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Growth and Export Performance of Maize from India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Maize is India's third most important cereal crop after rice and wheat and it is the only cereal crop which can be cultivated throughout the seasons. The present study focuses on the growth in area, production, productivity and export performance of maize from India by using secondary data for the period (1999-2019). To estimate the growth rate in area, production and productivity of maize in India, the following analytical tool was used that is Compound Growth Rate (CGR). The results revealed that area, production, productivity observed positive compound growth rate at one per cent level of significance during overall study period. Export quantity showed the positive growth rate at ten per cent level of significance. Export value of maize showed the positive compound growth rate at one per cent level of significance during overall study period. In country wise analysis Yemen Republic showed highest growth rate in terms of export quantity and Nepal showed highest growth rate in terms of export value respectively. The research will help us understand the primary factors influencing maize production and export of maize from India. So, it becomes a paramount importance for a country like India to start promotion measures to boost up the pace of its exports.

Keywords: Compound growth rate; area; production; productivity; export quantity; export value.

1. INTRODUCTION

In the worldwide market, there is a high demand for cereals, which creates a better environment for the export of Indian cereals such as wheat, rice, maize, sorghum, pearl millet and barley. It is a good opportunity for the country to enhance cereal production and their export share in total

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cereal exports of world. India is not just the world's largest producer of cereals, but also the world's largest exporter of cereal crops, Joshi Malvika (2013). In India, maize acreage increased to 9.2 million ha in 2018-19 [1].

Maize known as the *"queen of cereals"* is one of the most versatile emerging crops with wider adaptability under varied agro-climatic conditions Geetha et al. (2019). Maize has the highest genetic yield potential among cereal crops [2]. The United States, China, Brazil, European Union, Argentina, Ukraine, India and Mexico are the top maize producers, Nithyashree *et al*. (2020). India's export of cereals stood at Rs.47,287.12 crore /6,611.09 USD Millions during the year 2019-20 (APEDA). Major maize export destinations from India are Nepal, Bangladesh, Myanmar, Pakistan, Bhutan, Saudi Arab and UAE (APEDA) [3].

Despite the fact that India's productivity is about half that of the rest of the world, the average daily productivity of Indian maize is at par with many leading maize producing countries. To increase exports, it is necessary to improving quality at many stages of production such as cultivation, post-harvest, processing, handling and storage until it reaches the final customers [4]. Maize has an abundant nutritional content, high levels of starch as well as rich proteins and oils, are all reasons why it is consumed as a staple food all over the world [5]. In 1957, the All India Coordinated Research Project (AICRP) on maize was established with the goal of developing and disseminating genetically better cultivars as well as production/protection technologies. The (AICRP) resulted in refining efforts in varietal improvement (APEDA) [6]. Ill management of farms, small farm sizes, low level of education of farmers, injudicious use of fertilizers, pesticides, and other inputs were the major contributors to the low production and productivity of maize. Manan et al. [7].

2. METHODOLOGY

The present study was based on secondary data. Required time series data for area, production and productivity were collected from indiastat. Data for export quantity and export value were assembled from government website like Agricultural and Processed food products Export Development Authority (APEDA). The time series data has been divided into three periods for better comparison viz., Period I (1999-2000 to 2008-2009), Period II (2009-2010 to 2018-2019), Overall period (1999-2000 to 2018-2019) (Anjum and Madhulika, 2018). To analyse the data R statistical software was used. To estimate the compound growth rate in area, production, productivity, export quantity and export value the following analytical tool was used that is Compound Growth Rate (CGR) which was elaborated as under:

2.1 Growth Rate Analysis

The growth rates in production and export of maize was calculated by using compound growth rates (CGR). It helps to analyze the changes in production and export of maize from India. In the present analysis of the study the compound growth rate in production of maize were measured by best fitting exponential equation [8].

The growth rate was estimated by using following model:

$Y = a.b^t$

Where,

Y = Production/ Export quantity/ Export value of maize export.
a = Intercept
b = Regression Coefficient
t = Time Variable

From the estimated function the compound growth rate was worked out by

CGR (r) = [Antilog (log b) - 1] × 100

Where,

r = Compound growth rate.

3. RESULTS AND DISCUSSION

3.1 Growth Rate Analysis

The growth rate analysis of area, production, productivity, export quantity and export value of maize are presented in Tables 1 and 2. It was observed that during period I (1999-2000 to 2009-2010) area, production and productivity witnessed positive and significant growth rate of 2.93 per cent, 5.28 per cent and 2.28 per cent at one per cent level of significance respectively. During period II (2009-2010 to 2018-2019) area observed growth rate of 0.73 per cent at ten per cent level of significance, production and

productivity observed growth rate of 3.26 per cent and 2.5 per cent at one per cent level of significance respectively.

