A Study on Growth in Area, Production and Yield of Principal Crops in Karnataka

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Abstract
After India gained independence, there was drastic changes in growing of food grains in the form of Green Revolution. It is necessary to know the trends in principal crops. Here researcher has been used selected principal crops in Karnataka for the present study. The main aim of the study is to analyse the trend performance of principal crops in Karnataka in terms of area cultivated, production and productivity and also Minimum Support Price given by GoK to the principal crops. The principal crops in Karnataka are Paddy, Jowar, Ragi, Bajra, Wheat, Cotton, Sugarcane and Groundnut etc. In order to analyse the present status of the principal crops in Karnataka, we have used mean, standard deviation, skewness, kurtosis and correlation as statistical tools. For collecting information related to principal crops various secondary source have been used.

Keywords: Principal crops, Minimum Support Price, Area, Production, Average growth rate

Introduction:

Karnataka tourism slogan is that "one state many world" because of its geographical distribution of natural resources. It is considered a miniature of India as it exhibits most of the geographical features of India in climate, soil type, rainfall, crop grown and varieties of natural resources. It has ideal soil, temperature region, humid and arid regions which is very suitable for growing of crops.

Geographical area of Karnataka divided into four distinct regions i.e., coastal plain, Hill range (western ghat), Northern and Southern plateau. The coastal plain represents a northward continuation of the Malabar coast.

The climate of Karnataka is subtropical, with Winter (January and February) Summer (March to May). Southern monsoon (June to September) northeast monsoon (October to December) are the four seasons recognised in the Karnataka state.

Land use pattern of Karnataka can be understood by the following table. It has 53.41 percentage of land for cultivation.

The land use pattern of Karnataka

Land use	(In 000 ha)	Percentage
Total geographical area	19179	NA
Reporting area for land utilisation	19051	100
Forest	3072	16.13
Not available for utilisation	2163	11.35
Permanent pasture and other grazing lands		
Land under miscellaneous	923	4.85
Cultivable wetland	290	1.52
Fallow land other than current fallow	413	2.17
Current fallow		
Net area sow	516	2.71
	1500	7.84
	10174	53.41

Source: Directorate of Economics & Statistics & State Agriculture Census commission

From the available cultivable land various crops are grown by peoples of Karnataka i. e Paddy, Jowar, Ragi, Bajra, Wheat, Cotton, Sugarcane and Groundnut etc.

The present article discussed about cropping pattern (i.e Area, Production and Productivity) of principal crops in Karnataka and Minimum Support Price (MSP) by government to major principal crops.

Review of literature:

Limbore Nilesh et al. (2015) focused on agricultural crop pattern in India and export especially wheat. For the collecting the secondary data they have used secondary source i.e.,Maharashtra State Agricultural Marketing (MSAMB), Directorate General of Commercial Intelligence and Statistics (DGCIS) Annual report, Database of National Horticulture Board, Ministry of Agriculture, Government of India and Food and Agriculture Organisation (FAO). Further for analysing of data they have used Trend analysis, Graphical analysis, ANOVA and Descriptive statistics like Mean, Standard deviation and Variance etc. They finally concluded that India is one of the largest producers of wheat in the world but compared to production of wheat India is not as much large exporter.

Rohillah amin et al. (2017)emphasized on status of growth in area production and productivity of major crops in Jammu and Kashmir state. For better understanding of changes in area under food grains crops in Jammu region, they have divided time lag in two different periods and analyzed the data with student t- distribution statistical tool.

Asis Kumar Senapati et al. (2018)deals with agricultural growth and production variability of principal crops in India.For the purpose of analysis of data, they have classified time series data into different periods. They have used Kinked Exponential model and Instability Index as statistical tool for interpreting the data. Lastly, they concluded that moderate and significant growth in production accompanied by a low level of instability of any crop is desirable for sustainable development of agriculture in India as compared to high growth in production and high level of instability. There is an inevitable trend that arable land in India will decline over time due to urban development and industrialization.

M Marimuthu et al. (2018)documented that, the trend inproduction of principal food crops in India such as Rice, Jowar, Maize, Small Millets, Wheat and Barley. For the purpose of analysis of data, they have used in Scatter plot, Timeline, Method of least square and R- square. Finally, they have reported that the production of small millets reduces over the years and the production of all the other principal food crops increases over the years. The variables such as rainfall and area of production must also be considered as the influencing factors.

