Growth and Decomposition of Onion Production in Maharashtra, India

ABSTRACT

The study was aimed to investigate the growth, instability and decomposition of onion in Maharashtra. The data of area, production and productivity of onion pertaining to 30 years (1989-90 to 2018-19) were made available through the secondary source of NHRDF which was further analysed using exponential function, Cuddy Della Valle's Index and decomposition analysis model. The results of the study disclosed that, there was positive and significant growth of area, production and yield of onion during overall study period with annual growth rates of 8.43 per cent, 9.36 per cent and 0.85 per cent, respectively. There was high instability during overall period for area and production while, productivity showed a stability with low instability value of 12.89 per cent. The decomposition analysis indicated that the area under onion cultivation played an important role for the rise in production of onion with 62.80 per cent of area effect, 4.97 of yield effect and 32.21 per cent of the interaction effect during overall study period. The results of decomposition analysis have important policy implications because each growth component alone has a limited scope to expand overtime. There is need for horticulturists, breeders and entomologists which are working in the SAU and ICAR institutes to pay attention and find some technological breakthrough to increase the productivity of onion in the state.

Key Words: Growth Rate, Instability, Cuddy Della Valle's Instability Indices, Decomposition, Onion

Introduction

Onion (*Allium cepa L*) is one of the most important vegetables in the consumption basket of people, across the length and breadth of the country as well as across the socio-economic strata of society. Onion is believed to have originated in Asia, though it is likely that onions may have been growing wild on every continent. Onion cultivars are consist about 89 per cent water, 4% sugar, 1 per cent protein, 2 per cent fiber and 0.1 per cent fat. They are high in vitamin C, vitamin B6 and folic acid and are a good source of dietary fiber. They are very low in fats and in sodium, and with an energy value of 166 kJ (40 kcal) per 100 g (3.5 oz) serving.

The worldwide production of Onion is 999.68 Lakh tonnes which is cultivated on an area of over 51.93 Lakh ha with productivity of 19.25 tonnes/ha. The major onion producing countries are China, India, USA, Egypt, Turkey, Pakistan, Sudan, Bangladesh, Iran and

Russia. These ten major countries account for around 66 per cent of total global onion production. China stood at first position among the major onion producing countries followed by India with an area of 12.20 Lakh ha, 228.19 Lakh tonnes of production and 18.70 tonnes/ ha of productivity. These two countries together contributes nearly 50 per cent of global area and production of onion (FAO, 2021).

Maharashtra ranks first in Onion production with a share of 29.55%. It produces about 8087 thousand ton of onion from 450-thousand-hectare area with the productivity of 17.88 ton/ha (NHRDF, 2018-19). The state of Maharashtra is, therefore, called onion basket of India.

The paper has worked out the subsequent objectives: 1) To analyse the growth rates of area, production and productivity of onion in Maharashtra, 2) To work out instability of area, production and productivity of onion in Maharashtra and 3) To estimate relative contribution of area and yield to change in the output of onion in Maharashtra.

MATERIALS AND METHODS

The current study was based on secondary time series data of area, production and productivity of onion pertaining to 30 years starting from 1989-90 to 2018-19, which was collected from NHRDF. The selected study period was divided as; period I: 1989-90 to 1998-99, period II: 1999-00 to 2008-09, period III: 2009-10 to 2018-19 and Overall period: 1989-90 to 2018-19. The tools that were used for the analysis of the data to fulfill the objectives are:

1. Growth rate

The compound annual growth rate (CAGR) of onion were estimated for area, production and productivity spanning to 30 years (1989-90 to 2018-19). The CAGR for the same were carried out using the exponential model as mentioned below-

$$Y = a.b^t \quad \text{..... (1)}$$

Where,

Y = Depended variable for which growth rate is to be estimated

a = Intercept

b = Regression Coefficient

t = Time Variable

Transforming equation (1) as follows

$Log_y = Log_a + t\ Log_b$ ……..... (2)

Then the per cent compound growth rate (g) was computed using the relationship.

