Companies in the State which take a major share of sugarcane production. With this background the study discussed about sugar production in Karnataka as follows.

Figure 7: Value of Output of Sugar in Karnataka (At Current Prices) (Rs. crore)



Source: National Statistical Office, Ministry of Statistics and Programme Implementation, GoI.

The figure 7 shows the trends in value of output of Sugar in Karnataka for the period from 2004-05 to 2017-18. It is found that the value of output of Sugar was Rs.1601.69 crores in 2004-05 which is increased Rs.12522.55 crores in 2015-16, which again decreased to Rs.10305.56 crores in 2017-18. It clearly shows that there is an increasing trend in the value of output of Sugar with slight fluctuations during the study period.

Table 15: Results of Growth Model of Value of output of Sugar in Karnataka

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	12.0179	0.163893	73.33	0.0001***

time	0.158785	0.0192483	8.249	0.0001***
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Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

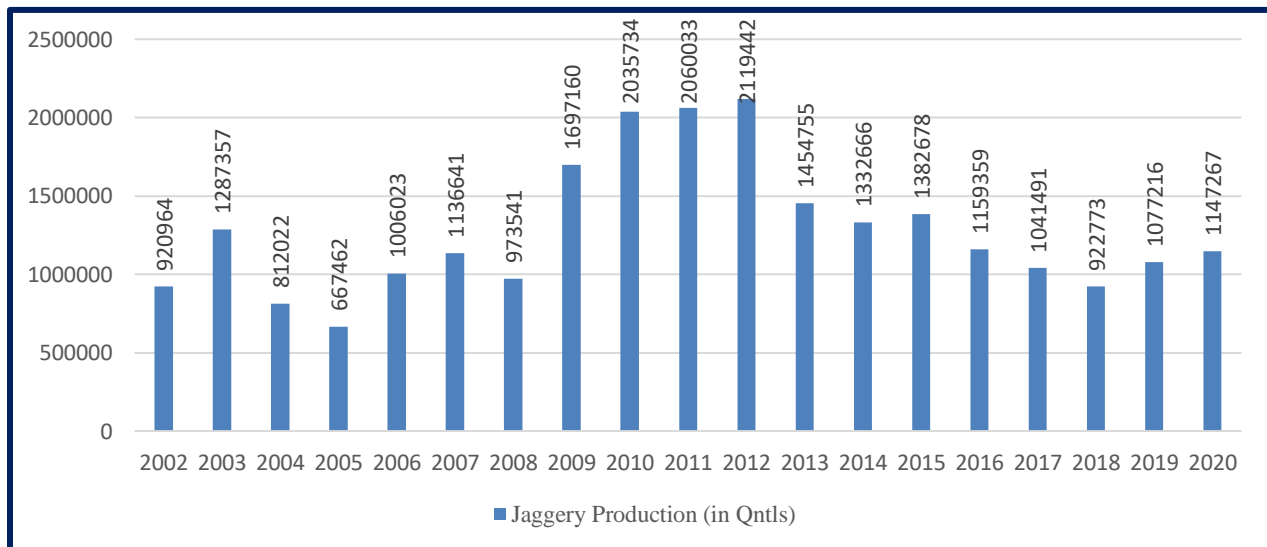
* Indicates 10% Level of Significance

The growth of value of output of Sugar in Karnataka is presented in the table 15 for the period from 2004-05 to 2017-18. It is found that the value of output of Sugar has positive growth of 15.87 percent over the study period. The growth is also statistically significant at 1 percent level of significance.

5.3. Jaggery Production in Karnataka

Jaggery making is a vast cottage industry in Karnataka. Most of the jaggery units in state are operated by the farmers for crushing their own crop. Some of the jaggery units operate purely on commercial basis by purchasing cane from the farmers. The details about Jaggery production in Karnataka shown as follows.

Figure8: Production of Jaggery in Karnataka(In Quintals)



Source: Krishi Marata Vahini, Government of Karnataka

https://www.krishimaratavahini.kar.nic.in/Kannada/Main_Rep.aspx

The figure 8 shows the production of Jaggery in Karnataka from 2002 to 2020. In the initial stage of the study period that is from 2002 to 2008 the production of Jaggery was very low. But starting from 2009 the value of production of Jaggery started to increase with slight fluctuations. The highest production of Jaggery reached to 2119442 quintals in 2012 and decreased to 1147267 quintals in 2020.