During overall study period (1999-2000 to 2018-2019) area, production and productivity recorded positive and significant growth rate of 1.90 per cent, 4.93 per cent and 2.97 per cent at one per cent level of significance. The results were in close association with findings of Ayalew & Sekar (2016), Dhakre & Sharma (2010), Patil et al. (2018) and Swamy et al. [9].

Table 1. Compound growth rate of area, production and productivity of maize in India

Particulars	CGR	R^2	SE	t value
Area				
Period I	2.93***	0.93	0.0026	10.88
Period II	0.73*	0.37	0.0033	2.189
Overall period	1.90***	0.88	0.0016	11.68
Production				
Period I	5.28***	0.73	0.010	4.72
Period II	3.26***	0.81	0.0053	5.98
Overall period	4.93***	0.92	0.0031	15.09
Productivity				
Period I	2.28***	0.40	0.0096	2.33
Period II	2.50***	0.77	0.0047	5.22
Overall period	2.97***	0.87	0.0026	11.06

****,** and * denotes significant at 1%, 5% and 10% level, respectively*

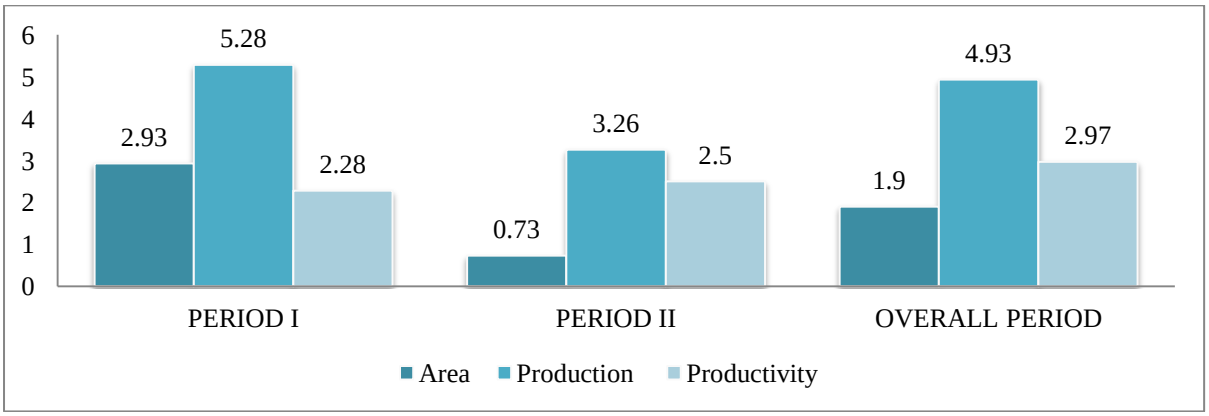

Fig. 1. Compound growth rate of area, production and productivity of maize in India

Table 2. Compound growth rate of export quantity, export value (in Rs. Lakh and in Million US $) of maize in India

Particulars	CGR	R^2	SE	t value
Export Quantity(in MT)				
Period I	63.31***	0.85	0.072	6.80
Period II	-23.76***	0.73	0.057	-4.72
Overall period	11.59*	0.21	0.049	2.20
Export Value (in Rs. Lakhs)				
Period I	66.64***	0.88	0.064	7.91
Period II	-18.18***	0.60	0.056	-3.53
Overall period	18.87***	0.43	0.046	3.72
Export Value (in Million US $)				
Period I	67.38***	0.88	0.067	7.68
Period II	-22.01***	0.70	0.056	-4.41
Overall period	15.78***	0.32	0.049	2.97

****,** and * denotes significant at 1%, 5% and 10% level, respectively*

During period I ((1999-2000 to 2009-2010) export quantity observed the growth rate of 63.31 per cent at one per cent level of significance. Export value (in Rs. Lakh and in Million US $) observed the growth rate of 66.64 per cent and 67.38 per cent at one per cent level of significance respectively. During period II (2009-2010 to 2018-2019) export quantity observed negative growth rate of -23.76 per cent at one per cent level of significance and export value (in Rs. Lakh and in Million US $) observed negative growth rate of -18.18 and -22.01 at one per cent level of significance respectively. During overall period (1999-2000 to 2018-2019) export quantity of maize witnessed positive and significant compound growth rate of 11.59 per cent per annum which was statistically significant at five per cent level of significance. With respect to the export value (in Rs. Lakhs and in Million US $) observed positive and significant compound growth rate of 18.87 per cent and 15.78 per cent respectively, at one per cent level of significance. Adhikari et al. (2016) and Tiwari Akash [10].

