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Growth and instability in area, production and productivity of dry chilli in Karnataka

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Abstract

The study is an attempt to assess the growth trend in production of dry chilli in Karnataka. The secondary data was collected from Statistical wing, Directorate of Horticulture, Bengaluru for the period from 2008-09 to 2017-18. The annual growth in area, production and productivity was estimated using the compound annual growth rate function and Cuddy Della index was used to measure instability. Bellary, Haveri and Dharwad districts are the major dry chilli producers in Karnataka. The maximum growth rate in area and production was observed in Bellary district and was positively significant. The instability was found to be more in area and productivity than production. Negative and significant growth in area was seen in Belagavi and Chitradurga districts; and Haveri and Dharwad districts showed negative growth both in area and production. Maximum growth rate in area (10.52%) and production (18.45%) was observed in Bellary district and was found to be positively significant. The growth rate in productivity was positive and significant in Yadgiri district.

Keywords: growth rate, trend, productivity, instability

1. Introduction

Chilli is the dried ripe fruit of the genus *capsicum*. '*Capsicum annum* L.' is an annual subshrub. Dry chilli is an important commercial spice crop of India and the crop is grown in tropical and sub-tropical regions and needs a warm humid climate. Though, chilli can be grown in varieties of soils, well drained loamy soils, rich in organic matter are well-matched for the cultivation. Chilli is stated to have its origin from South America (Peru). In daily life, chillies are most essential and important component in many different foods in various countries around the world as it adds pungency, taste, flavour and colour to the dishes. More than 50 varieties of chilli are grown in India. Indian chilli is considered to be well-recognized in the world for two major important commercial qualities *viz.*, colour and pungency levels. There are more than 400 varieties of chilli grown all over the world with '*Carolina reaper*' variety of USA being the hottest chilli in the world. Different varieties of chillies are cultivated for various economic uses like vegetable, pickles, spice, condiments and doubling as a nutraceutical crop (Geetha *et al.* 2017) [5].

Chilli is produced throughout India, making our country the most dominating player in the world market (Velayutham, 2015) [16]. Dry chilli is produced in around 70 countries of the world on an area of about 18,56,641 hectares with total production to 46,25,833 tonnes. India has the largest area and production of dry chilli in the world. During 2017, India has around 45 per cent of world's both area and production of dry chilli. India, Thailand (7.56%), China (6.79%), Ethiopia (6.63%), Ivory Coast (3.39%), Pakistan (3.20%), Bangladesh (2.96%), Myanmar (2.82%), Ghana (2.59%) and Vietnam (2.07%) are the major producers of dry chilli which constitute around 83 per cent of the total world's production (www.faostat.fao.org).

India is the largest producer, consumer and exporter of dry chilli in the world. In India major producers of dry chilli are the states like Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka, West Bengal, Orissa, Gujarat, Assam, Rajasthan, Punjab etc. In the year 2017-18, dry chilli was cultivated on an area of 752 thousand hectares with 2149 thousand MT of production. Andhra Pradesh, Telangana and Madhya Pradesh are the leading producers with Andhra Pradesh having major share of 43 per cent in total India's production (www.indiastat.com). Karnataka stands fourth in production of dry chilli in India. The chilli varieties grown in Karnataka are Byadgi chilli, Sankeshwar, Chincholi, Arsikere, Gowribidanuru, Mysore, Kollegal Javari, G-3, Deluxe *etc.*

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2. Materials and Methods

The secondary data on area, production and productivity of dry chilli was used analyse the growth. The secondary data was collected for the period from 2008-09 to 2017-18. The study is based on the secondary data collected from Statistical Wing, Directorate of Horticulture, Bengaluru, Karnataka. In order to assess the growth in area, production and yield of dry chilli, ten years data from 2008-09 to 2017-18 was used. The compound annual growth rates (CAGR) were estimated by using the exponential function of the form.

$$Y_t = AB^t \cdot U_t \dots\dots\dots (1)$$

Where,

Y_t = Area, production and productivity of dry chilli in the year t

t = 1,2.....n years

U_t = Disturbance term in year “t”

“a” and “b” are the parameters to be estimated

The equation (1) was transformed into log linear form and parameters were estimated by using ordinary least squares (OLS) technique. Compound annual growth rate (g) was then estimated by using the relationship $g = (10^b - 1) * 100$. The growth rate was estimated and tested for its significance with ‘t’ statistics.