Savita Panwar et al. (2018)discussed that pattern of land holdings, land utilization, cropping intensity and trend of area, production and productivity under principal food crops and commercial crops.The data on area, its utilisation, production and productivity of major crops were collected from the secondary sources of information. The important published sources of information are Statistical Abstract of Haryana 2015-16 and 2016-17 published by the Department of Economic and Analysis-Haryana 2017 and 2018, Economic Survey of Haryana, Draft Policy Document of Government of Haryana 2017, website of Ministry of Agriculture, Government of India and other such sources. They have used Mean, Percentage and Trend analysis as analytical tools.They conclude that 48.11% farmers with land holding up to 1 hectare possesses 9.88% of total area only. This trend is reversed with the increase in size of land holdings. Land utilisation showed an increase in cropped area, irrigated area and cropping intensity.

Research problem:

Many studies have been conducted on principal crops in Karnataka. This state is an agricultural dominant economy with over 50 percentage area under cultivation. Karnataka blessed with various soil pattern and which is supports to grow the various food grains and commercial crops. But present study focuses only on selected major crops, i.e. Bajra, Cotton, Groundnut, Jowar, Maize, Paddy, Ragi, Sugarcane, Sunflower and Wheat. The present paper discussed about the area wise, production wise and advisor distribution of major principal crops and also Minimum Support Price (MSP) provided by Karnataka state government over the eight years. This is specific study overlooks about the pattern of cropping, production and minimum support price by the government.

Objectives of the study:
01. To analyze the area, production and productivity of principal crops in Karnataka.
02. To examine the Minimum Support Price of principal crops in Karnataka.

Methodology:

The study based on exploratory, descriptive and analytical method of research. For analyzing the data some statistical tools and techniques were used which are suitable for the specific study i.e., Mean, Standard Deviation, Coefficient Standard Deviation, Skewness, Kurtosis and Correlation,diagrammatic representation and graphical representation have been adopted to easy interpret the data in a relevant manner.Secondary data have been collected from a different published source which includes Books, Journals, Articles, Government authorities, Directorate of Economic and Statistics Government of Karnataka, Krishimaratavahini, Krishi Mitra, Karnataka State Department of Agriculture and Directorate of Rice Development Government of India.

Results and Discussion:

For the purpose of analysing of data researcher has used statistical tools i.e.mean, standard deviation, skewness, kurtosis and correlation.

Mean is the average or central value of given series of data. It is an important that is widely used for analyse the data because, mean considers of all the observation of the series. We can obtain the mean value of series by following formula. (Statistics 11th department of pue kar)

Mean $= \dfrac{x1+x2+x3+x4.....xn}{n}$

In words, mean $= \dfrac{sum\ of\ the\ variables}{total\ no\ of\ variables}$

Symbolically, A= $\frac{\sum xi}{n}$ i = 1,2,3, 4…. n

Standard deviation is a statistical toll used to know the dispersion of a data set relative to its mean. Low standard deviation (σ) means data are spread near to its mean value. High standard deviation (σ) indicates that data are more spread out. It is sensitive to outliers. A single outlier can raise standard deviation (σ) and in turn, distort the picture of spread. We can find the dispersion of data series from their mean value from the following formula. (Statistics 11th department of pue kar)

$$SD_{sample} = \sqrt{\frac{\sum |x - \bar{x}|^2}{n - 1}}$$

Where SD = Standard Deviation
X= Observation   n = Number of observations
$\bar{x}$ = Mean

Skewness refers to a distortion or asymmetry that deviates from a symmetrical bell curve or normal distribution in a set of data. If the curve is shifted to the left or right, it is to be skewed. Skewness is characterized by asymmetry of a statistical series, differences in the value of the average viz Mean, Median and Mode. It skewed positive, it is to be said skewed right, that means right tail of distribution is larger than left. If skewed is equal to zero, the data are perfectly symmetrical. (Statistics 11th department of pue kar)

Positively skewed $\bar{x}$> M > Z
Negatively skewed $\bar{x}$< M < Z
Bulmer classified skewness in the following categories.

- If skewness is less than -1 or greater than +1, then distribution called as highly skewed.
- If skewness is between -1 and -1/2 or between +1/2 and +1 then distribution can be called as moderately skewed.
- If skewness is between -1/2 and +1/2 then distribution can be called as approximately symmetric.