Table 16: Results of Growth Model for Production of Jaggery in Karnataka (In Quintals)

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	13.8992	0.153868	90.33	0.0001***
time	0.0110236	0.0134951	0.8169	0.4253

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The growth of production of Jaggery in Karnataka is presented in table 16 for the period 2002 to 2020. It is found that the production of Jaggery has positive growth of 1.10 percent during the study period, but the result is insignificant.

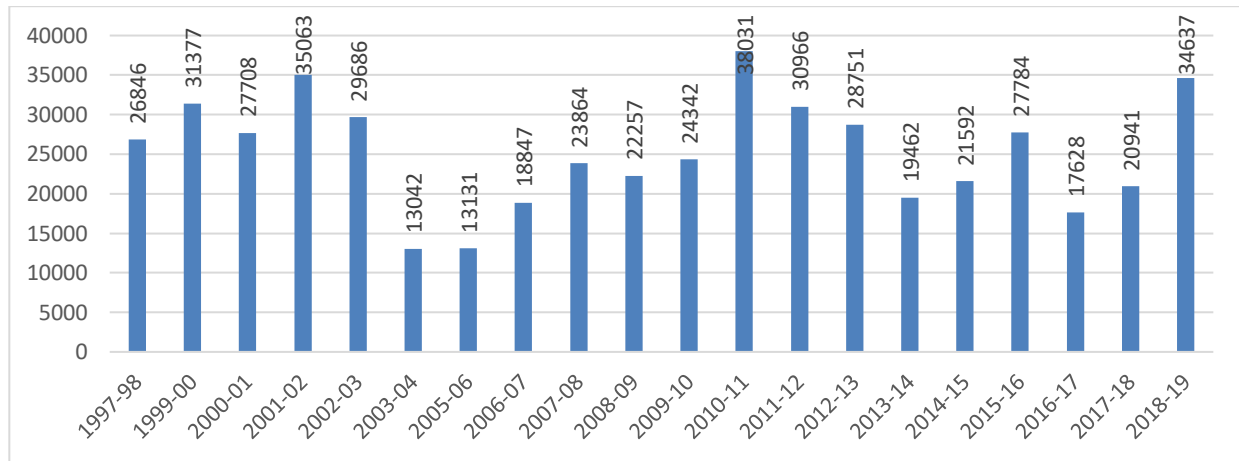
5.4. Trends in Sugarcane, Sugar and Jaggery Production in Mandya District.

Keeping in view the objective of the study, this section discusses the results of the study pertaining to the trends and pattern of sugarcane, sugar and Jaggery in Mandya District.

5.4.1. Area Under Sugarcane, Production and Yield in Mandya District

Sugarcane is grown mainly in 16 districts of the state. Belgaum, Bagalkot, Bijapur, Mandya, Mysore, Chamrajnagar and Bidar are the major sugarcane producing districts. Mandya district is one of the largest producer of sugarcane in Karnataka. Mandya district ranks fourth in Sugarcane production from an area of 34.67 thousand hectares and production of about 3.72 million tonnes during 2018-19. The detailed explanation regarding sugarcane in Mandya district is mentioned below.

Figure9: Sugarcane Area in Mandya District(in Hectare)



Source: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The figure 9 exhibits the area under Sugarcane in Mandya district. It shows the area under Sugarcane from 1997-98 to 2018-19. In 1997-98 the area under Sugarcane was 26,846 hectares. Then it increased to 35,063 hectares in 2001-02. Then it decreased to 13,042 hectares in 2003-04 again it increased to 34,637 hectares in 2018-19. The sugar factories located at Pandavapura and Mandya were disfunctioned during 2016-17, hence it negatively affects the area under sugarcane during 2016-17 and 2017-18.

Table 17: Results of Growth model of Area Under Sugarcane in Mandya District

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	10.1160	0.143741	70.38	0.0001***
time	-0.00171760	0.0119992	-0.1431	0.8878

Source: Values Computed by Researcher.