The coefficient of variation was used as a measure to study the variability in area, production and productivity of dry chilli in Karnataka. The coefficient of variation (CV) or the index of instability was worked out using the formula given in equation 2.

Standard Deviation

$$CV = \frac{\text{Standard deviation}}{\text{Mean}} \times 100 \dots\dots\dots (2)$$

Linear trend was fitted to the original time series data, for a period of 10 years from 2008-09 to 2017-18. The parameter estimates were tested for their significance. Whenever the

trend of series was found to be significant, the variation around the trend rather than the variation around mean was used as an index of instability. The formula suggested by Cuddy and Della (1978) ^[3] was used to compute the degree of variation around the trend, means coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determination (R^2) in the cases where r^2 was significant to obtain the Instability Index.

$$\text{Instability Index} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100 \times \sqrt{(1 - R^2)}$$

3. Results and Discussion

3.1 Growth in area, production and productivity of dry chilli in Karnataka

The results of growth in area, production and productivity of dry chilli in Karnataka from 2006-07 to 2017-18 are presented in the Table 1. The average area, production and productivity was estimated to be 91243.72 ha, 143650.31 tonnes and 1697.21 kg/ha respectively. The growth rates for the same years were found to be -4.65, 4.68 and 9.79 per cent respectively for area, production and productivity. The negative growth in area is accounted to the decrease in area under major traditionally chilli growing districts (Dharwad and Haveri). The positive and significant growth in production is attributed to the higher production in non-traditional dry chilli growing districts (Bellary, Raichur etc.) which is less susceptible to pests and diseases. The trend in area, production and productivity of dry chilli in Karnataka for the same year is given in Fig.1. The area under dry chilli in Karnataka has decreased over the years and production as a whole has increased over the years, the production was highest during the year 2016-17. The increase in production is due to increase in productivity rather than increase in area (Ramachandra *et al*). It is observed that in some years there is alternate increase and decrease in the area because of the fact that the higher prices in one year incentivize farmers to increase area in the subsequent year which leads to increased production and decreased prices which in turn decrease the area in the upcoming years.

Table 1: Growth in Area, production and productivity of dry chilli in Karnataka (2008-09 to 2017-18)

Years	Area (hectares)	Production (tonnes)	Productivity (kg/ha)
2008-09	123378.00	141927.40	1150.35
2009-10	121500.50	119901.00	986.84
2010-11	107475.00	109701.00	1020.71
2011-12	89984.02	121904.18	1354.73
2012-13	51581.55	122937.64	2383.36
2013-14	78856.25	159976.33	2028.71
2014-15	90819.99	124494.08	1370.78
2015-16	78889.55	179002.06	2269.02
2016-17	104621.36	182947.22	1748.66
2017-18	65331.00	173712.14	2658.95
Mean	91243.72	143650.31	1697.21
S.D	22232.63	26367.92	576.23
CAGR (%)	-4.65 *	4.68 *	9.79 *