Kurtosis is a statistical tool measures that how heavily the tails of a distribution differ from the tail of normal distribution. The reference standard is a normal distribution, which has a kurtosis of 3. In token of this, often excess of kurtosis is represented, excess of Kurtosis is simply Kurtosis – 3. For example, the Kurtosis reported by excel is actually the excess of Kurtosis.(Statistics 11th department of pue kar)

- Mesokurtic is a normal distribution ha Kurtosis = 3 (excess of Kurtosis exactly 0)
- Platykurtic is a distribution with Kurtosis < 3 (excess of Kurtosis < 0)
- Leptokurtic a distribution with Kurtosis > 3 (excess of Kurtosis > 0)

Correlation is a statistical device which helps in analysing the covariation of two or more variable. Interpretation of correlation:(Statistics 11th department of pue kar)

- A positive value of γ indicates positive correlation.
- A negative value of γ indicates negative correlation.
- If γ = +1, then the correlation is perfect positive.
- If γ = -1, then the correlation is perfectly negative.
- If γ = 0, then the variables are non-correlated.
- If γ ≥ 0.5, then the correlation will be of higher degree.

Table 1.1 Statement Showing Area-wise Distribution of Principal Crops in Karnataka (Area in Lakh Hectors)

Crops	Mean	Standard Deviation	Coefficient of SD	Skewness	Kurtosis
Bajra	2.3379388	0.5618616	0.2403235	0.814237	0.513124
Cotton	6.80769	1.2381963	0.181882	0.256925	-0.54714
Ground nut	6.1522	0.743908	0.1209174	0.461512	-0.9308
Jowar	10.342536	0.7791856	0.075338	-0.32003	-0.98744
Maize	13.551794	0.8176969	0.0603386	0.215627	1.170634
Paddy	11.862163	1.2884226	0.1086162	-0.38944	-1.25696
Ragi	6.6926563	0.6832086	0.1020833	-0.26408	0.392134
Sugarcane	4.528	0.5321037	0.1175141	0.857546	0.057695
Sunflower	2.7307388	1.1780732	0.4314119	0.036247	-2.13739
Wheat	1.7324675	0.2625185	0.1515287	-0.33041	-0.23168

Source: 1. Karnataka State Department of Agriculture (KSDA)
2. Crop Production Statistical Information System (CPSIS)

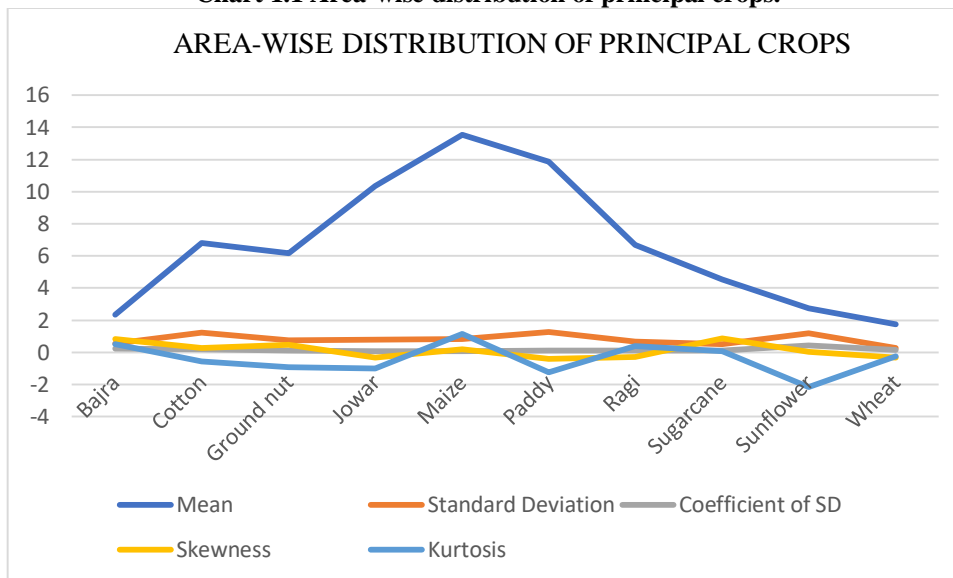**Chart 1.1 Area-wise distribution of principal crops.**

Table 1.1 demonstrated that area wise distribution of principal crops in Karnataka. Maize (13.55 lh) has highest mean production in area wise and followed by Paddy (11.86 lh), Jowar (10.34 lh) and cotton (6.80 lh).

