A comparative study on area, production, yield and stability of maize in northern and southern districts of Karnataka

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 Received: 23.5.2019/Accepted: 7.6.2019

ABSTRACT

A comparative study on area, production, yield and stability of maize in northern and southern districts of Karnataka was conducted, Northern and southern districts of Karnataka were purposively selected due to their major contribution in maize production. Among the northern districts, Belagavi and Haveri and among southern districts, Davangere and Chitradurga had the highest area and production under maize in 2016. Karnataka state is famous for maize production and industrial glucose extraction. Growth in area, production and yield of maize in northern and southern districts of Karnataka was worked out. Right from 2000 to 2014 it was found that northern Karnataka had higher area, production and yield of maize. Area, production and yield ranged from 26,613 to 62,103 ha, 52,997 to 3,63,803 MT and 1.80 to 4.65 tonnes per ha respectively in northern Karnataka in comparison to 17,289 to 41,901 ha, 36,217 to 1,36,537 MT and 1.88 to 3.49 tonnes/ha respectively in southern karnataka. The compound annual growth rate of area, production and yield under maize in northern Karnataka was estimated at 6.51, 7.55 and 1.07 per cent respectively. In case of southern Karnataka growth in area, production and yield increased by 6.90, 9.38 and 2.50 per cent respectively. Average instability in area, production and yield of maize in northern and southern Karnataka was worked out and it was estimated to be 58, 65 and 37 per cent for northern Karnataka and 51, 59 and 44 per cent respectively for southern Karnataka. Hence it could be inferred that northern Karnataka had higher instability in production and yield and southern Karnataka in area.

Keywords: Maize; CAGR; area; production; yield; stability

INTRODUCTION

Maize (*Zea mays*) is after wheat and rice the most important cereal grain in the world providing nutrition to humans and animals and serving as a basic raw material for the production of starch, feed, oil, protein, alcoholic beverages, food sweeteners and more recently bio-fuel. Maize is grown primarily for food that includes sweet corn and pop corn although dent, starchy or floury and flint maize are also widely used as food. It is preferred in poultry feed because of its easy availability. Maize is a high energy grain because it is high in starch and oil and low in fibre. It contains about 70 per cent starch, 85-90 per cent TDN, 4 per cent oil and about 8-12 per cent protein (Anon 2012).

Maize production in India has seen a boom in recent years which has been possible due to increase in area as well as productivity. During 1950-51 India produced only 1.73 MT maize which has reached to 25.89 MT in 2016-17. The average productivity of maize in India is 2.43 tonnes/ha. Maize is highly preferred in most countries including developing countries like India. In India maize is the third most important food grain after wheat and rice. The four states namely Madhya Pradesh, Andhra Pradesh, Karnataka and Rajasthan account for more than half of the total maize production. Currently India is among the top five exporters of maize worldwide. Despite that only 25 per cent of India's population uses it as a food crop. Area under hybrid varieties is increasing thereby leading to improved nutrition and availability

of low-cost high quality food. This has resulted in demand increasing at a much faster pace (http://pib.nic.in/newsite/PrintRelease.aspx?relid=177904).

The present study was undertaken to assess the growth and trends in area, production and yield of maize in northern and southern Karnataka.

METHODOLOGY

The 30 districts of Karnataka (the latest district not considered) were categorized into two regions namely northern and southern Karnataka. The data on area, production and yield of maize were collected from the 12 districts of northern and 15 districts of southern Karnataka. The mean area, production and yield were calculated for each district from 2000 to 2014. These data were presented for the two regions. The aggregated mean district data were used for calculating instability, compound annual growth rate (CAGR) and for comparison between two regions.

Compound annual growth rate (CAGR) analysis

In order to study the growth rates in area, production and yield of maize in sample districts CAGR analysis technique was employed. The functional form of the compound growth rate analysis was:

$$Y = a\, ab^t e^{ut} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where Y= Dependent variable for which growth rate is estimated, a= Intercept, b= Regression coefficient, t= Time variable, e^{ut}= Error term

The compound growth rate was obtained from the logarithmic form of the equation (1) as below:

$$\ln Y = \ln a + t \ln b + ut$$

The per cent compound growth rate (g) was derived using the relationship:

$$g = (\text{Anti ln of } b - 1) \times 100$$

Pattern of growth rates over the years was identified using the 'b' coefficient. If coefficient was statistically significant and positive then growth of the estimated parameters over the years was accelerating. If it was negative it was implied that growth was decelerating over the years.