*Significant at 5 per cent level

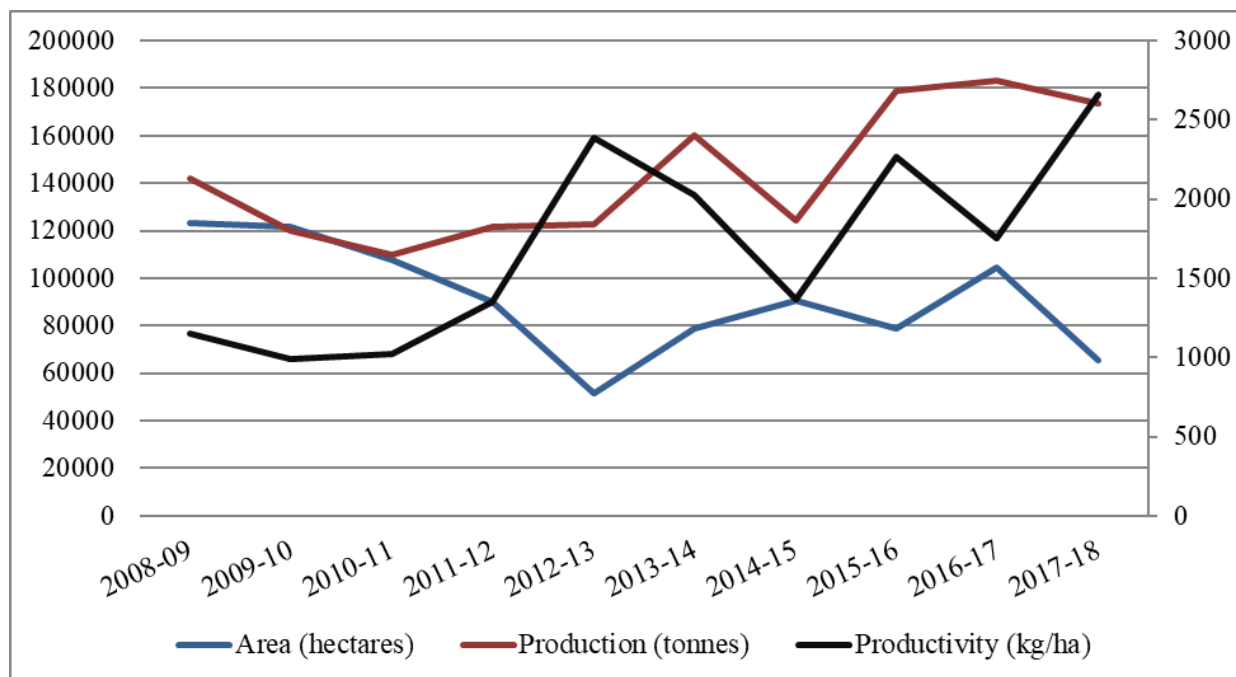


Fig 1: Trend in Area, production and productivity of dry chilli in Karnataka (2008-09 to 2017-18)

3.2 Instability in area, production and productivity of dry chilli in Karnataka

Cuddy Della Index was used to compute the instability in area, production and productivity of dry chilli in Karnataka which is provided in Table. 2. The variation around the trend

(instability index 12.65) and the variation around mean (CV 18.36%) was less in case of production than in area and productivity. The instability was mainly due to the fluctuation in prices, shifting of area under cultivation to other substitute crops etc. (Suman *et al.*2018) [14].

Table 2: Instability in area, production and productivity of dry chilli in Karnataka

Particulars	Area	Production	Productivity
CV (%)	24.37	18.36	33.95
Instability Index	20.78	12.65	21.46

3.3 Area, production and productivity of dry chilli in major districts of Karnataka

The results of district-wise area, production and productivity of dry chilli in Karnataka during the year 2017-18 are presented in the Table 3. which indicate that the total area under dry chilli in Karnataka was 78,699 hectares. The production and productivity were found to be 1,43,308 MT and 1,820.99 kg per hectare for the same year.

Bellary, Dharwad and Haveri districts have highest area under dry chilli with area of about 24,639 ha, 19,231 ha and 15,716

ha respectively. Of the total area under dry chilli, Bellary has 31 per cent of area under dry chilli followed by Dharwad (24.44%), Haveri (19.97%), Gadag (10.10%) and Raichur (5.15%). Even in terms of production, Bellary district stands first with production of about 63,266 MT followed by Haveri and Dharwad districts which have 22,354 MT and 19,231 MT production respectively. Forty-four per cent of production is accounted by Bellary district followed by Haveri (15.60%), Dharwad (13.42%), Gadag (11.55%) and Raichur (5.65%).

Table 3: District-wise area, production and productivity of dry chilli in Karnataka during 2017-18

Sl. No.	Districts	Area (hectares)	Production (MT)	Productivity (Kg/ha)
1	Bellary	24639.00 (31.31)	63266.00 (44.15)	2567.72
2	Dharwad	19231.00 (24.44)	19231.00 (13.42)	1000.00
3	Haveri	15716.00 (19.97)	22354.00 (15.60)	1422.37
4	Gadag	7949.00 (10.10)	16551.00 (11.55)	2082.15
5	Raichur	4050.00 (5.15)	8100.00 (5.65)	2000.00
6	Belgaum	1721.00 (2.19)	4429.00 (3.09)	2573.50
7	Chitradurga	1081.0 (1.37)	1127.00 (0.79)	1042.55
8	Gulbarga	964.00 (1.22)	1646.00 (1.15)	1707.47
9	Chikmagaluru	582.00 (0.74)	582.00 (0.41)	1000.00
10	Yadagiri	525.00 (2.80)	1050.00 (0.73)	2000.00
11	Other districts	2241.00 (2.85)	4973.00 (3.47)	2.22
Total		78699.00	143308.00	1820.99

3.4 Growth in area, production and productivity of dry chilli in major districts of Karnataka

The trend in area, production and productivity of dry chilli in

three major dry chilli growing districts of Karnataka area are given in Fig.2. Fig.3 and Fig.4. As seen above, during 2017-18 Bellary, Dharwad and Haveri are the three major districts

which have more area under dry chilli. So, the trend in area, production and productivity of dry chilli in these districts from 2008-09 to 2017-18 has been presented in the given figures.

