EXPORT PERFORMANCE OF MAIZE FROM INDIA

BY

KOLHE PRAJAKTA RAM

B.Sc. (Agriculture)

A thesis submitted to

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

In partial fulfillment of the requirement for the degree of

MASTER OF SCIENCE

IN

AGRICULTURE

(AGRICULTURAL ECONOMICS)

DEPARTMENT OF AGRICULTURAL ECONOMICS

COLLEGE OF AGRICULTURE, PARBHANI

VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH

PARBHANI–431402 (M.S.) INDIA

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2021

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled, **"Export performance of Maize from India"**, submitted by me is based on the actual work carried out by me under the guidance and supervision of **Perke Digambar Shivram**. The extent of information derived from the existing literature have been duly cited and referenced. The existing research work or its any part is not submitted anywhere else for the award of any degree or diploma.

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Place: **Parbhani**

Date: 30 /09 / **2021**

(Kolhe Prajakta Ram)

Reg. No: 2019A/54M

CERTIFICATE-I

This is to certify that the thesis entitled, **"Export performance of Maize from India"** submitted by **Kolhe Prajakta Ram, Reg. No.2019A/54M** in partial fulfillment of the requirements for the award of the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **Agricultural Economics** submitted to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani is a record of bonafide research work carried out by her under my guidance and supervision. The thesis or its any part has not previously formed the basis for the award of any degree, diploma or other similar title.

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(D. S. Perke)

Research Guide

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( )
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Research Guide

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Place: ***Parbhani***

*Date:*30/ 9 / *2021*

(Kolhe Prajakta Ram)

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ABBREVATIONS USED

%	:	Percentage
/	:	Per
$	:	Dollars
Fig	:	Figure
et.al.	:	Et alia (and associate)
i.e.	:	That is
kg	:	Kilogram
ha	:	Hectare
Rs.	:	Rupees
viz	:	Namely
Sr. No.	:	Serial Number
HS	:	Harmonised System
MT	:	Metric Tonnes
etc.	:	Et cetera
APEDA	:	Agricultural and Processed Food Product Export Development Authority
Q	:	Quintal
GDP	:	Gross Domestic Product
WTO	:	World Trade Organization
MSP	:	Minimum Support Price
EPR	:	Export Performance Ratio
CGR	:	Compound Growth Rate
CV	:	Coefficient of variation
CII	:	Coppock's Instability Index
SD	:	Standard Deviation
SE	:	Standard Error
NPC	:	Nominal Protection Coefficient
RCA	:	Relative Comparative Advantage

THESIS ABSTRACT

THESIS ABSTRACT

1.	Title of the thesis	: "Export Performance of Maize from India"
2.	Full name of the candidate	: Kolhe Prajakta Ram
3.	Full name of the Research Guide	: Digambar Shivram Perke
4.	Department	: Agricultural Economics
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ABSTRACT

The present study evaluates the export performance of maize from India. Globally, Maize is known as "Queen of Cereals" because it has the highest genetic yield potential among the cereals. Maize contributes nearly 9 per cent to the national food basket. The predominant maize growing states that contributes more than 80 per cent of the total maize production are Madhya Pradesh, Karnataka, Bihar, Rajasthan, Maharashtra, West Bengal, Andhra Pradesh and Uttar Pradesh. India is one of the top five maize exporters in the world as it contributes nearly 14 per cent of the total maize exported to the different countries of the world. Last 20 years data was collected from the period 2000-2019. Secondary data on area, production, productivity, export quantity, export value, domestic prices and international prices were collected from Agricultural and Processed Food products Export Development Authority(APEDA), Agmarknet. and indiastat etc.

For better comparison data were divided into two sub period and overall period viz., Period I (1999- 2000 to 2008-2009), Period II (2009-2010 to 2018-2019) and overall period (1999-2000 to 2018-2019). Exponential model were used to estimate the compound growth rate (CGR) in area, production, productivity, export quantity and export value and instability was calculated by using Co-efficient of Variation (CV) and Coppock's Instability Index (CII). For trend analysis in

domestic and international prices, linear, quadratic and exponential model were used. Export competitiveness of maize was analyzed by using Nominal Protection Coefficient (NPC).

The results showed that the compound growth rate of area, production, productivity, export quantity and export value witnessed positive and significant growth rate during the overall study period. With regard to Co-efficient of Variation (CV) and Coppock's Instability Index (CII) of area was 11.46 per cent and 3.66 per cent respectively, with respect to production it was 28.15 per cent and 13.02 per cent respectively, and with respect to productivity it was 18.34 per cent and 11.22 per cent respectively. Export quantity showed the instability with 91.95 per cent and 125.33 per cent respectively, and with respect to export value it was 99.09 per cent and 109.37 per cent respectively, during overall period.

Among the top ten countries the highest growth rate in terms of export quantity was observed in Yemen Republic and in terms of export value Nepal showed the highest growth rate during the overall period. And among the top ten countries to which maize is exported from India, Malaysia witnessed the highest instability in terms of export quantity and export value. In trend analysis, it was observed that for the domestic price exponential model was best fitted with R^2 value 0.90 while for the international price quadratic model was best fitted with R^2 value 0.90. NPC value showed that in the international market maize experience moderate export competitiveness.

(Keywords: Export, Compound growth rate, Coefficient of Variation, Coppock's Instability Index, Nominal Protection Coefficient and exponential model)

CHAPTER – I

INTRODUCTION

CHAPTER- I

INTRODUCTION

Agriculture plays an important role in the contribution of India's GDP (Gross Domestic Product) as it accounts to almost 18 per cent of GDP and also in the overall socio-economic fabric of India. The agricultural and allied sector carries greater importance to the Indian Economy as it contributes nearly one-sixth to the Indian National Income and provides employment to nearly 50 per cent of the Workforce. During COVID'19 Pandemic most sectors of the economy reported to be under significant stress, even in such situation the agricultural sector continued to be promising and cushioning the economy (NABARD, 2020).

Maize (*Zea mays* L), *the queen of cereals*, is one of the most versatile emerging crops with wider adaptability under varied agro-climatic conditions (Geetha *et. al*., 2019). It belongs to the family *Gramineae* and has the highest genetic yield potential among cereal crops. The primary centre of origin of maize is Central America and Mexico. The United States of America (USA) is the leading producer of maize which accounts for nearly a 35 per cent in the total global production and it serves as a major driver of the US economy. It is grown on nearly 150 m ha across 160 countries having vast range of soil, climate, biodiversity and management practices. This contributes to 36 per cent (782 m t) in the world grain production.

After rice and wheat, Maize is India's third most important cereal crop and it is the only cereal crop which can be cultivated throughout the seasons. The grain, leaves, stalk, tassel, and cob are all economically valuable parts of maize plant that can be utilised to make a wide range of food and non-food goods. Maize accounts around 9 per cent to the national food basket. It provides large amounts of green fodder for the cattle. Maize cobs are utilised as a source of biomass fuel. In the United States, it is increasingly being used as a feedstock for the production of ethanol fuel. When used to fuel motor vehicles, Ethanol is blended with gasoline to reduce the number of pollutants released. In addition to being a source of staple food for humans and quality feed for animals, maize is a basic raw component to thousands of industrial goods, including starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries etc. Maize

will be used in a variety of ways in the coming years, particularly in businesses that are expected to grow rapidly in the future.