Paddy (1.28lh), cotton (1.23 lh) and Sunflower (1.17 lh) production area has high standard deviation from their mean value and other crops has low standard deviation in terms of area cultivated.

Jowar (-0.32 lh), Paddy (-0.38 lh), Ragi (-0.26 lh) and Wheat (-0.33 lh) has negatively skewed and other major crops are positively skewed. Only maize has relatively leptokurtic distribution of observation.

Table 1.2 Statement Showing Production-wise Distribution of Principal Crops in Karnataka (Production in Lakh tones)

Crops	Mean	Standard Deviation	Coefficient of SD	Skewness	Kurtosis
Bajra	2.591408	0.920079	0.35505	-0.248437	-0.914443
Cotton	16.662	5.013279	0.300881	0.207098	-1.518782
Ground nut	5.05012	0.97215	0.1925	0.181263	-1.655189
Jowar	10.48435	1.901831	0.181397	0.151859	-1.374081
Maize	42.40861	7.73424	0.182374	0.43216	0.011842
Paddy	35.13824	5.152147	0.146625	-0.282201	-2.175911
Ragi	10.91817	3.474494	0.31823	-0.750146	0.135069
Sugarcane	376.7389	50.10567	0.132998	-1.136966	2.272863
Sunflower	1.577394	0.607812	0.385326	0.589033	-1.542888
Wheat	1.978581	0.449678	0.227273	0.003214	-0.945618

Source: 1. Karnataka State Department of Agriculture (KSDA)
2. Crop Production Statistical Information System (CPSIS)

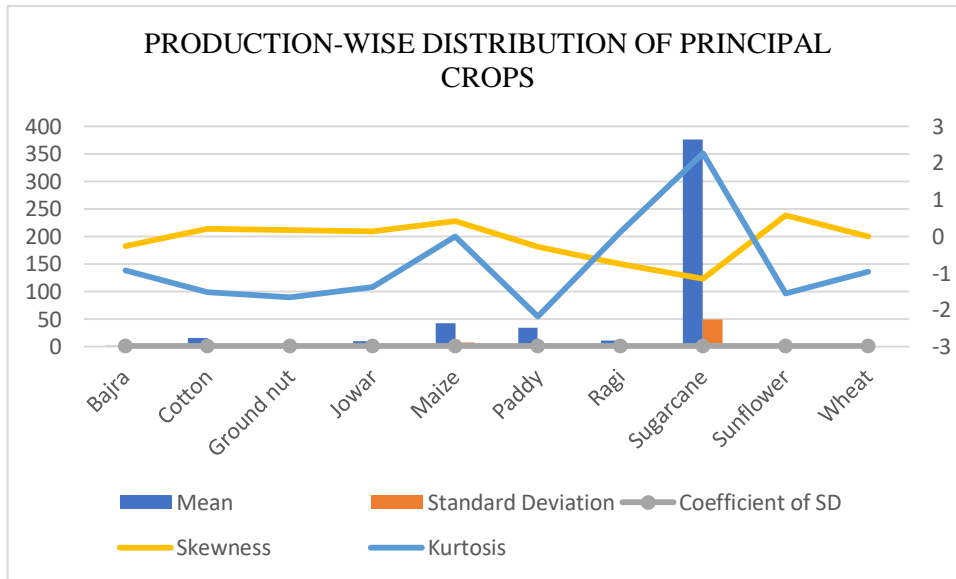**Chart 1.2 Production-wise distribution of principal crops**

Table 1.2 describes that production wise distribution of principal crops in Karnataka. Sugarcane (376.73 lt) has highest value of mean productionand followed by Maize (42.40 lt), Paddy (35.13 lt), Cotton (16.66 lt), Ragi (10.91 lt) and Jowar (10.48 lt).

At the same time Sugarcane (50.10 lt) has high standard deviation and followed by Paddy (5.15 lt), Cotton (5.01 lt) and Ragi (3.47 lt), other crops have low standard deviation from their mean value.