CAGR = [Antilog (log b)-1] × 100 …….. (3)

The significance of the regression coefficient was tested using the student's' 't' test.

I. Instability

To compute the instability of onion in terms of its area, production and productivity, Coefficient of Variation (CV) and Cuddy Della Valle's instability indices were utilized.

$$CV = \frac{\sigma}{\bar{x}} \times 100$$

Where,

σ = Standard deviation

$\bar{x}$ = Arithmetic mean

The Coefficient of Variation (C.V) often contains the trend component which over estimates the instability level in time series data, therefore to over-come this problem, Cuddy Della Valle's instability (CDVI) was used.

$$CDVI = CV\sqrt{(1 - R^2)}$$

Where,

CV = Simple Estimates of coefficient of variation in per cent and

R^2= Coefficient of determination from a time trend regression (linear) adjusted by the number of degree of freedom.

II. Decomposition analysis

The relative contribution of area and yield to the total output of the onion crop, Minhas (1964) Decomposition analysis model was used which is given below.

$Po = A_0 \times Y_0$ and

$Pn = A_n \times Y_n$ ---------- (1)

A_0, Po and Y_0- area, production and productivity in base year

A_n, Pn and Y_n- values of the respective variable in nth year item respectively.

Where,

A_0 and A_n- Area

Yo and Y_n- yield

$Pn - Po = \Delta P$

$A_n - Ao = \Delta A$

$Y_n - Yo = \Delta Y$ ---------- (2)

Equation (1) and (2) can be written as,

$$Po + \Delta P = (Ao + \Delta A)\ (Yo + \Delta Y)$$

Hence,

$$P = \frac{Ao\ \Delta Y}{\Delta P} \times 100 + \frac{Yo \Delta A}{\Delta P} \times 100 + \frac{\Delta Y \Delta A}{\Delta P} \times 100$$

(Production= Yield effect + area effect + interaction effect)

RESULTS AND DISCUSSION

Compound annual growth rate of onion

The period wise compound growth rates of area, production and productivity of onion in Maharashtra have been presented in Table 1. During period I the growth rate of area and production found to be positive i.e. 4.28 and 2.30 per cent per annum, respectively. While, productivity registered negative growth rate i.e. -1.90 per cent per annum. The probable reason for negative growth of onion productivity during the period was unavailability of high yielding quality seeds, sub-optimal standards of cultivation adopted by onion cultivars and susceptibility of the crop to pests and diseases (Immanueiraj, et al, 2014).

During period II there was increase in the growth rate of production (11.15 per cent per annum) which may be due to the significant rise in growth rate of area by 10.15 per cent per annum with 1.34 per cent non-significant growth of productivity.

During period III the growth rate of production significantly increased at a decreasing rate of 9.12 per cent per annum, which might be due to the decrease in area under onion crop and this was also registered through the significantly lowered growth rate (7.84 per cent per annum) of area during the same period, while productivity registered a growth of 1.52 per

cent per annum that was no doubt more than period II. The increase in productivity might be due to the

Table 1. Compound growth rate of onion in Maharashtra

(per cent)

Sr. No.	Period	Particulars	CAGR	t-value
1	Period I	Area	4.28	1.58
		Production	2.30	0.67
		Yield	-1.90	-1.62
2	Period II	Area	10.15**	7.35
		Production	11.62**	5.74
		Yield	1.34	1.36
3	Period III	Area	7.48*	2.76
		Production	9.12**	5.77
		Yield	1.52	0.81
4	Overall	Area	8.43**	17.72
		Production	9.36**	17.02
		Yield	0.85**	3.16

Note: *- 5% level of significance and **- 1% level of significance.

The growth rates of onion (area, production and productivity) were significantly positive at 1 per cent level during the overall study period. In the period production was increased by 9.36 per cent per annum with increased in area and productivity i.e. 8.43 and 0.85 per cent per annum, respectively.