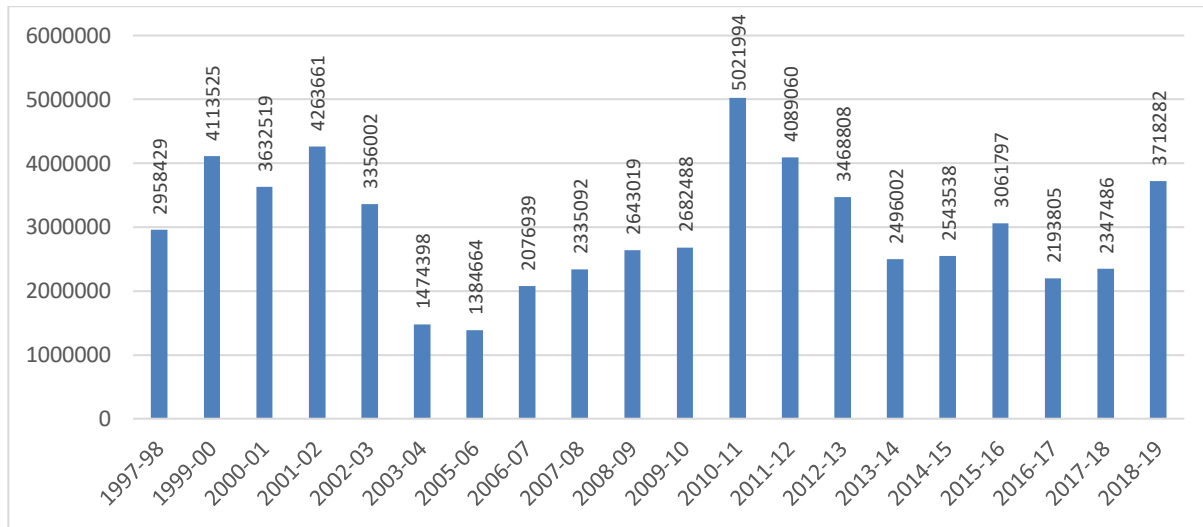
Note: *** Indicates 1% Level of Significance

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* Indicates 10% Level of Significance

The growth of area under Sugarcane in Mandya district is presented in the table 17 for the period from 1997-98 to 2018-19. It is found that the area under Sugarcane has negative growth of 0.17 percent over the study period. The growth is statistically in significant.

Figure10: Sugarcane Production in Mandya District(in Tonnes)



Source: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The production of Sugarcane in Mandya district is reported in the figure 10 for the period from 1997-98 to 2018-19. Starting with the sugarcane production of 29,58,429 tonnes during 1997-98 the production of sugarcane increased to 42,63,661 tonnes during 2001-02 and it is 37,18,282 tonnes 2018-19. The sugar factories located at Pandavapura and Mandya were disfunctioned during 2016-17, hence it negatively affects the production of sugarcane during 2016-17 and 2017-18.

Table18: Results of Growth model of Sugarcane Production in Mandya District

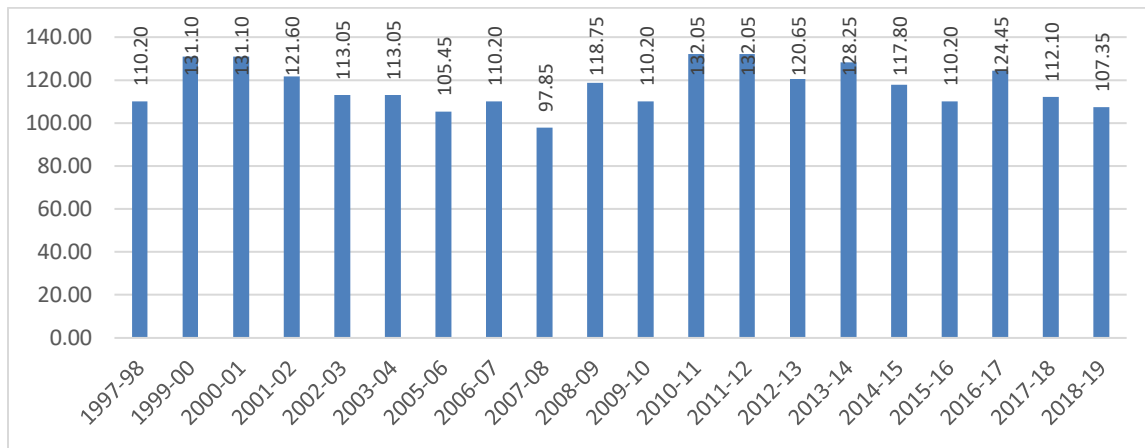
Variable	Coefficient	Std. Error	t-ratio	p-value
constant	14.8855	0.161911	91.94	0.0001***
time	-0.00243974	0.0135161	-0.1805	0.8588

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance
 ** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

The growth in production of Sugarcane in Mandya district is reported in the table18. The coefficient value is -0.24, it means that during the study period production of Sugarcane has negative growth by 0.24 percent. But the growth is statistically in significant.

Figure11: Sugarcane Yield in Mandya District(Tonnes/Hectare)



Source: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

The figure 11 presents the trends in Sugarcane yield in Mandya district. The trends show the yield is more or less stable during the study period. However, the yield of Sugarcane has started to increase from 2010. Further it is found that during 2007-08, 2015-16 and 2018-19 the yield of Sugarcane in Mandya district was slightly low.

