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Growth and Instability in Garlic Area, Production and Yield in Southern Rajasthan

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ABSTRACT: Garlic (*Allium sativum*) is one of the important horticultural crop which belong to Alliaceae family and occupies important position in bulbous spice category after onion. It has medicinal and nutritive value and widely consumed bulbous spice crops. The present study is based on secondary data. The secondary data related to area, production and yield of garlic were collected to analyze compound annual growth rate of garlic from 2008-09 to 2020-21 from various sources. The performance of garlic was analyzed by calculating growth rate and instability index in area, production and yield of garlic crop. The results of present study revealed that the area and production of garlic crop were found positive growth rate but in case of yield, it's positive and significant growth rate during this time period. The higher growth rate and instability was registered in case of production as compared to area and yield of garlic over the period of time.

Keywords: Compound growth rate, instability index, bulbous spices, area and production, positive, significant.

INTRODUCTION

Garlic *(Allium sativum)* is one of important bulbous spices. It is medicinal and widely consumed bulbous spice crops of *Amaryllidaceae* (Alliaceae) (Patidar *et al*., 2018). It is the second most widely cultivated crop in the family Alliaceae after onion (Ahmed *et al.*, 2007). Garlic is also known by a lot of names likes alho, Knoblauch, toi, bawang, poondoo, ail, aglio, katiem, thum, knoflook, lasun, chesnok, gratiem, sarmisak and lehsun. *Allium sativum* was originated and introduced in India from Central Asia about3000 years and later spread to the Mediterranean regions. Garlic is hardy, bulbous, rooted, perennial plant with narrow flat leaves and bears small white flowers and bulbils (Spices board of India, Indian spices.com). *Allium sativum* is commercially grown in China, India, South Korea, Egypt and Russia, USA, Spain, Thailand and Turkey (Innvista, 2005). In India, *Allium sativum* is widely grown in Madhya Pradesh, Gujarat, Orissa, Rajasthan, Uttar Pradesh and Maharashtra states. India is the second largest producer of garlic in the world (FAOSTAT-2020). Garlic holds fifth position in the area under cultivation among vegetable crops in India (Patidar *et al.*, 2018). In India, total area under Garlic cultivation was 385324 hectare in 2021-22 which led to production of 3164.63 thousand Tonnes. In India, Madhya Pradesh obtained first position in term of area and production of garlic which has total area of 196100 hectares and total production of 2016.13 thousand Tonnes in 2021-22. Whereas Rajasthan had an area of 90,926 hectares with production of 539.18 thousand Tonnes under garlic cultivation during 2021-22. (National Horticulture Board, 2021-22). Garlic is most important spices crop and foreign exchange earner in India. It is also exported to Pakistan, Thailand, USA, Nepal, Bangladesh and Malaysia (RuTAG, 2019). In India, total export of garlic is 22181 Tonnes with 18619.81 lakh rupees in 2021-22 while total export of garlic is 17643 Tonnes fetching a value of 14971.04 lakh rupees 2020-21 (Directorate General of Commercial Intelligence & Statistics (DGCIS), 2021-22).

The bulbs of garlic is consisted several cloves, covered by a thin white skin. It can be consumed as a spice or condiment in the form of different processed products such as garlic paste and pickles. It is also used as an ingredient in several food preparations like chutneys, vegetables, curries, curry powders and in meat preparations etc. Garlic is a high valued crop and used as medicine, food, preservative and curative agent. It requires cool and moist climate during vegetative growth and bulb development stages but warm dry weather during maturity. The production of garlic

requires growing periods of 4.5-6 months and the amount of rainfall ranges between 600mm to700 mm during its production seasons. It require cool climate and grows at higher altitudes between ranges of 900-1200 meters (Spices Board, 2021). Garlic cultivation requires a high level of working capital and human labour that profit margins were good and that price levels were generally stable and concluded that timely and adequate irrigation facilities are essential in raising the profitability of the Garlic crops (Kucchadiya *et al.,* 1992). The study was taken up with a following objective

1. To estimate the growth and instability in garlic area, production and yield in Southern Rajasthan.

MATERIAL AND METHODS

The study is based on secondary data. The data related to area, production and yield of garlic were collected from Directorate of Economics and Statistics, Pant Krishi Bhawan, Jaipur and its website www.rajasthankrishi.gov.in and Report of Horticulture Statistics Division, 2017.
(Rajasthan Agricultural Statistics at a glance)

Analytical tools

Growth rate analysis: To analysis the CAGR (Compound Annual Growth Rates) in area, production, productivity of garlic in Southern Rajasthan by using the exponential growth function for the period of 2008-09 to 2020-21. For this, ordinary least square was used. The following form of exponential function was used to calculate the compound growth (Acharya *et al*., 2012).