Sugarcane (-1.13 lt) has highly negative skewed and followed by Ragi (-0.75 lt), Paddy (-0.28) and Bajra (-0.24). All other crops are positively skewed.

Sugarcane has relatively leptokurtic distribution (2.27 lt) and remaining crops has platykurtic distribution.

Table 1.3 Statement Showing Yield-wise Distribution of Principal Crops in Karnataka (Yield in Tones per hector)

Crops	Mean	Standard Deviation	Coefficient of SD	Skewness	Kurtosis
Bajra	1.090933	0.261417	0.239627	0.427762	2.001793
Cotton	2.438968	0.563095	0.230874	0.46191	-1.16298
Ground nut	0.83	0.158514	0.192101	0.884868	0.730021
Jowar	1.013649	0.159435	0.157288	-0.82219	-0.22946
Maize	3.132914	0.578473	0.184644	1.057046	1.688265
Paddy	2.952674	0.152504	0.051649	-0.29361	-0.99572
Ragi	1.6022	0.392922	0.245239	-1.34371	1.323991
Sugarcane	86.83208	9.412303	0.108397	-0.73717	1.065968
Sunflower	0.61509	0.169563	0.275672	0.060307	-0.85752
Wheat	1.062869	0.163223	0.153569	-0.70977	2.25147

Source: 1. Karnataka State Department of Agriculture (KSDA)
2. Crop Production Statistical Information System (CPSIS)

Chart 1.3 Yield-wise distribution of principal crops

YIELD-WISE DISTRIBUTION OF PRINCIPAL CROPS

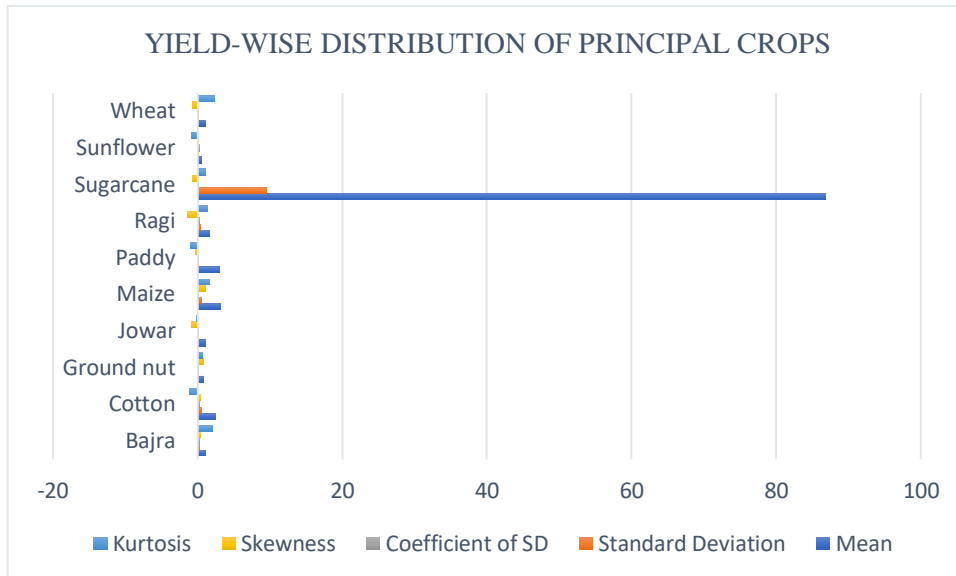Legend: Kurtosis, Skewness, Coefficient of SD, Standard Deviation, Mean

Table 1.3 depicts that yield wise distribution of principal crops in Karnataka. Sugarcane (86.83 tph) has highest mean yield and followed by Maize (3.13 tph), Paddy (2.95 tph), and Cotton (2.43 tph).

Only, Sugarcane (9.41 tph) has high standard deviation and all other principal crops has low standard deviation.

Jowar (-0.82 tph), Ragi (-1.34 tph), Paddy (-0.29 tph), Sugarcane (-0.73 tph) and Wheat (-0.70 tph) has negatively skewed and all other principal crops are positively skewed.

Cotton (-1.16 tph), Jowar (-0.22 tph), Paddy (-0.99 tph) and Sunflower (-0.85 tph) has negative kurtosis and all other principal crops has positive kurtosis.