Trend in area under dry chilli in Bellary, Dhawad and Haveri districts is given in Fig.2. It was observed that in Bellary district area under dry chilli has been increasing from 2008-09 to 2017-18, in case of Dharwad and Haveri districts declining trend is observed the reason might be occurrence of pest and diseases and the farmers have substituted dry chilli for maize. During the year 2012-13 a steep decline in area in Dharwad districts was observed because of dry spells during the period. Price is one of the important factor wherein the prices prevailing in a particular year will determine the area under dry chilli for the upcoming season.

Trend in production of dry chilli in Bellary, Dhawad and Haveri districts is given in Fig.3. In Bellary district there is increase in production of dry chilli as there is increase in area and because of the irrigation potential existing in the area. In Dharwad and Haveri districts there is slight decrease in production from 2008-09 to 2017-18. In most of the areas of all the three districts, the dry chilli variety grown is Byadgi, so the higher production in Bellary is attributed to irrigation condition.

Trend in productivity of dry chilli in Bellary, Dhawad and Haveri districts is given in Fig.4. The productivity also followed the same pattern as that of trend in production in these districts. The productivity of Byadgi dry chilli in irrigated condition is around 14-20q per hectare and 8-12q per hectare in rainfed areas.

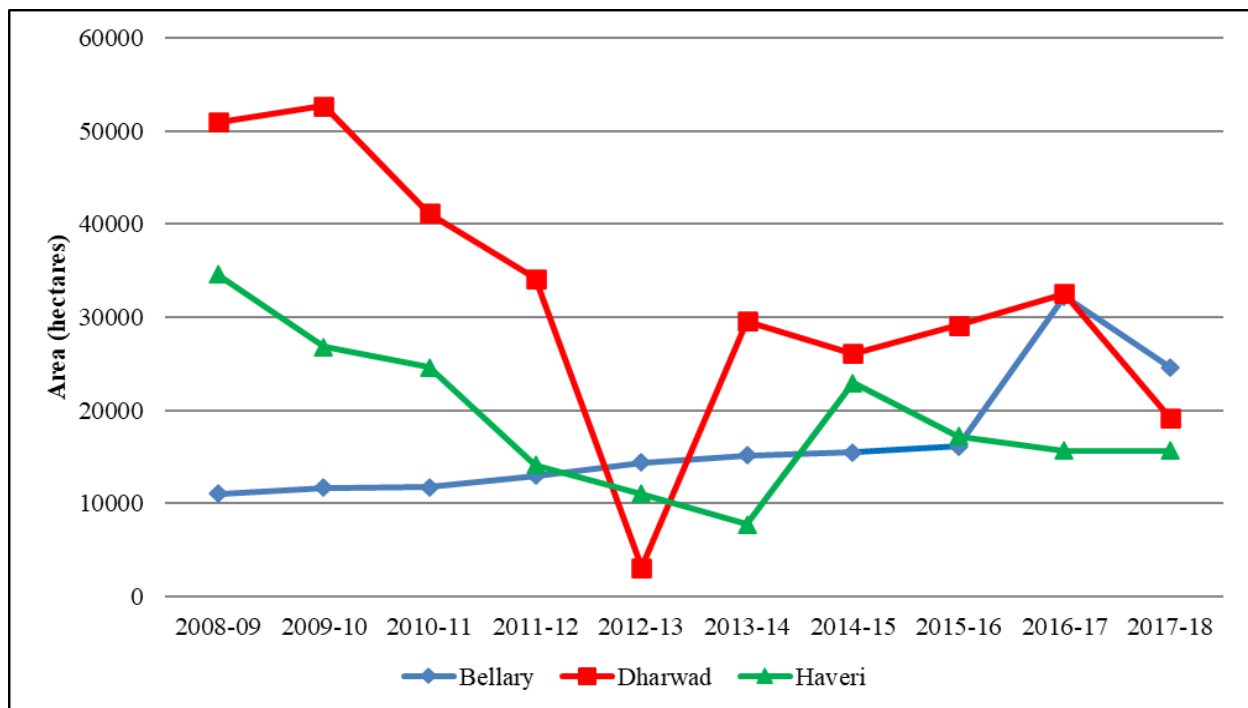


Fig 2: Trend in area under dry chilli in three major districts of Karnataka (2008-09 to 2017-18)