Hence, it can be concluded from the discussion that there was positive growth in area and production of onion crop in Maharashtra during study period. the production of onion has increased mainly due to area expansion rather than any technological breakthrough, as indicated by the growth rate of land productivity, which was often less than two per cent or negative.

Instability in Onion

In order to study the variability in area, production and productivity of onion for period I, period II, period III and overall period, CV and CDVI were worked out and results are presented in Table 2.

Table 2. Instability indices of onion in Maharashtra

Sr. No.	Period	Particulars	Area	Production	Yield
1	Period I	CV	25.40	26.67	10.98
		CDVI	21.70	25.13	9.54
2	Period II	CV	33.05	40.55	9.70
		CDVI	13.32	19.58	8.71
3	Period III	CV	25.61	27.81	16.69
		CDVI	17.73	11.57	15.99
4	Overall	CV	73.49	80.42	15.16
		CDVI	30.35	32.57	12.89

Table 2 depicted that, during period I, period II, period III and overall period production exhibited highest variability with coefficient of variation (26.67, 40.55, 27.81 and 80.42 per cent, respectively). While productivity recorded lowest variability with coefficient of variation (10.98, 9.70, 16.69 and 15.16, respectively). A notable thing in overall period, area instability was larger with coefficient of variation (73.49 per cent) whereas, during period I, period II and period III coefficients of variation were (25.40, 33.05 and 25.61 per cent, respectively).

In cuddy Della Valle's Instability Index also production exhibited highest instability with CDVI during period I & II and overall period (25.13, 19.58 and 32.57 per cent, respectively). Even the lowest variability was registered in productivity during period I & II and overall period with CDVI (9.54, 8.71, and 12.89 per cent, respectively). Whereas, in period III, lowest instability was noticed for onion production (11.57 per cent). While during period III area recorded highest instability (17.73 per cent). The reason for high instability in area may be due to volatility in the market price during the study period (Kale et al, 2016).

Decomposition analysis in onion production.

In this aspect, an attempt has been made to find out the contribution of area and productivity over the change in onion production.

Table 3. Contribution of area, yield and their interaction over change in Onion production of Maharashtra.

Sr. No.	Period	Area Effect	Yield Effect	Interaction
1	Period I	109.5	-5.49	-3.98
2	Period II	66.9	14.90	18.18
3	Period III	80.3	8.78	10.97
4	Overall	62.8	4.97	32.21

The Table depicts that, during all the study periods area effect was the most responsible factor for increasing production of onion in Maharashtra. The highest area effect was observed during period I i.e. 109.5 per cent with negative yield and interaction effect i.e. -5.49 and -3.98 per cent, respectively. While during period II and period III the area effect were (66.9 and 80.3 per cent, respectively with yield effect (14.90 and 8.78 per cent, respectively) and interaction effect (18.18 and 10.97 per cent, respectively). During overall period area, yield and interaction effect were recorded as 62.8, 4.97 and 32.21 per cent, respectively.

Thus, overall area effect had played an important role in the variation of onion production in Maharashtra during the study periods.

CONCLUSION

The result of this study leads to the conclusion that, the growth rates were positive in area and production of onion crop in Maharashtra. There was high instability in area and production of onion during all the study periods while there was stability in yield of onion crop in Maharashtra during the study periods. Area effect played a dominant role on onion production in Maharashtra during the study period. The results of decomposition analysis have important policy implications because each growth component alone has a limited scope to expand overtime. For example, land's growth potential (the acreage effect) is limited due to the scarce supply of water resources. If the current yield trends continue, the growth in crops production will decline overtime because of the limitations on land growth potential. There is need for horticulturists, breeders and entomologists which are working in the SAU

and ICAR institutes to pay attention and find some technological breakthrough to increase the productivity of onion in the state.

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