Country wise export of maize in terms of quantity and value from (1999- 2019) were presented in the Table 3. Bangladesh observed negative growth rate of -1.09 per cent in terms of export quantity, which was statistically non-significant and growth rate of 10.50 per cent in terms of export value at one per cent level of significance was observed during the overall study period. Vietnam recorded growth rate of 46.60 per cent at 5 per cent level of significance and 43.80 per cent at one per cent level of significance in terms of export quantity and export value respectively, during the overall study period. Amongst all countries, during the overall study period, Nepal witnessed highest growth rate 66.76 per cent in terms of export value at one per cent level of significance and in terms of export quantity it was 60.96 per cent at one per cent level of significance. Quantity exported to Malaysia during the overall period observed the growth rate of 23.21 per cent and growth rate of 22.72 per cent in terms of export value respectively, which was statistically non-significant [11].

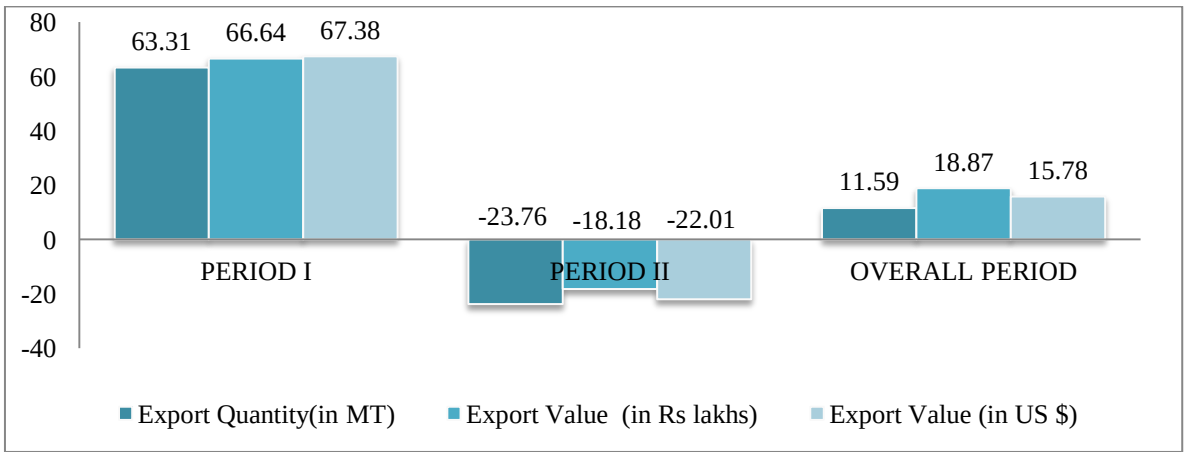

Fig. 2. Compound growth rate of export quantity and export value of maize

Table 3. Country wise Compound Growth Rate of Export quantity and value of maize from India

Sr. no.	Particulars	CGR	
		Export quantity (in MT)	Export value
1	Bangladesh	-1.09	10.50***
2	Vietnam	46.60**	43.80***
3	Nepal	60.96***	66.76***
4	Malaysia	23.21	22.72
5	UAE	7.59	14.13*
6	Yemen Republic	69.89***	59.09***
7	Singapore	10.19	12.89
8	Oman	50.80***	46.18***
9	Japan	45.83***	38.77***
10	Saudi Arab	44.77***	46.37***