Maize was grown in a wide range of production environments including tropical, Sub tropical and temperate region. Maize has been grown in a wide range of soils ranging from loamy sand to clay loam. However, soils with good organic matter content with high water holding capacity and neutral pH are assumed good for higher productivity. Moisture stress, particularly excess soil moisture and salinity stress, affects maize crop. It is needed to avoid low lying fields having poor drainage facility and higher salinity. As a result, the fields with adequate drainage should be chosen for maize production. Maize crop requires extra rains because they are drought-sensitive. The maize crop is grown in two or three crop rotations.

The United States, China, Brazil, European Union, Argentina, Ukraine, India and Mexico are the top maize producers. Maize is grown throughout the year in India for a variety of reasons, including grain, fodder, green cobs, sweet corn, baby corn, pop-corn in semi-urban regions. Madhya Pradesh, Karnataka, Bihar, Rajasthan, Maharashtra, West Bengal, Andhra Pradesh and Uttar Pradesh are the leading maize growing-states, accounting for more than 80 per cent of the total maize production. The top maize producing states are Andhra Pradesh (20.9 per cent), Karnataka (16.5 per cent), Rajasthan (9.9 per cent), Maharashtra (9.1 per cent), Bihar (8.9 per cent), Uttar Pradesh (6.1 per cent), Madhya Pradesh (5.7 per cent) and Himachal Pradesh (4.4 per cent). Maize is divided into two types i.e., Yellow and White, based on their colour and flavour. Yellow maize is one of the richest Source of Vitamin A and various hybrid varieties of maize exist depending on the size and composition of endosperm, like dent corn, flint corn, sweet corn, popcorn. The poultry industry alone uses for (47 per cent) of the country's total maize consumption and expected to continue doing so in the future followed by food with a share of (24 per cent), Livestock (16 per cent) and Industry (16 per cent).

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 and AICRP conducts inter-disciplinary, inter -institutional, co-operative and systematic testing of newly created

cultivars of both public and private sectors for various agro-climatic zones of the country. The (AICRP) resulted in refining efforts in varietal improvement. Since 1961, a total number of 187 cultivars have been published across the nation, including single cross hybrids, composites and multiple parent crosses.

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 cereal exports of world. Several nations have expanded their market share in the maize trade during the last few years, and new countries are also entering the international market at a faster rate. One of the best examples is Brazil, a large maize importer that has recently become a major maize exporter in the international market.

In the year 1961, four double cross hybrids were released i.e., Ganga-1, Ganga-101, Deccan, and Ranjeet. In 1967, six composites were released which are Vikram, Vijay, Amber, Kisan, Jawahar and Sona. Amongst all the varieties the top cross varieties are Ganga-2 and Hi-starch.

Nutritional Value

Maize has 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. Maize may contain a number of vital vitamins such as vitamin B, folic acid, Vitamin C and A, depending on the variety. Phosphorus, magnesium, manganese, Zinc, Copper, Iron and selenium are all abundant in maize, with only a small amount of potassium and calcium. Maize is a good source in both dietary fibre and protein. It contains (70 per cent) carbohydrate, (10.4 per cent) albuminoides, (10 per cent) protein, (4 per cent) oil, (2.3 per cent) crude fibre, and (1.4 per cent) ash. Therefore, for people who are unable to receive fresh vegetables throughout the year, should include maize in their diet.

Indian Scenario

India is not just the world's largest producer of cereals, but also the world's largest exporter of cereal crops. India ranks 4^{th} in terms of area and 7^{th} in terms of production among maize growing countries, accounting for 4 per cent of total

global maize area and 2 per cent of total production. In India, maize acreage increased to 9.2 million ha in 2018-19. (DACNET, 2020). In 1950-51, India used to produce1.73 million MT maize which rose to 27.8 million MT by 2018-19, recording close to 16 times increase in production. During this time, average productivity increased by 5.42 times from 547 kg/ha to 2965 kg/ha, while area has increased nearly by three folds. 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 leads 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. India's export of cereals stood at Rs.47,287.12crore /6,611.09 USD Millions during the year 2019-20 (APEDA). Rice (including basmati and non- Basmati) occupy the major portion in India's total cereals export with (95.7 per cent) during the same period.

According to latest studies, by 2025 maize will become the crop with the highest production in developing countries and by 2050 the demand for maize in the developing nation will almost double. During this COVID' 19 Pandemic, the development and meritorious performance of agricultural sector had a major impact on the achievements of many other sectors. We can conclude that the dynamic growth in agricultural sector is a boon for most sectors of the Indian Economy.

Export Scenario

Export is a major activity to accelerate the pace of economic development of any country. India is one of the top five maize exporters in the world, accounting for nearly (14 per cent) of the total maize exported to the different nations around the world. Major maize export destinations from India are Nepal, Bangladesh, Myanmar, Pakistan, Bhutan, Saudi Arab and UAE. Japan was the leading importer of maize in 2019 with maize import amounting to 3.52 million thousand US dollars followed by Mexico (3.19 million thousand US dollars) and Korea (2.353 million thousand US dollars). Most of the countries in Asia are net importers of maize. The strong growth in the livestock industry along with rising incomes is the major supporting factors behind the fast growth in Asian imports and major maize exporting countries are USA, followed by Brazil, Argentina, Ukraine and India (APEDA 2019). There is a continuous increase in demand for Indian maize (corn) from Malaysia and

Vietnam. During 2019-2020, India exported around 370066.11 MT of Maize for the worth of Rs. 101929.83 lakhs (APEDA).

The Agricultural and Processed Food Products Export Development Authority (APEDA) data shows that maize exports in the first half of the fiscal was 9.22 lakh tonnes at a value of $184.52 million compared to 3.70 lakh tonnes worth $142.78 million the whole of the last fiscal. According to the data released by APEDA, maize exports during April-November of the current fiscal had increased tremendously in the world due to its high demand. 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. Harmonized System is a standardized numerical method of classifying traded products. The HS (Harmonized System) code of Maize is 100590.

Importance of the Study

Maize is a high yielding annual plant with great geographic adaptability, a key feature that has helped its spread over the world. Maize is a high yielding crop that is also easy to process, readily digested and less expensive than other cereals. Maize is one of the most vital cereals in the world as it provides more human food than any other cereals. Its importance comes from the fact that it is utilised not only as a source of human food and animal feed, but also has a variety of particular applications. Area, production and productivity of maize in India observed an increasing trend from 1999-2019. It is essential to study the performance of maize production and their potential in export for further economic development. The current study was done with the following particular objectives in mind, taking into account the importance of this crop for the Indian economy and its export concerns.

Objectives

1. To estimate the growth in production and export of maize
2. To work out the instability in production and export of maize
3. To study the trends in domestic and international price of maize
4. To study the export competitiveness of maize in India

Hypothesis

1. There is significant stable growth in production and export of maize in India
2. Indian Maize have better competitiveness in international market

Scope of the Study

Other researcher will use the findings of this study as a starting point for their maize research. This study will provide proof of maize production and export performance 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.

We produce and market maize in India, and we export it to nearly every country around the world. India had a glorious export background, particularly in agriculture and allied sectors. Export is the foundation of a country's overall growth performance. Any developing country can pave the route for development by generating foreign liquidity by boosting its export rate. So, it becomes a paramount importance for a country like India to start promotion measures to boost up the pace of its exports. The research will help us understand the primary factors influencing maize production and export of maize from India. The current study examines the growth performance, export performance and export competitiveness of maize in India which may help in formulating alternative management techniques and policies to promote maize export in India

Limitations

The current research is limited to a single crop Maize. The study was totally based on secondary data gathered from various published sources. The research will be based on data collected over a twenty-year period. Often data from several sources may not agree with each other and some efforts to choose the better among them are inevitable. In making such selections, special care has been taken to avoid personal prejudice. The limitations of secondary data, on the other hand, must be noted.