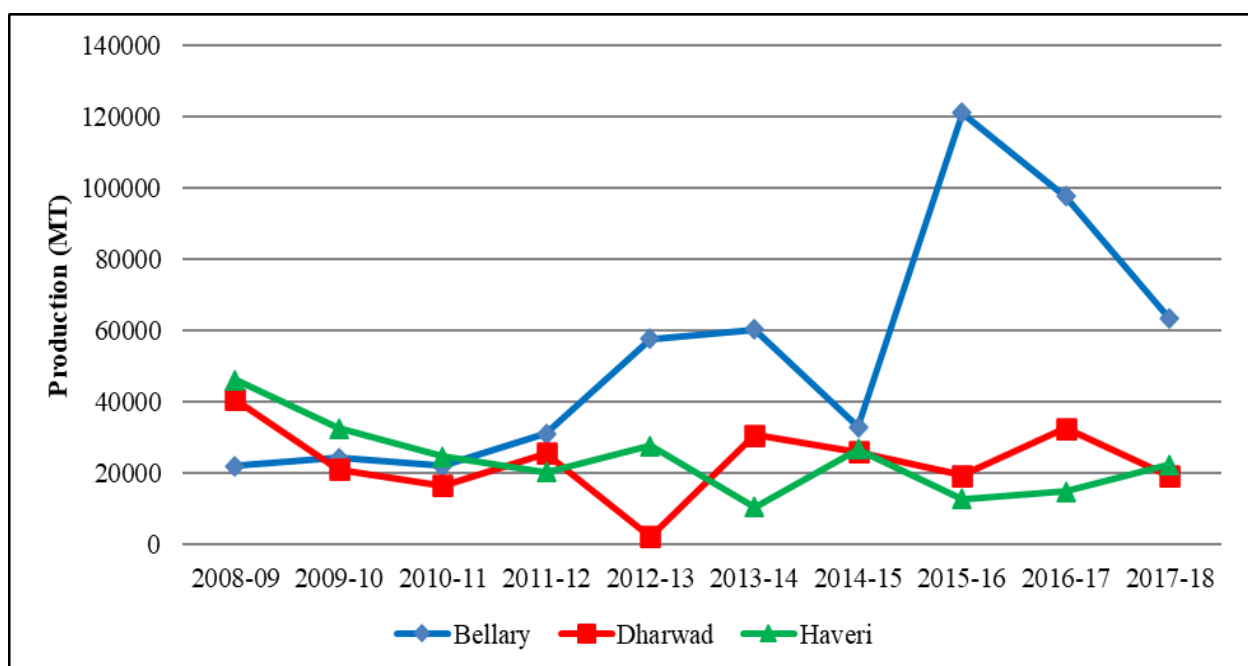


Fig 3: Trend in production of dry chilli in three major districts of Karnataka (2008-09 to 2017-18)