****, ** and * denotes significant at 1 %, 5% and 10% level, respectively*

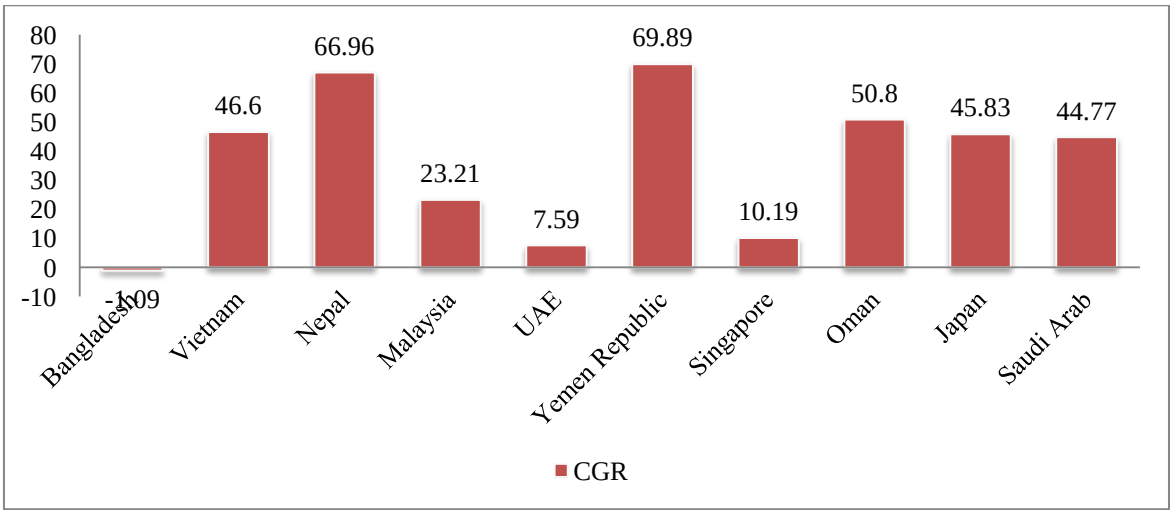

Fig. 3. Compound growth rate of maize exported from India in quantity during the study period

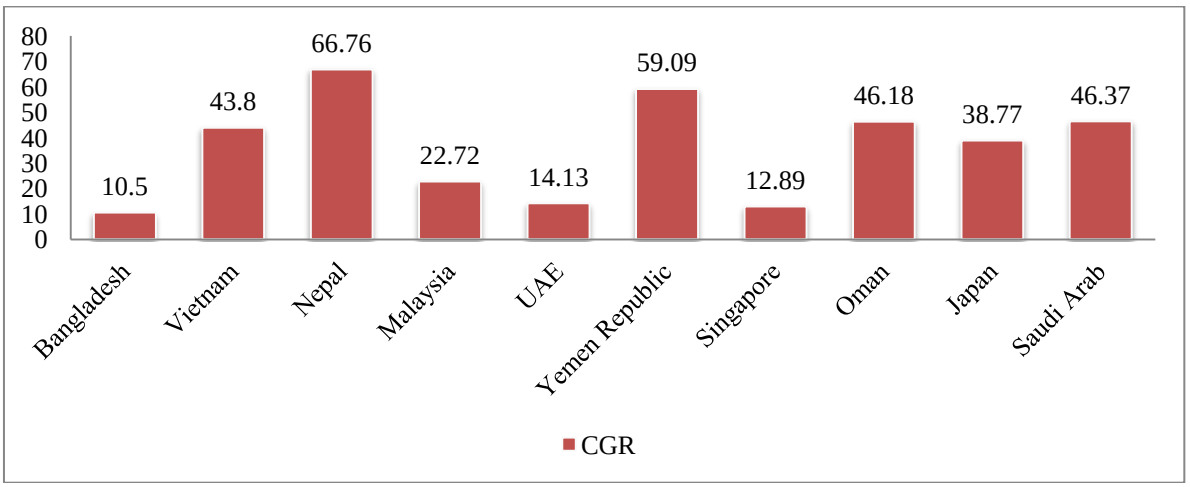

Fig. 4. Compound growth rate of maize exported from India in value measured in Indian rupees during the study period

Quantity exported to UAE showed the growth rate of 7.59 per cent which was non-significant and in export value growth rate of 14.13 per cent at ten per cent level of significance recorded during overall period. Amongst all countries, Yemen Republic displayed the highest growth rate of 69.89 per cent at one per cent level of significance in export quantity and 59.09 per cent at one per cent level of significance in value earned from export during overall period. During overall period, Singapore observed growth rate of 10.19 per cent and 12.89 per cent with regard to export quantity and export value which was statistically non-significant respectively [12].

In Oman, growth rate of 50.80 per cent and 46.18 per cent at one per cent level of significance was observed during overall period in terms of export quantity and export value respectively. Japan witnessed the growth rate of 45.83 per cent and 38.77 per cent at one per cent level of significance in terms of export quantity and export value during overall period respectively. Quantity exported to Saudi Arab showed the growth rate of 44.77 per cent and 46.37 per cent at one per cent level of significance with respect to export quantity and export value respectively [13,14].

4. CONCLUSIONS

In the above study area, production and productivity observed the growth rate of 11.90 per cent, 4.93 per cent and 2.97 per cent during overall period of study, respectively. Production witnessed comparatively higher growth rate than

area and productivity. With regards to export quantity and export value recorded positive and significant compound growth rate of 11.59 per cent and 18.87 per cent, respectively during overall period. In country wise analysis Yemen Republic showed highest compound growth rate (CGR) in terms of export quantity and Nepal in terms of export value. Export is a major activity to accelerate the pace of economic development of any country. This research study which may help in formulating alternative management techniques and policies to promote maize export in India as well as help in growing India's potential in the field of futures trading and boosting the volumes of maize traded through futures along with ongoing growth in the production. It is important for India to increase its yield so as to improve the social and economic situation for the marginal farmers and bring in an increase in foreign reserves levels for India.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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