CHAPTER – II

REVIEW OF LITERATURE

CHAPTER-II

REVIEW OF LITERATURE

Review of Literature is an important part of the research process so it serves as a strong analytical source of knowledge for the current study by assessing and aggregating previous works, gaining a better understanding of the subject, and creating a conceptual framework related to the subject by making improvements based on the objectives. Past reviews and studies on the particular crop and allied crops are detailed in the following sections, keeping in mind the objectives connected to maize export performance.

1. Estimate growth in production and export of maize

Dhakre and Sharma (2010) studied that there was a positive growth in the area, production, productivity of maize in Nagaland at the growth rate of 3.86 per cent, 8.76 per cent, 4.71 per cent respectively, which was found statistically significant at the 1 per cent level of significance in the area, production, productivity of maize.

Scott and Suarez (2011) observed that from 2000-2009 growth rate for average annual production had sharply declined. The steady drop in annual CGR for potato yield signals the absence of development and introduction of new technology for yield raise. The study revealed that potato production in India had marked periodic massive surges in supply rather than a steady expansion.

Acharya *et al.* (2012) analysed the area, production and productivity of important crops in Karnataka from 1982-83 to 2007-08 were calculated, and the results revealed that pulses, vegetables and spices, fruit and nuts exhibited considerable positive growth in area, whereas cereals displayed significant negative growth. Annually, the area under Jowar, bajra, ragi and minor millets decreases significantly. The area under rice has increased gradually each year. The area under oilseed and commercial crops grew at a negative and negligible rate. Similarly, it was observed that cereals, pulses, vegetables, and fruits production increased by a large amount. The productivity of diverse crops increased significantly in the case of cereals, pulses, and fruits, whereas the production of oilseed and commercial crops grew insignificantly. Oilseed productivity grew at a moderately positive growth rate.

And it was observed that commercial crops productivity increased by a negligible amount, while vegetable output increased by a negligible amount.

Naidu *et al.* (2014) worked out the trends in acreage, production and productivity of several oilseed crops in Andhra Pradesh's Chittoor district. In terms of area and production, Andhra Pradesh is one of the country's most important oilseed growing states. The primary oilseeds account for 15.7 per cent of the country's total net sown area. Major oilseed production reached 2.95 lakh tonnes, accounting for 99.3 per cent of total oilseed production in the country. Oilseed production has risen in recent years (from 184.40 lakh tons in 2000-01 to 297.99 lakh tons in 2011-12).

Misra and Ghosh (2015) observed that the recent changes in India's floriculture industries, particularly in terms of cut flower production and the industry's growth and trading with the rest of the globe. The findings revealed that between 2000-01 and 2014-2015, the production of both loose and cut flowers grew at a Compound Annual Growth Rate (CAGR) of 9.92 per cent and 26.66 per cent, respectively. However, the first decade did not see substantial growth in export of floricultural products from India. During the last decade, export increased at a CAGR of 4.33%. India's share of global floriculture trade at a present is only about 0.6%.

Pangayar *et al*. (2015) studied the growth trends for area, production and productivity of maize in India. The secondary data collected from 1970-71 and 2013-14 thus, the result showed that the percentage of growth was higher in terms of production (223.14 per cent) followed by productivity (91.41 per cent) and area (60.63per cent) at the same time, linear growth rate was found to be high in terms of production as well as in area than productivity. The study shows that the increase in production of maize over the years has been mainly due to parallel expansion in area.

Ayalew and Sekar (2016) studied the growth rate of maize area, production and productivity in major producing states of India for the period 1980-1981 to 2011-2012. The result demonstrates that the maize area, production and productivity in India have increased at the rate of 1.88per cent, 4.20 per cent and 2.28 per cent per annum. The area and production growth of maize was the maximum in Maharashtra (9.19 per cent and 12.24 per cent, respectively) which was followed by Karnataka (7.98 and 8.48) and Andhra Pradesh (8.68 per cent).

Beeraladinni *et al.* (2016) studied the growth in area, production and productivity of cotton across different parts of India. There was a considerable growth

in area from 2.29 to 4.69 per cent from period I and to period II while the productivity growth has increased from -2.66 to 6.48 per cent. The area and production of cotton has reached all time high of 12.18 million hectares and 353 million bales during 2011-12.The trends in area, production and productivity of cotton across the country are growing alarmingly.

Patil and Yeledhalli (2016) analysed during the years 1998-99 to 2013-14, researchers looked at the increase and the instability of area, production and productivity of several crops in Bengaluru division. The data revealed that chrysanthemum production grew at the fastest rate of 22.36 per cent per year. In Shivamogga district highest CAGR observed in production of sunflower to an extent 29.57 per cent. In Tumkuru area under green chilly was growing at rate of 34.46 per cent per annum. Maize showed a positive growth in its area, production and productivity growth rate at 8.74, 15.04 and 5.75 per cent, respectively.

Suresh and Mathur (2016) analyzed the trend in export of agricultural commodities exports from India. There was significant rate of growth of exports during the previous decade with wide difference across various commodity groups. The study discovers a significant increase in the share of export of cereals (3.3 to 6.9 per cent), guar gum and other raisins (1.0 to 7.5 per cent), cotton (14.1 to 17.3), spices (2.3 to 3.3 per cent), and sugar (3.9 to 4.3 per cent). On the other hand, the share has dropped in some commodities- the important one being fish and marine products (14.0 to 7.6 per cent), fruits and nuts (6.1 to 3.5 per cent), and coffee & tea (5.4 to 3.5 per cent).

Tewari *et al.* (2017) analyzed the growth and instability in terms of area, production and productivity of wheat in Uttar Pradesh during period 1990-91 to 2013-14. Which was further divided into five sub periods. Throughout the period, area under wheat has increased in all parts of the state. In contrast, except for sub period III, positive development in production and productivity was found. Wheat productivity was discovered to be highest in the western region and lowest in Bundelkhand.

Kshirsagar *et al.* (2018) examined in their study during 2006-07 to 2014-2015 at both the increase of India’s mango trade and determined the factors that influenced it. To estimate trend and instability, as well as predicted export to other nations, the compound growth rate and the instability index were used. As per the

results, during the study period, the mango contributed significantly to total horticultural exports. The higher growth recorded in the value of mango export (8.77 per cent) than the quantity of export (-6.54 per cent) due to phytosanitary barriers in European and American countries during 2006-07 to 2014-15. The growth of unit value of mango export is higher (16.39 per cent).

Kumareswaran *et al.* (2019) studied the growth in coffee area, production, yield, export quantity and export value for a period of 30 years from 1985 to 2015. The growth rates in area, production and yield, export quantity and export value of coffee were found to be 2.4 per cent, 3 per cent, 0.6 per cent, 3.2 per cent and 4.2 per cent, respectively, as per the study. The results showed that the export performance ratio for coffee has a constant and positive fluctuation trend.

Kumar *et al.* (2019) analysed the growth in area, production and yield of garlic in Haryana with respect to India from 1990-91 to 2016-17. The result showed that the area and production witnessed increasing trend in Haryana at the rate of 5.19 per cent and 6.62 per cent respectively. However, yield showed negative growth of 1.41 per cent but in case of India, the area, production and productivity growth were positive.