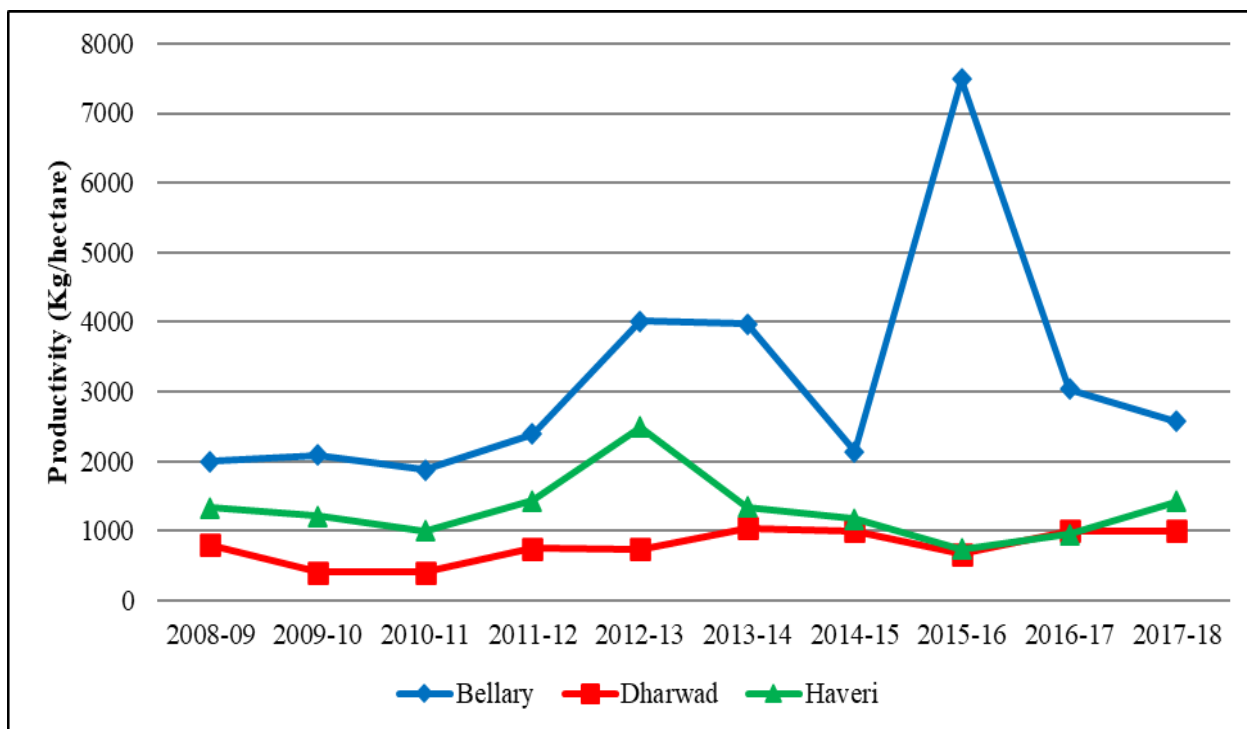


Fig 4: Trend in productivity of dry chilli in three major districts of Karnataka (2008-09 to 2017-18)

The compound annual growth rate of area, production and productivity in major districts i.e. Bellary, Dharwad, Haveri, Gadag, Raichur, Belagavi, Chitradurga, Kalburgi, Chikamagaluru and Yadgiri districts of Karnataka for the period 2008-09 to 2017-18 is indicated in Table 4.

The table depicts that among the ten districts; maximum growth rate in area (10.52%) and production (18.45%) was observed in Bellary district and was found to be positively significant. This might be because farmers have undertaken Byadgi dry chilli cultivation as the commodity has gained popularity in recent years and because of the fact that it fetches higher price. As Bellary district is a non-traditional area, less susceptibility to pest and diseases and production of dry chilli under irrigated condition was found to be the cause for growth in production. Negative and significant growth in area was seen in Belagavi (-4.23%) and Chitradurga (-2.07%)

districts. Negative growth was also observed in districts which have highest area under dry chilli like Dharwad (-7.27%) and Haveri (-6.75%) districts. It was observed that growth rate in production in Raichur was positive and significant (10.18%) and was also noticed that in Haveri (-8.94%), and Dharwad (-0.19%) districts which have highest production of dry chilli, the growth rate in production was negative. Dharwad and Haveri districts are the traditional areas producing dry chilli and they are more susceptible to pest and diseases in general and murda complex in particular, therefore negative growth rate both in area and production was observed. The growth rate in productivity was found to be positive and significant in Yadgiri district. Irrigation was found to be the reason for increase in productivity (Acharya *et al.* 2012) [1].

Table 4: Compound annual growth rate of area, production and productivity of dry chilli in major districts of Karnataka (2008-09 to 2017-18)

Sl. No.	Districts	Compound Annual Growth Rate (%)		
		Area	Production	Productivity
1	Bellary	10.52*	18.45*	7.18
2	Dharwad	-7.27	-0.19	7.63
3	Haveri	-6.75	-8.94	-2.35
4	Gadag	-5.29	-1.22	4.29
5	Raichur	7.76	10.18*	2.25
6	Belagavi	-4.23*	-1.72	2.63
7	Chitradurga	-2.07*	2.06	4.22
8	Kalburgi	2.44	6.20	3.67
9	Chikamagaluru	-8.17	-9.47	-1.41
10	Yadgiri	-10.40	0.57	12.25*

*Significant at 5 per cent level

4. Conclusion

There is a declining trend in area which is observed in Dharwad and Haveri districts and increasing trend in Bellary district (non-traditional area). But there is decrease in overall area under dry chilli and the production is found to be increasing over the years indicating the increased supply to

the markets. So there is need to upgrade the existing market infrastructure at the specialized markets. Since the production of dry chilli in Bellary district is showing maximum growth rate, it is necessary to develop required infrastructure for marketing and processing of dry chilli in Bellary district.

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