Instability analysis

Coefficient of variation (CV) is a relative measure of dispersion based on standard deviation. CV was used to test the consistency. There is an inverse relationship between the coefficient of variation and consistency. The series having greater CV are said to be more variable and less stable than the other and the series having less CV are said to be less variable and more stable.

$$\text{Coefficient of variation (\%)} = \frac{\text{Standard deviation} \times 100}{\text{Mean}}$$

RESULTS and DISCUSSION

Area, production and yield under maize in Karnataka

The growth in area, production and yield under maize in northern and southern Karnataka was analyzed and the results are presented in Table 1.

In northern Karnataka the annual growth rate of area, production and yield was 6.51, 7.55 and 1.07 per cent respectively. In case of southern Karnataka the growth in area was 6.90 per cent. Production increased by 9.38 and the yield by 2.50 per cent. Hence it could be concluded that the growth in area, production and yield in southern districts was more than the northern districts.

Instability in area, production and yield of maize in Karnataka

Instability in area, production and yield of maize in different districts of Karnataka was analyzed and the data are presented in Table 2.

Northern Karnataka

It can be seen from the data that instability in area under maize was higher in Bidar (81%) followed by Uttara Kannada (72%), Koppal (64%) and Vijayapura (61%). More stability in area was observed in Belagavi (20%), Haveri (22%), Ballari (26%) and Bagalkot (29%).

With respect to production, more instability in production was observed in districts like Haveri (146%), Bidar (106%), Uttara Kannada (93%) and Vijayapura (77%). More assurance of production was observed in Bagalkot (32%), Ballari (34%), Belagavi (36%) and Gadag (43%) districts.

Table 1. Growth in area, production and yield under maize in northern and southern Karnataka

Year	Northern Karnataka			Southern Karnataka		
	Area (ha)	Production (MT)	Yield (tonnes)	Area (ha)	Production (MT)	Yield (tonnes)
2000	28,921	83,333	2.71	17,289	40,227	2.29
2001	31,902	1,00,999	3.10	19,069	61,577	2.74
2002	28,943	62,249	2.04	20,149	36,217	1.88
2003	26,613	52,997	2.15	19,921	38,262	2.06
2004	36,955	1,06,284	2.93	27,127	82,263	2.61
2005	44,759	1,39,078	2.97	26,583	75,839	3.03
2006	42,456	1,24,793	2.62	30,071	76,268	2.74
2007	52,600	1,50,147	2.76	32,114	96,821	3.18
2008	48,214	3,63,803	4.65	32,649	96,903	3.07
2009	58,002	1,01,455	1.80	36,580	1,01,947	2.78
2010	59,316	1,90,548	3.03	36,547	1,36,537	3.49
2011	60,858	1,80,390	2.82	39,621	1,14,890	2.96
2012	57,744	1,35,632	2.79	40,724	1,062,69	2.57
2013	62,103	1,99,354	3.13	41,901	1,29,692	3.05
2014	57,774	1,78,385	2.95	41,187	1,35,989	3.26
CAGR (%)	6.51	7.55	1.07	6.90	9.38	2.50

Table 2. Per cent instability in area, production and yield of maize in Karnataka (2000-2014)

Northern Karnataka				Southern Karnataka			
District	Area	Production	Yield	District	Area	Production	Yield
Bidar	81	106	41	Dakshina Kannada	143	149	42
Uttara Kannada	72	93	61	Chikkamagaluru	110	108	28
Koppal	64	73	25	Udupi	86	86	13
Vijayapura	61	77	26	Kolar	51	59	29
Raichur	55	54	21	Hassan	51	64	150
Kalaburgi	49	49	32	Mandya	48	61	38
Gadag	46	43	31	Bengaluru Rural	40	46	23
Dharwad	41	46	33	Chitradurga	36	46	29
Bagalkot	29	32	14	Shivamogga	33	41	26
Ballari	26	34	178	Tumakuru	33	40	23
Haveri	22	146	49	Mysuru	32	36	20
Belagavi	20	36	34	Chamarajanagar	32	46	28
Average	47	66	45	Average	58	65	37

