

RESEARCH ARTICLE :

Growth and instability analysis of onion and garlic in India

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SUMMARY : Onion (*Allium cepa*) and Garlic (*Allium sativum*) are important vegetable and spice commodities grown all over the world. These crops are grown in different parts of the country mainly by small and marginal farmers. Onion and garlic are used as spice, condiment and vegetable almost daily, because of special pungency, they have more value for seasoning a wide variety of dishes. Dehydrated flakes or powder are in great demand both in domestic and export markets. This study was mainly based on secondary data, the data were collected from National Horticulture Research and Development Foundation and National Horticulture Board and analyzed using compound annual growth rate (CAGR) and instability index. The study revealed that for onion, area, production and productivity CAGR was highest in the last ten years. There was a positive growth in area and productivity of onion in India and Karnataka. Attempt has to be made in order to see that popularization of improved varieties, quality seed production and distribution, expansion of area in nontraditional pockets and contract production for export. Productivity of garlic expressed the negative trend which can be enhanced through improved cultural practices, distribution of planting materials, disease control measures, and selection of appropriate crop according to agro climatic conditions and irrigation facilities.

KEY WORDS :

Growth rate,

Instability index,

Area, Production,

Productivity

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BACKGROUND AND OBJECTIVES

Onion and garlic are important vegetable and spice commodities grown all over the world. Onion is crop of mass consumption round the year all over the world. The pungency in onion is due to the presence of sulphur compounds. Onion has several medicinal properties. Garlic is also used as a condiment and is rich in proteins, phosphours, potash, calcium, magnesium and carbohydrates. Garlic is also known to possess insecticidal property.

World onion production in 2015 was 863.44 lakh tons with an average productivity of 19.79 t/ha (Source: FAOSTAT, 2015). China (226.00 lakh tons) and India (163.09 lakh tons) are the major onion producers followed by USA (32.77 lakh tons), Iran (22.60 lakh tons), Russian Federation (20.81 lakh tons), etc. The productivity of onion is maximum in USA (54.62 t/ha) followed by Iran (31.83 t/ha), Russian Federation (22.59 t/ha), China (22.05t/ha), India (17.01 t/ha) etc. There is a steady increase in the demand for onion across

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the world. China is the leading producer of onion constituting about 35 per cent of the world total production followed by India (26 %), USA (5%), Iran (4%), Russian Federation and Pakistan 3 per cent each and Ukraine, Myanmar, Bangladesh and Nigeria 2 per cent each. In case of garlic China and India have remained the top 2 global garlic producers for the last 5 years. Uzbekistan, Egypt, China have shown highest yields/ha. Worldwide in 2014-15, garlic production was 2226 Lakh MT (Source: APEDA Agri. Exchange). China is world leader in production (86.07%), followed by India (5.62%). India, although second by production, is among the lowest as far as productivity is concerned. The low productivity of garlic in India can be mainly attributed to the non-availability of virus free planting material, which is of utmost importance in a vegetatively propagated crop like garlic.

Indian onion and garlic scenario :

Onion is produced in all the States in India, the key onion producing states are Maharashtra, Karnataka, Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh and Bihar which together constitute around 70 per cent of the area under onion in the country. Maharashtra accounts for 37.22 per cent of the cultivated area, contributing about 28.62 per cent of the Indian production. Karnataka with 11.80 per cent and Madhya Pradesh with 10.71 per cent of cultivated which area account for 15.94 and 15.84 per cent of Indian onion production, respectively as per National Horticulture Research and Development Foundation (NHRDF). The top five onion producing states include Maharashtra, Karnataka, Gujarat, Bihar and Madhya Pradesh accounting for about 70 per cent of the total production. The area, production and productivity of garlic in India are very low due to unawareness of farmers about improved varieties, climate, soil and agro-techniques, diseases and pest damaging the crops and their control measures as well as post-harvest management are though main reasons, inadequate market support is also responsible for limiting the area, production and productivity indirectly. During 2014-15, garlic was grown on 2.44 lakh hectares with a total production of 12.91 lakh tons (Source: NHRDF, 2015). Madhya Pradesh, Gujarat, Rajasthan, Uttar Pradesh, Assam, Punjab, Maharashtra, West Bengal and Orissa are the main garlic growing states. Gujarat and Madhya Pradesh produce 40 per cent of country's garlic. Karnataka, Bihar, Tamil Nadu, Punjab, Haryana and Andhra Pradesh also produce sizeable quantity of garlic

in cooler regions of the states.