$Y = abt\ eut$

Where,
Y = area, production and productivity of garlic in years
t = times variable
a = intercept
b = regression coefficient
eUt = error term
The equation was estimated after transforming it to logarithmic form as follows

$\ln y = \ln a + t \ln b + Ut \ln e$

Then, the per cent compound growth rate (g) was calculated using the relationship

$G = [(\text{antilog of } b)-1] \times 100$

Significance of compound growth rate (CGR) was tested by student's t-test.

Instability index analysis: In order to study the variability in the area, production and productivity, coefficient of variation was used to calculate instability.

$C.V. = SD/\ AM \times 100$

Where,
C.V. = Coefficient of variation
SD = Standard deviation,
AM = Arithmetic mean

RESULTS AND DISCUSSION

In this sections finding of research objective is presented and briefly discussed. The important finding of present study are depicted under following area, production and yield of garlic.

A. To estimate the growth and instability in garlic area, production and yield in Southern Rajasthan

Both Pratapgarh and Chittorgarh districts were selected for the present study due to highest area and production of garlic in these districts. To estimate the growth and instability in garlic area, production and yield, the study period was taken from 2008-09 to 2020-21.

(i) Growth rate of area, production and productivity of garlic in Pratapgarh district. To study the growth and instability performance for area, production and yield of garlic crop with contribution of basic components of garlic production in Pratapgarh district time series data were examined for the period 2008-09 to 2020-21. The result of growth in area, production and yield of garlic crop are depicted in Table 1. It indicated that, the area and production of garlic crop showed increasing trend from 2008-09 to 2020-21. In 2009-10, production was exceptionally less (1534 tonnes) as the year was a drought year. In case of yield, same pattern was follow.

Table 1: Compound growth rate of area, production and productivity of garlic in Pratapgarh district.

Year	Area(ha)	Production(tonnes)	Yield(kg /ha)
2008-09	2552	14036	5500
2009-10	2789	1534	550
2010-11	2896	17376	6000
2011-12	3708	22248	6000
2012-13	4168	26754	6419
2013-14	4876	33894	6951
2014-15	5538	38766	7000
2015-16	6446	45122	7000
2016-17	6518	58662	9000
2017-18	7271	58168	8000
2018-19	6193	49544	8000
2019-20	6060	48480	8000
2020-21	6498	51995	8002
CAGR	9.02*	20.58 *	10.60*
P value	0.09	0.20	0.10
Instability	32.55	50.79	31.49

******Significant at 5% level of significant
*Non-significant
Source: Computed from data published by Rajasthan Agricultural Statistics at a glance-Commissionerate of Agriculture, Jaipur, Rajasthan

The area, production and yield of garlic crop in Pratapgarh district witnessed positive growth rate during this time period. The growth rate was found higher for production (20.58 per cent) as compared to area (9.02 per cent) and yield (10.60 per cent). The instability index was observed that for area to be 32.55 per cent, production 50.79 per cent and yield 31.49 per cent, respectively. It was conclude that instability in area and yield was at par. Production of garlic is increased due to increasing area is in study area. Difference in production was due to cultivation practices along with different varieties of garlic that produce in Pratapgarh district. The high growth rate and instability was registered in production (Patil and Kerur 2016; Kumar *et al.,* 2019).

(ii) Growth rate of area, production and yield of garlic in Chittorgarh district. The growth rate in area, production and yield of garlic in Chittorgarh district are presented in the Table 2 from the period of 2008-09 to 2020-21. The result of the study showed that highest area (11200 hectare) and production (72800 tonnes) was observed in 2007-08 due to favourable climate condition in study area.

Table 2: Compound growth rate of area, production and productivity of garlic in Chittorgarh district.