Table 1.4 Statement Showing Minimum Support Price of Principal Crops in Karnataka (Amount in Rs)

Crop	Average	Standard Deviation	coefficient of SD	Skewness	Kurtosis
Bajra	1703.75	423.0902	0.248329	0.11742	-2.3127
Cotton	4896.25	811.985	0.165838	0.150464	-2.2456
Groundnut	4663.125	609.7127	0.130752	0.263206	-1.88218
Jowar	2108.375	534.0299	0.25329	0.062444	-2.52367
Maize	1575.625	242.5525	0.15394	0.094922	-2.32666
Paddy	1660.375	220.761	0.132959	0.043137	-1.86756
Ragi	2443	805.4188	0.329684	0.050737	-2.48478
Sunflower	4804.75	1013.235	0.210882	0.091951	-2.51131
Wheat	1761.25	212.1447	0.120451	-0.2973	-1.54228

Source:1. Karnataka State Department of Agriculture (KSDA)
2. Crop Production Statistical Information System (CPSIS)
3. Karnataka State Agricultural Marketing Board

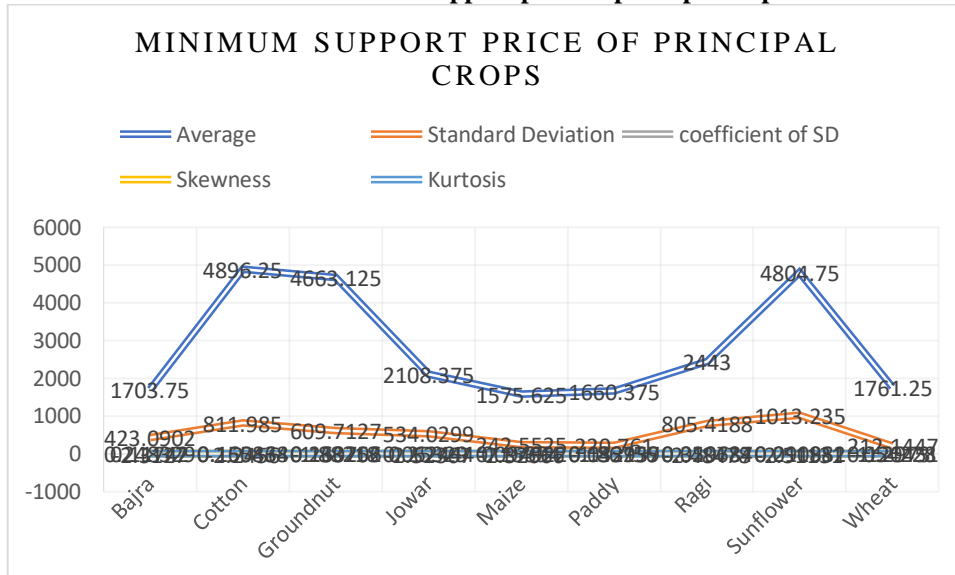**Chart 1.4 Minimum support price of principal crops**

Table 1.4 showing that Minimum Support Price. Cotton (Rs 4896.25) has highest mean support price and followed by Sunflower (Rs 4804.75), Groundnut (Rs 4663.12), and Jowar (Rs 2108.37).

Sunflower (Rs 1013.23) has high standard deviation and followed by Cotton (Rs 811.98) Ragi (Rs 805.41) and Ground nut (Rs 609.71).

Only Wheat (Rs -0.2973) have negatively skewed and all other crops have positive skewed. All principal crops have negatively kurtosis with platykurtic distribution.

Table 1.5 Statement Showing Average Growth Rate of Area, Production and Productivity of Principal Crops in Karnataka Over Seven Years (Rates in %)

Crops	Area	Production	Productivity
Bajra	1.109274301	15.52780394	6.7917557
Cotton	2.844173364	6.274673659	2.4470081
Ground nut	3.170073087	5.494463724	4.5901333
Jowar	-0.684851109	-0.6567054	0.4361785
Maize	-0.243660023	4.855272304	6.0384951
Paddy	-0.5862387	0.072861648	0.4536017
Ragi	1.572298804	23.43013739	11.643398
Sugarcane	5.139890019	2.773935451	2.7205987
Sunflower	14.52758387	8.124406938	4.9696074
Wheat	-6.141216536	8.257316771	5.026753