Onion and garlic scenario in Karnataka :

Karnataka is the second largest onion-growing state in the country. Onion occupies 11.80 per cent of total area sown in Karnataka. As per the Department of Horticulture, Bangalore the compiled Horticulture Crop Statistics of Karnataka State 2013-14, the major top ten onion growing districts in Karnataka are Vijayapur (3564 thousand MT), Chitradurga (2555 thousand MT), Gadag (2230 thousand MT), Bagalkot (2007 thousand MT), Haveri (1917 thousand MT), Belgaum (1420 thousand MT), Chikmanglore (1056 thousand MT), Ballary (1031 thousand MT), Dharwad (610 thousand MT), and Davanageri (554 thousand MT). There are fluctuations in onion production over the years. The same trend is also seen with area and productivity. Yields of onion were higher in the case of Uttar kannada (29.35 MT/ha) followed by Ramanagar (24.14 MT/ha) and Koppal (23.08 MT/ha). Due to lower yields, though Karnataka has the highest area under onion, it stands second in the production of onion in the country. Hence, there is a lot of potential for increasing the production of onion by improving the yields. Karnataka is the twelfth largest garlic producing state in the country. Garlic in Karnataka (5.19 thousand ha) occupies 0.42 per cent of total area sown in India (244.07 thousand ha). As per the Department of Horticulture, Bangalore, the compiled Horticulture Crop Statistics of Karnataka State 2013-14, the major top ten garlic growing districts in Karnataka are Haveri (228 thousand MT), Belgaum (60 thousand MT), Bijapur (54 thousand MT), Bidar (22 thousand MT), Mandya (7 thousand MT), Bagalkot (7 thousand MT), Gadag (6 thousand MT), Chamarajnagar (6 thousand MT), Gulbarga (6 thousand MT), and Chikkballapur (3 thousand MT). Yields of garlic were higher in the case of Chikkaballapur (11.64 MT/ha) followed by Bagalkot (10.21 MT/ha) and Bangalore (8.36 MT/ha). In the light of the above, the present study is proposed with the following specific objectives

Objective of investigation:

To estimate the growth in area, production and productivity of onion and garlic in India and Karnataka.

RESOURCES AND METHODS

The data used for the study was based on the

secondary sources. The data on area, production and productivity of onion and garlic were compiled from different sources like, National Horticultural Research and Development Foundation (NHRDF). National Horticulture Mission (NHB), Directorate General of Commerce Intelligence and Statistics (DGCIS), published journals, periodicals and official websites from 1995 to 2014 for the period of 20 years (Post WTO period), depending upon data availability and hence there is some extent of bias. However, efforts were made to minimize such bias through cross validation during data collection.

Growth rate analysis:

To analyze the CAGR (Compound Annual Growth Rate), the exponential form of regression analysis was employed. Analysis was done separately for India as a whole and state wise the details of the functional analysis are given below.

To compute average compound growth rates of area, production and productivity, the following form of regression equation was used.

$$Y_t = AB^t V_t \quad \dots \dots \dots (1)$$

where, Y_t = data on area, production and productivity in the year 't'.

A = intercept indicating Y in the base period (t=0).

T = time period

V_t = error term

$B = (1+g)$

g = average compound growth rate to be estimated.

Equation (1) was converted into logarithmic form in order to facilitate the use of linear regression.

Taking logarithms on both sides of the equation (1)

$$\ln Y = \ln A + t (\ln B) + \ln V_t$$

This can be written in the following form

$$Q_t = a + bt + U_t \quad \dots \dots \dots (2)$$

where, $Q_t = \ln Y_t$

a = $\ln A$

b = $\ln B$

$U_t = \ln V_t$

The values of 'a' and 'b' are estimated by using ordinary least squares estimation technique.

Later, the original 'A' and 'B' parameters in equation (1) were obtained by taking anti-logarithms of 'a' and 'b' value as

A = anti $\ln a$

B = anti $\ln b$

Average annual compound growth rate was calculated as

$$g = (B-1) \times 100$$

The significance of the regression co-efficient was tested using student's 't' test.