Swamy *et al.* (2019) the study focused on trends in area, production and productivity of maize crop in north eastern Karnataka districts. The result showed that the area, production and productivity of maize in NEK region was increased at a growth rate of 8.59 per cent, 6.77 per cent and 10.13 per cent respectively during 1998-2014.

2. Instability in Production and Export of maize

Hasan *et al*. (2008) measured in their study, the change and instability in area, production, and yield of two major cereal crops wheat and maize in Bangladesh. Maize production grew at a faster rate than its area, the growth in area, production and yield of wheat slightly improved and showed highest degree of instability in area and production. Also, the area and production of maize showed highest degree of instability because of its increasing tendency in the recent years. at the same time yield also showed remarkable degree of instability during these study period.

Kulkarni *et al.* (2012) analysed the instability analysis which is used to study the growth in area, production, productivity and export of onion. The share of

export in the production has also increased from 7.27 per cent (343.26 thousand tones 0during 2000 to 12.45 per cent (1664.92 thousand tonnes) in 2010. Highest instability was witnessed during the overall period with respect to area and production of onion with 48.13 per cent and 70.18 per cent as compared to Pre-WTO and Post –WTO periods. However, the instability in productivity was highest during the post-WTO period with 21.29 per cent.The co-efficient of variation was lowest in Pre-WTO period for area, production and productivity with 15.70, 18.42 and 4.16 per cent as compared to the Post-WTO and overall periods.

Kumar *et al.* (2014) studied the growth and instability in maize production in the major districts of major maize growing states in the country. The results showed that there was a significant increase in area and production. Karnataka, Andhra Pradesh, Maharashtra and Tamil Nadu together contributed about 55 per cent of total maize production in India.

Mokashi and Hosamani (2014) worked out the instability in Indian grapes using coefficient of variations for a period of 26 years from 1985-86 to 2010-11. During post- WTO period instability was observed to be 34.93 per cent, 24.75 per cent and 14.26 per cent in export quantity, export value and unit value respectively and during the overall study period instability of 36.52 per cent, 28.41 per cent and 17.78 per cent was observed in export quantity, export value and unit value.

Sihmar (2014) presented his findings on the growth and instability in agricultural production in Haryana. The instability was found to be low & also declined over the time for wheat and rice crop. Instability declined in few crops such as wheat, sugarcane and paddy not only in Punjab, but also in five more states namely Haryana, Kerala, Bihar, J and K and Rajasthan.

Adhikari *et al.* (2016) conducted the study to examined the growth performance and identified determinants of rice exports from India during the period 1980-81 to 2012-13and this study estimated the trend and instability & the project export to different countries. The study has witnessed that rice contributed substantially to the national income during the study period. The higher growth recorded in value of basmati rice export (15.87per cent) was due to higher growth in unit value than quantity of export (7.55 per cent) during 1980-81to 2012-13. The growth rate of unit value of rice export was higher in period 1(13.48 per cent) than period 2 (5.06 per cent). The growth rates in export of non- basmati rice in terms of

quantity, export earnings and unit value were 10.87 per cent, 17.74 per cent and 6.20 per cent, respectively during the study period. The instability index has been found highest for quantity (43.37 per cent) in case of basmati rice and value (141.36 per cent) in case of total rice during the entire period. The UAE has been found to be a highly preferred market for Indian basmati rice and Nigeria for Indian non-basmati rice, as indicated by the probability of retention of their past shares. The study has projected that during 2013-14 the major markets for Indian basmati rice would be Iran and Saudi Arabia, whereas for Indian non-basmati rice, the major markets would be Nigeria and South Africa. The estimated regression model has shown that export price, international price, lagged production, domestic consumption, and exchange rate are the major determinants of rice export from India.

Patil and Yeledhalli (2016) studied the growth and instability in area, production and productivity of different crops in Bengaluru division during period from 1998-99 to 2013-14. The 4 per cent (area of tamarind) was found to be lowest instability for selected crops in Chitradurga, in Kolar district 19.65 per cent instability witnessed in production of aware and was significant at one per cent. Maize being second highest among cereals its production and area was growing at rate of 13.91 per cent and 11.33 per cent had an instability of 33.49 per cent and 12.10 per cent.

Tewari *et al.* (2017) worked out the growth and instability in terms of area, production and productivity of wheat in Uttar Pradesh during period 1990-91 to 2013-14. After instability analysis it was observed that there was high instability in production and productivity as compared to area under wheat.

Sanjay *et al*. (2018) studied the trends, growth and instability in area, production and yield of cotton in Haryana. The study revealed a positive significant ($P<0.01$) trend with low annual growth rates of area of harvest (2.00 per cent), production (3.99 per cent) and yield (1.66 per cent). Instability was considerable, with yearly rates of 30.96 per cent for area, 25.76 per cent for production and 28.04 per cent for productivity in the same order.

Geetha and Shrivastava (2018) analysed the instability in maize exports from India for the period 1981-2016. In post WTO period, the export quantity, value and unit value grew significantly at the rate of 38.74 per cent, 42.12 per cent and 2.43 per cent per annum, respectively. The instability indices for export quantity and its value were shown to be lower in post WTO period. The study concluded that

the reasons for high instability may be inconsistence domestic production, consumption and foreign demand and therefore the export policies should be alinged with consistent growth of maize exports with low instability.

Gade *et al.* (2020) worked out the instability in production and yield of chilly in India during the period from 1995-96 to 2017-18. Coefficient of variation of chilly production and yield was observed to be 0.26 per cent and 0.30 per cent respectively and that was highly instable. Cuddy -Della Valle Instability index (CDI) for production and yield was observed to be 0.13 per cent and 0.12 per cent respectively. Results revealed that production as well as yield showed higher instability rate.

Mahmadajaruddin and Mamani (2020) worked out the instability index during the period from 2006-07 to 2017-18. The results revealed that Rajasthan exhibited high variability in area (43.30), production (46.70) and Productivity (36.76) i.e., Production instability was found to be highest in Rajasthan followed by Gujarat (34.55 per cent), Haryana (30.16 per cent), Maharashtra (29.96 per cent) others (23.87 per cent), Karnataka (21.87 per cent), Bihar (11.79 per cent) and India (23.70 per cent). In India has shown variability of (24.33 per cent) with reference to the variability of onion exports, the value of onion exports displayed a highest variability (35.01 per cent) than that of quantity (25.22 per cent). It was witnessed in instability index, with respect to India fluctuation was much observed in case of production which is mainly due to farmers changing the onion varieties.

Palanisingh *et al.* (2020) worked out the Instability in Groundnut export. Groundnut is the most important oil seed crop in India. India is the major exporter of groundnut in the world. The least Coefficient of Variation is 1.2 per cent in the North- East Asia region and it reveals that there was a consistency in export performance of Indian Groundnuts.

Tandane and Kaur (2020) examined the instability in area, production and yield of tea in major tea producing states of India namely; Assam, West Bengal, Tamil Nadu, Kerala and Karnataka during the period from 1990 to 2017. The results revealed that the instability in yield was high at 6.42 per cent than area (1.52 per cent) and production (0.79 per cent) state wise growth rate of production was positive and significant in Assam, West Bengal, Tamil Nadu and Karnataka whereas positive but

non-significant in Kerala. Instability index was high for yield than area in all the selected states.