Table 19: Results of Growth model of Sugarcane Yield in Mandya District

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	4.76947	0.0407417	117.1	0.0001 ***
time	-0.000722142	0.00340105	-0.2123	0.8342

Source: Values Computed by Researcher.

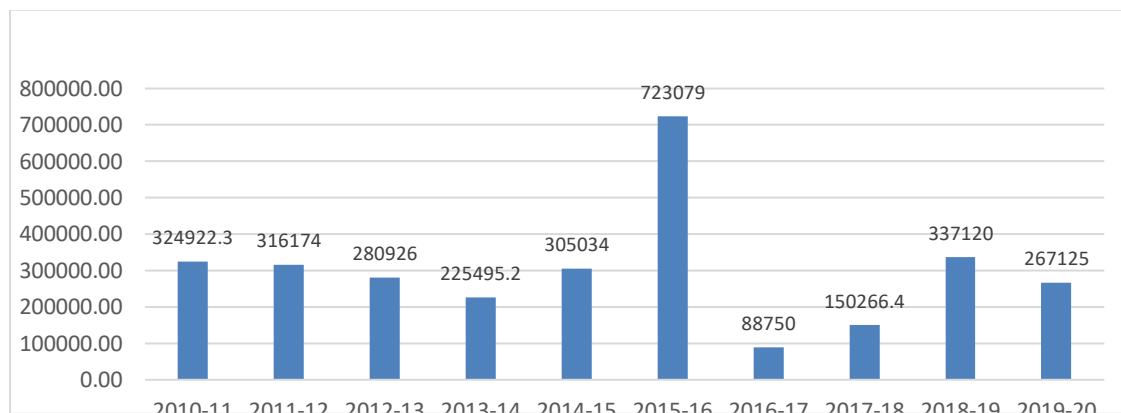
Note: *** Indicates 1% Level of Significance
 ** Indicates 5% Level of Significance
 * Indicates 10% Level of Significance

The growth in Sugarcane yield in Mandya district is reported in the table19. The coefficient value is -0.07, it means that during the study period Sugarcane yield has negative growth by 0.07 percent. The growth is statistically insignificant.

5.4.2. Sugar Production in Mandya District

The Mandya district is known as land of sugar. It is a prominent agricultural district, blessed with the irrigation waters of river Cauvery. There are five sugar factories producing sugar in Mandya district. The analysis of sugar production discussed as follows.

Figure12: Sugar Production in Mandya District (in Tonnes)



Source: Mandya District at a glance 2019-20.

The figure 12 shows the trends in production of Sugar in Mandya district for the period from 2010-11 to 2019-20. It is found that the production of Sugar is 324922.3 tonnes in 2010-11 which is increased 723079 tonnes in 2015-16, which again decreased to 88750 tonnes in 2016-17 due to the disfunction of sugar factories located at Mandya and Pandavapura. It is 267125 tonnes in 2019-20. It clearly shows that there is an increasing and decreasing trend in the production of Sugar during the study period because of improper functioning of sugar factories in the region.

Table 20: Results of Growth model of Sugar Production in Mandya District

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	12.7010	0.388158	32.72	0.0001***
time	-0.0386457	0.0625573	-0.6178	0.5539