Instability index :

In order to study stability in onion and garlic with respect to area, production and productivity, co-efficient of variation was estimated using the expression given below.

$$CV (\%) = \frac{\text{Standard deviation (SD)}}{\text{Mean (x)}} \times 100$$

OBSERVATIONS AND ANALYSIS

To understand the growth performance and relative contribution of basic components of onion and garlic production in India and Karnataka during the period 1995-96 to 2014-15 time series data on area, production and productivity were analyzed. Table 1 indicates the growth in area, production and productivity in India from 1996 to 2015. It is evident from the table that area which was

Table 1 : Growth rate of area, production and productivity of onion in India

Year	Area ('000 ha)	Production (in '000 MT)	Yield (Ton/ha)
1995-96	396	4080	11
1996-97	410	4428	11
1997-98	355	3201	10
1998-99	468	5332	11
1999-00	493	4899	11
2000-01	422	4551	12
2001-02	452	4831	12
2002-03	435	4506	11
2003-04	503	5923	10
2004-05	549	6435	9
2005-06	662	8683	10
2006-07	702	8885	10
2007-08	704	9138	10
2008-09	835	13588	16
2009-10	757	12191	16
2010-11	1064	15118	14
2011-12	1087	17511	15
2012-13	1052	16813	15
2013-14	1088	18981	15
2014-15	1192	19357	16
CAGR	6.71	10.12	2.23
R ²	0.92	0.92	0.48
Instability	40.93	59.04	19.79

396 thousand hectare has increased to 1192 thousand hectare with the growth rate of 6.71 per cent per annum which is supported by the time variable with 92 per cent. In case of production it was noticed the highest growth rate with 10.12 with the explained variable of time with 92 per cent. For the yield also it was calculated which happened to be 2.23 per cent per annum with the time variable explaining to the tune of 48 per cent. In order to assess the consistency of growth performance it becomes impressive to study instability index for onion during the study period the area, production and productivity of onion in India. For area it was observed 40.93 per cent of variation, production 59.04 per cent variation and 19.79 per cent variation for productivity. It was observed in instability index, with respect to India variation was much observed in case of production which is mainly due to farmers changing the varieties of onion in production.

Table 2 indicates the growth in area, production and productivity of onion in Karnataka. The growth rate in area registered to be 3.63 per cent with the time variable explaining to the tune of 63 per cent. In case of production

which happened to be 11.03 per cent increase per annum which was the highest among area and productivity. The same was explained by the time variable with the value of 77 per cent. In case of yield growth rate which registered to be 7.14 per cent with the time variable explaining to the extent of 60 per cent. The instability index for Karnataka, with respect to area it was observed 24.53 per cent variation, production to be 70.15 per cent and productivity to be 52.98 per cent variation. The instability variation was more in production that means the farmers are more inclined towards high yielding varieties of onion which may result in success or failure of the crop since the crop is one among the irrigated crop and volatility in the market price results in area instability (Dhakre and Bhattacharya, 2013 and Dhakre and Sharma, 2009).

Table 3 depicts the growth in area, production and productivity in India from 1996 to 2015. It is evident from the table that area which was 114.8 thousand hectare has increased to 230.59 thousand hectare with the growth rate of 5.12 per cent per annum which is supported by the time variable with 87 per cent. In case of production

Table 2 : Growth rate of area, production and productivity of onion in Karnataka

Year	Area ('000 ha)	Production (in '000 MT)	Yield (Ton/ha)
1995-96	79	440	6
1996-97	85	559	7
1997-98	91	517	6
1998-99	94	508	5
1999-00	126	595	5
2000-01	120	665	6
2001-02	126	721	6
2002-03	115	536	5
2003-04	101	361	4
2004-05	136	856	6
2005-06	151	870	6
2006-07	151	859	6
2007-08	182	1107	6
2008-09	165	3032	18
2009-10	141	2266	16
2010-11	191	2592	14
2011-12	177	2451	14
2012-13	160	2396	15
2013-14	137	2065	15
2014-15	141	2126	15
CAGR	3.63	11.03	7.14
R ²	0.63	0.77	0.60
Instability	24.53	70.15	52.98