Source: Directorate of Economics and Statistics, Government of Karnataka, India

Highest instability in respect of yield per hectare was recorded in Ballari district (178%) even though it was stable with respect to area and production. This was followed by Uttara Kannada (61%), Haveri (49%) and Bidar (41%) districts. Most stable districts in terms of yield per hectare were Bagalkot with 14 per cent instability followed by Raichur (21%), Koppal (25%) and Vijayapura (26%).

In overall northern Karnataka's average instability in area, production and yield was 47, 66 and 45 per cent respectively for the period 2000-2014.

Hence the districts selected for the study were highly instable in terms of area, production and yield of maize. More the stability in area, production and yield of maize, better are the opportunities for industries to invest more in the supply chain. In turn farmers may reap benefits of getting assured remunerative price for their produce.

Southern Karnataka

With respect to area under maize Dakshina Kannada, Chikkamagaluru, Udupi, Kolar and Hassan witnessed higher instability of 143, 110, 86, 51 and 51

per cent respectively. In contrast districts like Chamarajanagara (32%), Mysuru (32%), Shivamogga (33%) and Tumakuru (33%) witnessed higher stability in terms of area. This was a positive sign to the industries as the maize availability was better in these areas during the period.

With respect to production Dakshina Kannada, Chikkamagaluru, Udupi and Hassan registered higher instability of 149, 108, 86 and 64 per cent respectively. Districts that showed higher stability were Mysuru (36%), Tumakuru (40%) and Shivamogga (41%).

Yield obtained was stable in Udupi (13%), Mysuru (20%), Tumakuru (23%) and Bengaluru Rural (23%) whereas higher instability was observed in Hassan, Dakshina Kannada and Mandya with 150, 42 and 38 per cent respectively. In total southern Karnataka's average instability in area, production and yield was 58, 65 and 37 per cent respectively.

As per Dhakre and Sharma (2010) maximum decrease in area under maize crop (-16.02%) was found in 1999-2000 and maximum increase was 30.23 per cent in 2000-01 whereas maximum increase in production and productivity of maize crop in Nagaland was 103.05 per cent in 1988-89 and 101.26 per cent in 1988-89. Among area, production and productivity of maize the instability was highest for the production. Growth rates were significant at 1 per cent level of significance.

Karnataka registered a significant increase in maize area (8.01% per annum) during 1982-83 to 2007-08. The rapid expansion in area under the crop was mainly due to its important features like short duration, adaption to a wide range of soils and climatic conditions and high yield per hectare as compared to other cereal crops. Maize yield increased at the rate of 0.23 per cent per annum (Acharya et al 2012).

Pavithra et al (2018) did compound growth rate analysis for the food grains in Karnataka state from 1990-91 to 2014-15. The highest positive growth was observed in maize area and production of 7.74 and 7.64 per cent respectively. Negative growth was observed in maize productivity ie -0.10 per cent.

CONCLUSION

The study compared the growth in area, production and yield under maize crop in northern and southern Karnataka districts. The compound annual growth rate was worked out for area, production and yield from 2000 to 2014. The analysis revealed that growth in area, production and yield of maize was higher in southern than in northern Karnataka.

The average instability in area, production and yield of maize in northern Karnataka was 47, 66 and 45 per cent respectively and in southern Karnataka it was 58, 65 and 37 per cent respectively.

Thus the area under maize was more stable in northern Karnataka whereas the yield was relatively unstable. As more number of maize processing industries was located in northern in comparison to the southern Karnataka it was important to focus on programmes and policies for promotion of maize crop yield in northern Karnataka so as to provide the processing industries with sufficient raw material at a reduced cost.

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