Punia *et al.* (2021) worked out the instability of wheat and rapeseed mustard, in case of wheat during 1970, production increased at moderately constant rate. However, highest fluctuation was seen in the case of yield. Use of green revolution technology decreased yield instability in wheat in first period then it grew in second period and becomes high. In most of the states, yield instability was main source of instability in food grown production. With regards to rapeseed mustard; instability increased up – the economic reform period then started decreasing for area. Overall instability was found maximum in area, production as well as for yield (double than India). Overall instability in area was 11.32 per cent for India in comparison with Haryana (30.78 per cent). In case of area, Haryana registered decreasing trends over the years. Overall instability in production and yield was also high (41 per cent &50 per cent) for Haryana in comparison with India (21 per cent &16 per cent) yield instability highest in green revolution period (21.20 per cent). The result revealed the clear picture of instability which was much higher in rapeseed mustard than wheat, regardless of rabbi crops.

3. Trends in domestic and international price of Maize

Shende *et al.* (2002) analysed the export and import trend of Indian pulses. The author stated that both quantity and price effect the value of export. Time to time fluctuation in prices was recorded. An increase in price was observed over a period of time due to the inflationary effect.

Bhat *et al.* (2011) studied the Indian coffee prices and identified the factors affecting the Indian coffee prices. For analysis of Indian coffee prices, the period of study was divided into two periods viz. before deregulation of coffee trade (1980-1991) and after deregulation of coffee trade (1992-2007) as deregulation of coffee trade was a main event, which fetched a major change in Indian coffee trade. Results revealed that the instability in prices has increased during the post deregulation phase owing to opening up of Indian coffee market to world market. In terms of real prices, the growth was positive during the post deregulation period. During the post deregulation period, the international coffee prices were found to be having a significant impact on Indian coffee prices both in Arabica and Robusta

coffee. The findings of the study amply demonstrate that there is greater dependence on international price and accordingly Indian coffee prices move.

Mahesha (2011) examined the global price volatility of Indian spice exports and suggested that the selected spices i.e., pepper, ginger, cardamom, turmeric and chillies showed variability in the New York market over time and this persisted in the long term and also volatility clustering in prices was observed.

Jiang and Wang (2013) studied the price fluctuation of agricultural commodities in the worldwide market due to the increasing impact of price fluctuation on the economic stability of the country. In this paper, they studied the short-term dynamic impact of the price fluctuation in the international market on China's agricultural experienced in the domestic corn market of China due to the immediate shock from the international price changes.

Guledgudda *et al.* (2014) study was undertaken to analyse the Export Competitiveness and trade direction of Indian cashew nut. The total export earnings from export of cashew kernel and cashew nut shell liquid has increased from Rs. 447.80 crores in 1990-91 to Rs. 4390.68 crores in 2011-12. The main competitors for India in the international market are Vietnam, Brazil, Indonesia and Tanzania.

Sharma and Burark (2015) noted the price behavior of maize and market attention in Himbahera of market of Rajasthan. And the study was undertaken by gathering monthly wholesale prices of maize in main maize markets of Rajasthan for a period of 12 years (2002 to 2013). The seasonal price index delivers a measure of the month-to-month difference in maize prices. Price of maize was found to be highest during off season and lowest during harvest season. The higher seasonal indices of prices were recorded during April to August. And lowest price index was found during October in Nimbahera market.

More and Katkade (2016) studied the price fluctuation in oilseed crops over time. The result revealed that the prices of oilseeds crop i.e., soybean and safflower in all certain markets of Marathwada region of Maharashtra were seasonal. The price index of soybean was highest in the month of December with coefficient of variation value of 29 per cent and indicating highest prices during this month. With respect to safflower, the price index was highest in the month of June with desirable coefficient of variation 19 per cent only. Specified guaranteed highest prices for

safflower during month of June and maximum prices prevailed in Aurangabad market.

Arisoy and Bayramoglu (2017) examined the prices of agricultural commodities fluctuate depending upon some factors. In turkey, potatoes are one of the major products for which price variations are observed. This study was undertaken to determine the effect of the variation in potato prices on producer's income in turkey. The result showed that the price variation in potato prices has quite a rapid effect on production. It was determined that producer income varies greatly depending on yearly potato prices. The difference between estimated potato price and the actual price of the year 2012 resulted in an income loss of 11.198.6$/ha.

Sharma and Mehta (2017) analyzed the price behaviour of maize crop in the selected markets of main maize growing states of India. The result revealed that normally the maize prices were low in post-harvest period from October to January, high in pre-harvest period from June to August and moderate in the remaining months in all the markets.

Darekar and Reddy (2018) examined the wheat prices in India during the period from January 2006 to June 2017. The forecast showed that for the year 2017 -18 the market prices of wheat were ranging from Rs. 1620 to 2080/Q during harvest season. The month-to-month variation in world wheat prices had adversely affected Indian domestic wheat market. During the period procurement at MSP was limited to less than 20 per cent of wheat production. Market defectiveness in domestic wheat market had adversely affected domestic price of wheat in the country. Price indices of wheat was found to be the highest during off season and lowest during harvest season.

Dastagiri *et al*. (2018) conducted his research on trending prices for India's major cereals during WTO Regime. Until 2001-02 global price trends of maize were fluctuating followed by stable price trend. In 2005-06 global price trends of rice, wheat and total cereals were more or less stable. But 2006 onwards global price trends of this crops were found to be gradually increasing with fluctuations.

Mittal *et al*. (2018) measured the domestic and global prices and recorded higher fluctuations. In 2008, the domestic price of maize was below the global price leading to increase in export of maize and continued to increase till 2013.

Sharab *et al.* (2018) examined the price analysis of garlic for main markets of Maharashtra India. Huge fluctuations in prices of farm produce were witnessed during past few years. The data related to monthly average prices and arrivals of garlic were collected for main markets of Maharashtra viz. Ahmednagar, Karad, Pune and Nagpur for the period 2005-2016. The prices of garlic were higher from the month of September to January in several markets. i.e., Ahmednagar, Karad, Pune and Nagpur. And the prices decline slightly during June to August which is pre-harvest season. Price indices were lowest in February - May in all markets. The higher prices observed during the year 2006, 2007, 2011 and 2016. The price series of garlic in all selected markets were stationary at level with lag 1. Thus, the result revealed that there was high variability in the prices of garlic.

Sabu *et al.* (2019) examined the price behaviour of black pepper with reference to liberalization period. The results showed that the variation in the price of black pepper increased in the post-liberalization period.

Khasanah *et al.* (2020) examined the changing trends in red chilly prices to identify the influencing factors. A large and continuous demand for red chilli inconsistent with production volumes caused frequent and extreme price variations throughout the year. The study was conducted in the Sleman District of Yogyakarta, Indonesia. The study found a rising trend in prices in the Sleman regency from January 2014 to December 2016. The primary factor that significantly influenced the price of red chilli in Sleman regency was the price of cayenne peppers.

Ragade *et al.* (2020) worked out the price behavior of wheat in Maharashtra and concluded that domestic price of wheat was higher during the month of July to December in all selected markets. Price fluctuations in wheat were observed to have both seasonal and cyclical variations. The highest value of the cyclical indices for wheat price was recorded in the year 2008, 2014 and 2018.

4. Export Competitiveness of maize

Akhtar *et al.* (2013) examined the Pakistan's competitiveness in trade of selected horticulture goods with respect to global trade. The research indicated that Pakistan's comparative and competitive advantages have been risen in all the selected commodities during period under analysis which indicated the potential of horticulture trade for foreign exchange earnings. There is need to improve

comparative and competitive advantage in horticulture sector by policy support and facilitating role by all stakeholders.