Source: 1. Karnataka State Department of Agriculture (KSDA)
2. Crop Production Statistical Information System (CPSIS)

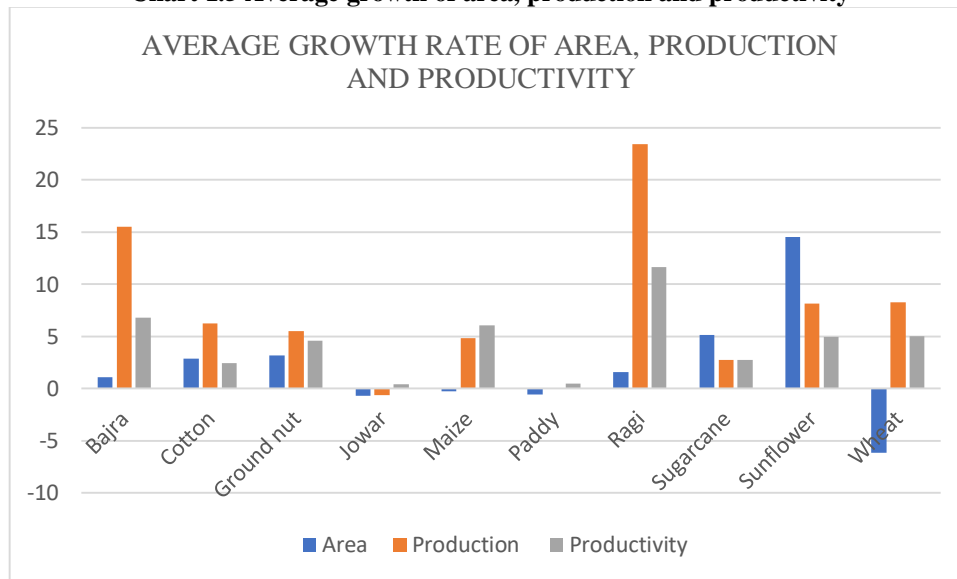**Chart 1.5 Average growth of area, production and productivity**

Table1.5 showing an average growth rate of area, production and productivity of principal crops in Karnataka. By observing seven years data relating to principal crops. Sunflower (14.52%) and Sugarcane (5.13%) has high growth rate in terms of area. Jowar (-0.68%), Maize (-0.24%), and Wheat (-6.14%) has negative growth rate and all other crops has positive growth rate with decreasing rate.

Ragi (23.43%) has higher growth rate in terms of production and followed by Bajra (15.52%), Sunflower (8.12%), Wheat (8.25%) and Cotton (6.27%).

Ragi (11.64%) has higher growth rate in terms of productivity rate and followed by Maize (6.03%), Wheat (5.026%) and all other crops has positive growth rate with decreasing rate.

Table 1.6 Statement Showing the Correlation Between Area and Production

Particulars	Area (In Lakh hector)	production (in Lakh tones)
2013-14	71.71036	522.6278
2014-15	72.15978	580.8129
2015-16	64.71994	465.382
2016-17	61.5471	368.7246
2017-18	62.75647	520.2894
2018-19	64.09992	534.3122
2019-20	67.4519	504.1936
2020-21	69.46	532.04

r=0.677721

Table 1.6 expresses that correlation between area and production of principal crops in Karnataka. The correlation between area cultivated and production of crops has high positive correlation.

Conclusion:

The primary intention of this article is to examine the area, production, productivity and Minimum Support Price facility given by Government for major principal crops in Karnataka.In order to examine the current status of major crops in Karnataka, research has been used various government websites and authenticated non-government official data as source for collection of information and used appropriate statistical tools for analysis of data.

After observing statistics of major principal crops in Karnataka over seven years. Least area cultivated, production and productivity has been recorded in the year 2016-17. Highest area cultivated (72.15978 lh), production (580.8129 lt) has been recorded in the year 2014-15. Furthermore, correlation between area cultivated and production is highly positively (0.677721) correlated.

Government of Karnataka have been providing minimum support price to the principal crops. The price of government support is unscientific, as there is a lot of variation in the government's support price as well as the cost of production of agricultural products. GoK have to conduct survey on fixing of Minimum Support Price for principal crops in Karnataka and

formers should be provided electricity, credit and mechanical services at concessionary rate that could promote agrarian to produce more agricultural products.

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