Year	Area(ha)	Production (tonnes)	Yield(kg /ha)
2006-07	6663	43646	6600
2007-08	11200	72800	6500
2008-09	5445	35393	6500
2009-10	3424	22256	6500
2010-11	4568	26038	5700
2011-12	6663	38179	5730
2012-13	6145	40557	6600
2013-14	5948	28195	4740
2014-15	5455	18472	3386
2015-16	6097	29753	4880
2016-17	6551	31930	4874
2017-18	6610	33921	5132
2018-19	5448	28046	5148
2019-20	5497	29761	5414
2020-21	6041	30682	5079
CAGR	2.12**	0.06**	-2.02**
P value	0.02	0.01	-0.02
Instability	15.82	20.07	16.44

* Significant at 5% level of significant
* Non significant

Source: Computed from data published by Rajasthan Agricultural Statistics at a glance Commissionerate of Agriculture, Jaipur, Rajasthan

It's observed that there is alternate increase and decrease in area and production in some years due to prices volatilization. The higher prices lead to the farmers to increase area in subsequent year which turns to increased production and lower prices lead to decrease the area in the subsequent years. The area and production of garlic crop are witnessed positive significant growth rate of 2.12 per cent and 0.06 per cent per annum but for yield, negative and significant growth rate of -2.02 per cent was estimated for the same years. It signified that shift in cultivation of crops towards of other crop. There was year to year variation in area, production and yield of garlic. The instability index was estimated 15.82 per cent, 20.07 per cent and 16.44 per cent for area, production and yield, respectively. The higher instability variation was observed in case of production because of fact that farmers are more inclined to the higher yielding varieties of garlic. Since the crop in one between the irrigated crop which may result of success and failure of the crop and price volatility in market.

(iii) Comparative analysis of growth rate of area, production and yield of garlic in Southern Rajasthan. The result of growth in area, production and yield of garlic crop are presented in Table 3. It was observed that from the Table 3, the area of garlic crop showed increasing trend from 2008-09 to 2020-21.

The area, production and yield of garlic were 6213 hectare, 23790 tonnes and 7050 kg/ha in 2009-10 which was exceptionally less as compared to other years because of the year was a drought year. It was observed that alternate increase and decrease in production in some years due to price volatilization. The area and production of garlic crop in Southern Rajasthan witnessed positive growth rate but in case of yield, it's positive and significant growth rate during this time period. The growth rate was found higher for production (7.64 per cent) as compared to area (5.11 per cent) and yield (2.61 per cent). It was observed that increasing trend of area leads to production of garlic in subsequent years. The instability index of area, production and yield were recorded to be 21.26 per cent, 29.66 per cent and 14.76 per cent, respectively. The higher instability recorded in production due to more use of higher yielding varieties of garlic by farmers, cultivation practices and price volatility in market. The high growth rate and instability was registered in production (Patil and Kerur 2016; Sajjan *et al.,* 2018; Kumar *et al.,* 2019).

Table 3: Compound growth rate of area, production and productivity of garlic in Southern Rajasthan.

Year	Area(ha)	Production (tonnes)	Yield(kg /ha)
2008-09	7997	49429	12000
2009-10	6213	23790	7050
2010-11	7464	43414	11700
2011-12	10371	60427	11730
2012-13	10313	67311	13019
2013-14	10824	62089	11691
2014-15	10993	57238	10386
2015-16	12543	74875	11880
2016-17	13069	90592	13874
2017-18	13881	92089	13132
2018-19	11641	77590	13148
2019-20	11557	78241	13414
2020-21	12539	82677	13081
CAGR	5.11*	7.64*	2.61 **
P value	0.05	0.076	0.026
Instability	21.26	29.66	14.76

**Significant at 5% level of significant
* Non significant
Source: Computed from data published by Rajasthan Agricultural Statistics at a glance- Commissionerate of Agriculture, Jaipur, Rajasthan

CONCLUSIONS

In this perspective an analysis has been made to know the growth rates of area, production and yield of garlic. The secondary data related to area, production and yield of garlic were collected from various source to analyze compound annual growth rate of garlic from 2008-09 to 2020-21. The result of the study revealed that the area, production and yield of garlic witnessed positive growth rate in Pratapgarh district. The growth rate found negative and significant growth for yield (-2.02 per cent) as compared to area (2.12 per cent) and production (0.06 per cent) in Chittorgarh district. The growth rate in area and production were recorded positive but and for yield of garlic was found positive and significant growth in Southern Rajasthan. The highest instability reported in case of production as compared to area and yield of garlic over the period of time in Pratapgarh, Chittorgarh district and Southern Rajasthan. The reason of higher production are more use of higher yielding varieties of garlic by farmers, cultivation practices and price volatility in market.

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Conflict of Interest. None.

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