Dastagiri *et al.* (2013) evaluated the vegetable export competitiveness and proposed methods to boost Indian vegetable exports. The findings revealed that Indian vegetables have a significant export potential. The results demonstrate that the Nominal Protection Coefficient for all vegetables is less than 1, indicating that they are competitive in global markets. As per the analysis, the Indian Government should improve vegetable cultivation, processing, exports.

Kumaresh and Sekar (2013) worked out the export performance and competitiveness of fresh mango and mango pulp in India during period from 1987-88 to 1999-00 as period I and 2000-01 to 2011-12 as period II. The data regarding country -wise export of fresh mango for two periods indicated that export retention share in UAE (72.73 per cent) in period I and UK (48 per cent), minor importing countries pooled under another category (59.62 per cent) in period II. In case of mango pulp export retention share in Yemen Republic (86.06 per cent) and others category (64.43 per cent) in period I and Netherlands (58.02 per cent), US (44.52 per cent) in period II. For fresh mangoes; UK, Nepal in period I and Saudi Arabia, Bahrain in period II were not a constant importer. Netherland in period I and Yemen Republic, UK in period II were not the constant importers. According to the report, export strategies should be focused at these countries in order to maintain the export of both fresh mango and mango pulp. According to the above findings, fresh mangoes are price competitive in the worldwide market and have a lot of room for growth as a domestic business in the next years.

Rani *et al.* (2014) examined the trends in competitiveness of main crops in pre- and post-WTO period. In case of maize, the lower NPC values under importable hypothesis in pre-WTO period show that the domestic process received by the farmers was lower than the global prices, implying that maize growers in the states were dis-protected. But in post-WTO period the NPC values were above one which showed the non- competitiveness maize crop in this period. Under exportable hypothesis NPCs were greater than unity for all the years. This implies that Andhra Pradesh do not have any advantage in the trade of this crop.

Darekar (2015) studied the performance and competitiveness of export of onion from India using different techniques as Nominal Protection Coefficient and export performance ratio. The export performance ratio (EPR) and Nominal Protection Coefficient (NPC) has been assessed to examine the export competitiveness of India in onion. Onion has shown competitive disadvantage during the pre-WTO, as values of NPC and EPR are more than one. But during post-WTO period, the competitiveness has risen as in evident from the NPC and EPR values which turned out to be less than one. The study has suggested to exploit the competitiveness of Maharashtra.

Karthik *et al.* (2015) studied the growth and export performance of ginger in India. The objectives are analyzed using Nominal Protection Coefficient and growth rate analysis. Indian agriculture has to face competitiveness in global trade for each commodity due to liberalization and agreement of WTO. Export competitiveness of ginger NPC was worked out for the years 2004-05 to 2008-09 .it showed that the NPC is less than one in all the years which was mainly due to higher domestic price than the world price. USA, Bangladesh, UK and Spain are the main importers of Indian ginger. The main competitors of ginger export are China, Nigeria and Thailand. In order to face competition and increase India's, market share in the world market India need to consistently supply variety of quality ginger at competitive prices.

Sharif *et al*. (2015) measured the competitiveness of cereals and their products export from Pakistan for a five years period (2008-13) using RCA index. The crops selected for the study were rice, wheat, maize, barley, millets and canary seeds. They found that Pakistan had a comparative advantage in production and export of cereals during study period. They further concluded that relatively less yields of wheat, barley and millets were responsible for poor policies towards these crops.

Bojnec and Ferto (2016) analysed the export competitiveness of the fruit and vegetable products of the European Union (EU-27) member states in the global markets. According to the findings, Spain and Netherlands had the strongest comparative advantage in all fruits and vegetable products sold in international markets, while the other EU-27 member states had comparative advantage in only a

small portion of the total fruits and vegetable products exported globally to other international market.

Devi *et al.* (2016) studied the direction trade of chilly and the global competitiveness of chilly was estimated using Nominal Protection Coefficient and has showed that USA is the most stable market for chilly, followed by UAE and Sri Lanka, while Malaysia, Bangladesh and Pakistan are the unstable importers. The study has found that during 2011-12. The main markets for Indian chilly were Malaysia (24.83 per cent) and Sri Lanka (14.20 per cent). The estimated NPCs had indicated that the Indian chilly was price competitive during the study period 2006-07 to 2010-11. A comparison of competitiveness of Indian chilly against Chinese red has revealed that Indian red chilly was globally price competitive for three years in the study period of five years, 2006-07 to 2010-11.

Aneja (2017) examined the Trends and Export competitiveness of major horticultural crops in India and computed that except for fruits like Mosambi, grapes and mango and vegetables like onion, India does not have any revealed comparative advantage in export. He inferred that the competitiveness of Indian fruits and vegetables is negatively impacted by the high delivery price.

Audichy *et al.* (2017) estimated export competitiveness of different importing countries for groundnut using Nominal Protection Coefficient (NPC) for the period 2009-10 to 2013-14. (NPCs) showed that groundnut was moderately competitive during the entire study period to all importing nations except Pakistan to which it was less competitive. The top groundnut importers from India were Indonesia, Malaysia, Philippines, Pakistan, Thailand and Ukraine.

Leau (2017) studied India's competitiveness Index and the revealed comparative advantage (RCA) was calculated. The index results showed that India has a Strikingly great comparative advantage and specialization in rice, groundnut pulses, fresh onions, guar gum, fresh mango, fresh grapes and fruits, vegetables and seeds.

Arora and Batra (2019) examined the export competitiveness of Indian oilseeds for period of 2001 to 2017. The main and huge production in agriculture is oilseeds which make India on the first number in Production of oilseeds in the world. The study showed that changes in India's share of the worldwide market for products

export in to competitiveness and structural consequences over 2001-2017. During the study period, India gains market share of her export of groundnut (oilseeds) in the various markets due to its competitiveness in the export of the same product. The analysis showed that India enjoys a competitive edge in groundnut export (oilseeds).

Pachpor *et al.* (2021) analysed the export competitiveness of pomegranate during period from 1988-89 to 2018-19 using Nominal Protection Co-efficient. The competitiveness of market depends upon NPC ratio. The results revealed that, at an overall level, the NPC values of pomegranate export was worked out to 0.82, it is indicating moderately export competitiveness of pomegranate in global level and proves commodity is protected in global market but when it was analyzed for the two different periods in period I and period II. It was witnessed that, the crop was during the period I and period II average NPC values was o.84 and 0.80, respectively which also indicated moderately export competitiveness for both the period I and period II. i.e., Indian pomegranate has better competitiveness in international market is accepted here.

Kshirsagar *et al.* (2020) studied the export competitiveness of spices from India from 2000-01to 2016-17 and revealed that in the international market Indian chilli and coriander were competitive while black pepper, turmeric and cumin were moderately competitive. The study showed that India could encash this competitive advantage by developing modern infrastructure.

CHAPTER – III

METHODOLOGY

CHAPTER- III

METHODOLOGY

The research methodology and design of the study is an important aspect of research to analyse given objectives of the study. The purpose of any investigation is to find the relevant conclusion in order to draw and conclude meaningful conclusion. It is an important step for the researcher to apply suitable method and procedure for the explanation of methodology adopted to justify the objective of the study. The present examination was undertaken to study the "Export performance of Maize from India". This chapter deals with the nature and source of data, period of the study and analytical tools and techniques used to draw the interferences.