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

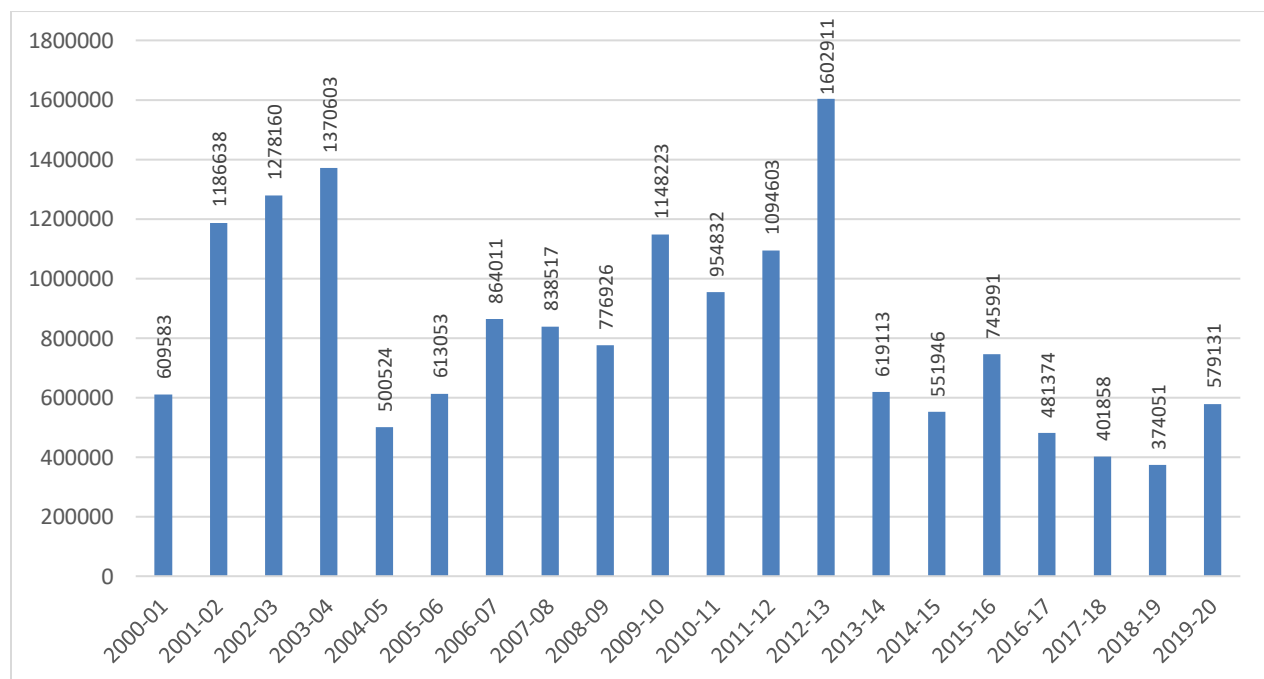
* Indicates 10% Level of Significance

The growth in production of Sugar in Mandya district is reported in the table20. The coefficient value is -3.86, it means that during the study period production of Sugar has negative growth by 3.86 percent. But the growth is statistically insignificant.

5.4.3. Jaggery Production in Mandya District

Mandya district is one among the major Jaggery production districts in Karnataka as the sugarcane is being cultivated in large areas since many years for manufacture of Jaggery, Khandasari and Sugar. The Jaggery production provides livelihood to agricultural families and their dependents particularly in rural areas. The information about Jaggery production in Mandya district has been discussed in the following sections.

Figure13: Jaggery Production in Mandya (in quintals)



Source: APMC, Mandya.

The figure 13 shows the production of Jaggery in Mandya district from 2000-01 to 2019-20. It is found that the production of Jaggery is 6,09,583 quintals in 2000-01 which is increased to 13,70,603 quintals in 2003-04, which again decreased to 5,00,524quintals in 2004-05. It is again increased to16,02,911 quintals in 2012-13 and but decreased to3,74,051 quintals in 2018-19. It is

5,79,131 quintals in 2019-20. It clearly shows that there are high variations in the production of Jaggery in Mandya district.

Table 21: Results of Growth model of Jaggery Production in Mandya District

Variable	Coefficient	Std. Error	t-ratio	p-value
constant	13.9113	0.174912	79.53	0.0001***
time	-0.0348599	0.0146014	-2.387	0.0281**

Source: Values Computed by Researcher.

Note: *** Indicates 1% Level of Significance

** Indicates 5% Level of Significance

* Indicates 10% Level of Significance

The growth of production of Jaggery in Mandya district is presented in table 21 for the period 2000-01 to 2019-20. The coefficient value is -3.48 which means that the production of Jaggery has negative growth of 3.48 percent during the study period. The result is significant at 5 percent level of significance.

6. Conclusion

The present study examined trends and pattern of Sugarcane, Sugar and Jaggery at Karnataka and Mandya District. The area under Sugarcane in Karnataka has significantly increased during the study period. However, the area under sugarcane in Mandya District has declined. It is observed that the area under Sugarcane in Northern districts is very high compare to Southern districts during the study period in Karnataka. It is found that the production of Sugarcane has positive growth of 3.02 percent in Karnataka over the study period. But the production of Sugarcane has negative shown a growth of 0.24 percent in Mandya District. It is also observed production of Sugarcane in Northern districts is very high compare to Southern districts in Karnataka. The growth of Sugarcane yield in Karnataka has increased significantly whereas in Mandya district it has been declined during the study period.

The value of output of Sugar in Karnataka has positive growth of 15.87 percent over the study period. But in Mandya district the production of Sugar has negative growth by 3.86 percent.

The value of out of Jaggery in Karnataka is increased by 1.10 percent. But it is found that the growth of production of Jaggery in Mandya district has negative growth by 3.48 percent during the study period.

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