Table 3 : Growth rate of area, production and productivity of garlic in India

Year	Area ('000 ha)	Production (in '000 MT)	Yield (Ton/ha)
1995-96	114.80	490.00	4.49
1996-97	96.60	451.50	4.93
1997-98	108.80	484.40	4.78
1998-99	123.20	570.80	4.37
1999-00	118.8	495.30	5.01
2000-01	103.08	487.80	6.42
2001-02	115.72	530.80	6.52
2002-03	112.45	468.31	5.14
2003-04	138.90	691.10	4.61
2004-05	144.10	646.60	4.44
2005-06	134.90	598.20	4.34
2006-07	159.20	776.26	5.96
2007-08	205.08	1068.42	5.11
2008-09	164.92	876.75	4.90
2009-10	166.48	890.11	6.06
2010-11	200.19	1057.84	4.67
2011-12	245.16	1225.50	4.79
2012-13	247.52	1259.27	4.38
2013-14	247.52	1,259.27	4.38
2014-15	230.59	1251.88	4.51
CAGR	5.12	6.30	-0.35
R ²	87	88	72.00
Instability	32.85	39.18	13.93

it was noticed the growth rate of 6.30 with the explained variable of time with 88 per cent and the yield is calculated which happened to be -0.35 per cent per annum decline with the time variable explaining to the tune of 72 per cent. Instability index indicated that in case of area it was 32.85 per cent, production 39.18 and productivity was around 13.93 per cent at the country level (Immanuelraj *et al.*, 2014 and Kumari and Basavaraja, 2015).

Table 4 indicates, the growth in area, production and productivity of garlic in Karnataka. The growth rate in area registered to be 1.37 per cent with the time variable explaining to the tune of 63 per cent. In case of production which happened to be 5.66 per cent increase per annum which was the highest among area and productivity. The same was explained by the time variable with the value of 54 per cent. In case of yield growth rate which registered to be 4.22 per cent with the time variable explaining to the extent of 61 per cent. The instability index in the Karnataka state were extreme variations that is with respect to area it was 17.81 per cent, production to be 37.17 per cent and productivity was

38.03 per cent. The variation in area and production was high which was only due to the majority of the farmers are shifting from garlic crop to other commercial crop. Since the garlic crop is highly susceptible towards the diseases and it is difficult to control the disease. It was also observed that instability was at par in production and productivity. Variation in production was due to the cultivation practices with different varieties of garlic that were produced in the state.

Policy implication :

There was a positive growth in area and productivity of onion in India and Karnataka. Attempt has to be made in order to see that popularization of improved varieties, quality seed production and distribution, expansion of area in non-traditional pockets and contract production for export. Productivity of garlic expressed the negative trend which can be enhanced through improved cultural practices, distribution of planting materials, disease control measures, and selection of appropriate crop according to agro climatic conditions and irrigation facilities.

Table 4 : Growth rate of area, production and productivity of garlic in Karnataka

Year	Area ('000 ha)	Production (in '000 MT)	Yield (Ton/ha)
1995-96	4.00	3.10	0.78
1996-97	4.00	3.00	0.75
1997-98	5.10	3.80	0.75
1998-99	3.60	3.00	0.83
1999-00	4.90	3.60	0.73
2000-01	3.90	4.00	1.03
2001-02	3.90	4.00	1.03
2002-03	5.30	4.00	0.75
2003-04	4.00	2.90	0.73
2004-05	5.10	3.50	0.69
2005-06	4.90	3.50	0.71
2006-07	7.00	4.00	0.57
2007-08	6.00	4.00	0.67
2008-09	5.63	4.16	0.74
2009-10	5.10	31.8	6.24
2010-11	5.70	5.76	1.01
2011-12	5.69	6.00	1.05
2012-13	4.22	4.50	1.07
2013-14	4.73	8.42	1.78
2014-15	4.73	8.42	1.78
CAGR	1.37	5.66	4.22
R ²	63	54	61
Instability	17.81	37.17	38.03

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REFERENCES

- Dhakre, D.S.** and Bhattacharya, D. (2013). Growth and Instability analysis of vegetables in West Bengal, India, *Internat. J. Bio-resource & Stress Mgmt.* **4**(3) : 456-459.
- Dhakre, D.S.** and Sharma, A. (2009). Growth and instability analysis of Ginger production in North-East Region. *Agric. Situ. India*, **66** : 463-466.
- Immanuelraj, T.K.**, Dastagiri, M.B. and Sajesh, V.K. (2014). Growth and instability of onion production in Maharashtra, India. *J. Glob. Econ.*, **2** : 107.
- Kumari, Premlata** and Basavaraja, H. (2015). Impact of climate change on growth and variability in area, production and productivity of major vegetables in India, *Karnataka J. Agric. Sci.*, **28**(5): 807-809.

WEBLIOGRAPHY

- www.dogr.res.in
- www.nhrdf.org.in
- www.nhb.org.in