3.1Nature and source of data

In the view of maize emerging as an important cereal crop in the world and its increased industrial uses also it was trading in domestic as well as international market. Due to this reason maize was selected for the analysis. The study was totally based on secondary data. The secondary data on export quantity, export value and international prices were gathered from Agricultural and Processed food products Export Development Authority (APEDA). The data for production and domestic prices was collected from Government portals like Indiastat, Agmarknet, Ministry of Commerce and Industry and Directorate of Economics and Statistics.

3.2 Period of study

The data concerning about production and export of maize in India for last 20 years from period (1999-2000 to 2018-2019) was collected (Anjum and Madhulika , 2018). The time series data has been divided into two sub periods and overall period for better comparison.

Period I (1999-2000 to 2008-2009)

Period II (2009-2010 to 2018-2019)

Overall period (1999-2000 to 2018-2019)

3.3Analytical tools and techniques

The data from (1999-2000 to 2018-2019) was collected from secondary sources subjected to proper analytical techniques in order to achieve a better conclusion.

The different analytical techniques used in the study are as follows:

- Tabular Presentation
- Growth rate analysis
- Instability analysis
- Trend analysis
- Nominal Protection Coefficient (NPC).

3.3.1Tabular Presentation

Collected data were presented in the tabular form to facilitate easy differentiation. The data were summarised with the aid of statistical tools like per cent Share to obtain the meaningful results.

From the tabular presentation logical and statistical assumptions are derived.

3.3.2 Estimation of Growth rates

The growth rates in production and export of maize was studied by using compound growth rates (CGR). It helps to analyse 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 assessed by best fitting exponential equation (Mahmadajaruddin and Mamani, 2020).

The growth rate was estimated using following model

$$\mathbf{Y = a.b^{t}}$$

where,

Y = Production/ Export quantity/ Export value of maize export.

a = Intercept

b = Regression Coefficient

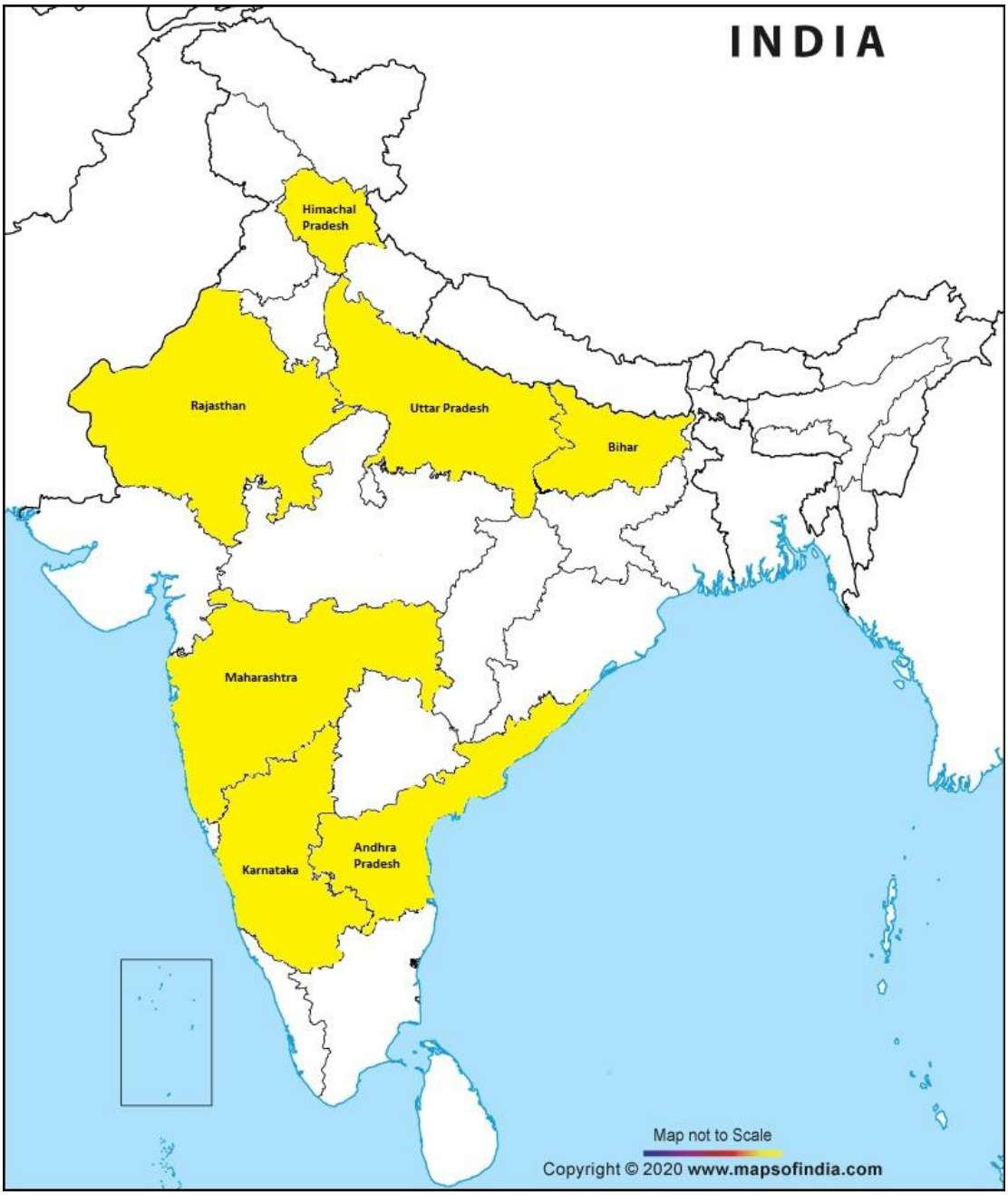

Fig. 3.1 Maize growing states in India

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.

3.3.3Degree of instability in production and export of maize

Instability in export is calculated to hamper the process of economic growth. To study the variability in production, export quantity and export value in maize from period (1999-2000 to 2018-2019) the Co-efficient of variation (CV) and Coppock's Instability Index (CII) was worked out.

3.3.3.1 Coefficient of variation

Degree of instability in production and export of maize was measured by using coefficient of variation (Sharma and Burark, 2015).

Co-efficient of variation **(CV) =** $\frac{\sigma}{\bar{x}}$ **×100**

Where,

$$\sigma = \sqrt{\frac{\Sigma (X - \bar{X})^2}{n - 1}}$$

σ = Standard deviation

$\bar{X}$ = Arithmetic mean

X = Variable

n = Number of observations

3.3.3.2Coppock's Instability Index (CII)

Coefficient of instability is another measure of instability besides coefficient of variation. The coefficient of variation estimates the variation around the trend. Coppock's Instability Index (CII) is close approximation of the average year to year percentage adjusted for the trend are extra pronounced than the absolute variation (Aware *et. al*., 2019).

Coefficient of instability was worked out using Coppock's Instability Index.

$$V \log = \frac{\sum \left(\log \frac{X_{t+1}}{X_t} - m \right)}{N}$$

The Instability Index = $\left[\text{Antilog}\left(\sqrt{\text{V log}}\right) - 1\right] * 100$

Where,

X_t = Production/ Export Quantity/Export value of maize in year t

N = Number of years minus one

m = Arithmetic mean of the differences between the log of X_t and X_{t-1}, X_{t-2} etc.

V log = Logarithmic variance of the series.

3.3.4 Trend Analysis

The trend in domestic and international prices of maize was worked out by using exponential or non-exponential function.

The goodness of fit of trend line to the data tested by computing the coefficient of multiple determinations which is denoted by R^2.

Following equations was used to work out the trend viz.,

$\mathbf{Y_t = a + bt}$

$\mathbf{Y_t = a + bt + ct^2}$

$\mathbf{Y_t = ab^t}$

where,

Y_t = Domestic / International Price

A = intercept

T = Time

b & c = Partial Regression Coefficient

3.3.5 Export competitiveness of maize

The export competitiveness of maize was measured by using Nominal Protection Co-efficient (NPC).

NPC was calculated to conclude the extent of competitive advantage of the commodity. The Nominal Protection Co-efficient (NPC) is well-defined as the ratio of the domestic price to the world reference prices of the commodity under consideration. In other words, it helps to measure the protection provided to the product. Nominal Protection Co-efficient (NPC) ratio helps to predict the competitiveness of market (Audichy *et al*., 2017). Nominal Protection Co-efficient (NPC) was estimated using following formula:

$$\mathbf{NPC} = \frac{\mathbf{P_d}}{\mathbf{P_r}}$$

where,

NPC = Nominal Protection Co-efficient

P_d = Domestic prices of the maize

P_r = World reference price of maize

If NPC > 1, the commodity is protected, compared to the situation that would prevail under free trade.

If NPC < 1, the commodity is not protected.

CHAPTER – IV

RESULTS AND DISCUSSION

CHAPTER-IV

RESULTS AND DISCUSSION

The present investigation evaluates the important discoveries of the study which are presented in the form of figures and tables. The present section had been commenced with a view to study "Export performance of maize from India". This chapter of the study deals with the information correlated to the export, growth and instability, export performance of maize, trend in international and domestic prices of maize and export competitiveness of maize in the worldwide market. For better understanding this section was divided into following subheadings:

4.1 To estimate the Growth in production and export of maize

4.2 To work out the instability in production and export of maize

4.3 To study the trends in domestic and international price of maize

4.4 To study the export competitiveness of maize in India

4.1 Growth rate in production and export of maize:

The present study describes the export performance of maize regarding Area, Production, Productivity, export quantity and value which is earned from export for the year 1999-2000 to 2018-2019. Compound growth rate was calculated for the collected secondary data. For analysis purpose, the study period (2000-2019) was sub-divided into three periods *viz*.

- Period I (1999-2000 to 2008-2009)
- Period II (2009-2010 to 2018-2019) and
- Overall Period (1999-2000 to 2018-2019)

To estimate the growth rate exponential form was used and results of analysis of growth rate in area, production, productivity, export quantity, export value are presented in the following Tables 4.1 and Table 4.2.

From Figure 4.1., it was observed that during initial period of study (1999-2000) 6582 thousand hectares area was recorded. Area under cultivation witnessed increasing trend during the entire study period. Growth in area reached its

maximum in the year 2016 with 9633 thousand hectares and then it steadily declined. During the overall study period (1999-2000 to 2018-2019) area under maize cultivation witnessed continuous fluctuations.

Figure 4.2 showed the production of maize and observed an increasing trend during the overall study period (1999-2000 to 2018-2019). It was observed that, in the early period of the study, (1999-2000) the production recorded was 13160 thousand tonnes and then it gradually declined in the year 2002 to 1152 thousand tonnes. Later on, maize witnessed the maximum production of 28753 thousand tonnes in the year 2017 and then again production of maize declined in the year 2019 with 27715 thousand tonnes. Like area, in the overall study period continuous fluctuation was observed in production of maize.

Figure 4.3 revealed that productivity of maize during (1999-2000) is around 2000 kg/ha which increased to 2676 kg/ha in the year 2013 and then gradually decline in the year 2016 with 2563 kg/ha. 3065 kg/ha productivity of maize was recorded during 2017. During (2018-19) maize recorded highest productivity of 3070 kg/ha. From the results it was clearly evident that there was an increasing trend in the productivity of maize.

The results in Table 4.1 showed that during period I (1999-2000 to 2008-2009) production of maize observed positive and significant compound growth rate of 5.28 per cent per annum followed by productivity 2.28 per cent per annum and area 2.93 per cent per annum at one per cent level of significance. In period II (2009-2010 to 2018-2019) Production and Productivity observed positive and significant compound growth rate of 3.26 per cent per annum, 2.50 per cent per annum respectively, at one per cent level of significance. While area in period II observed positive and significant compound growth rate of 0.73 per cent per annum at ten per cent level of significance.

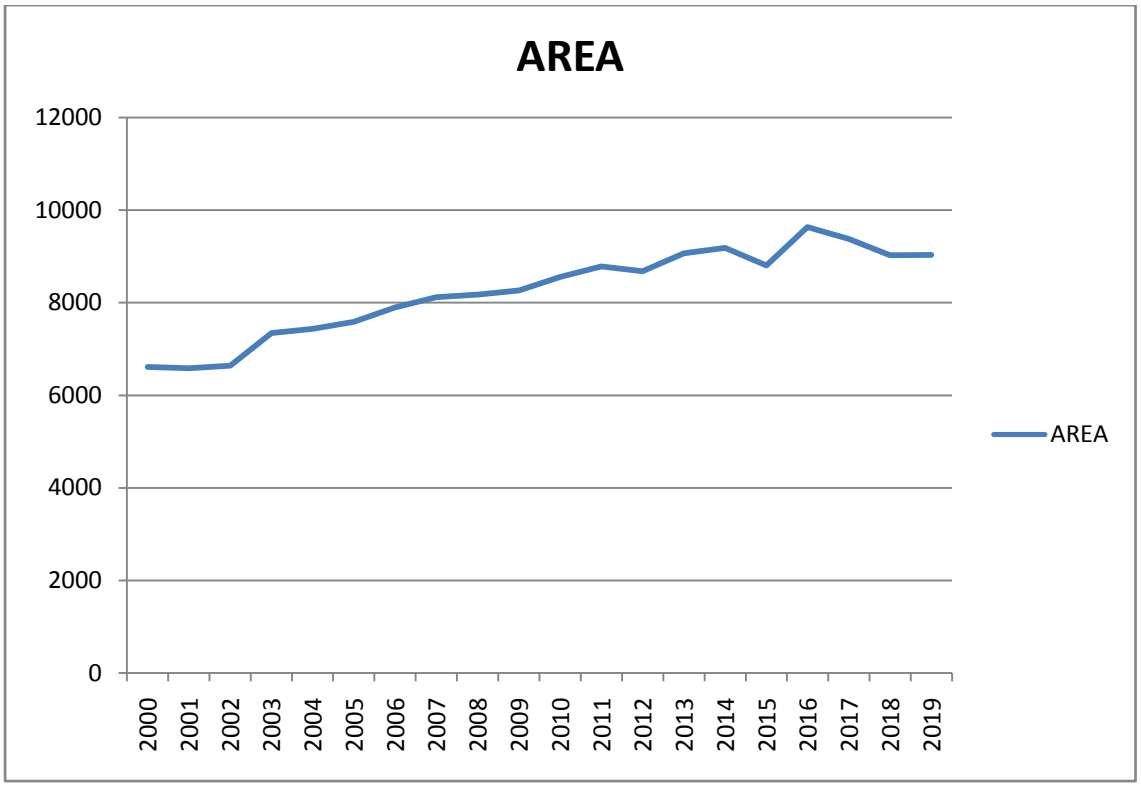

Fig. 4.1 Area under Maize cultivation

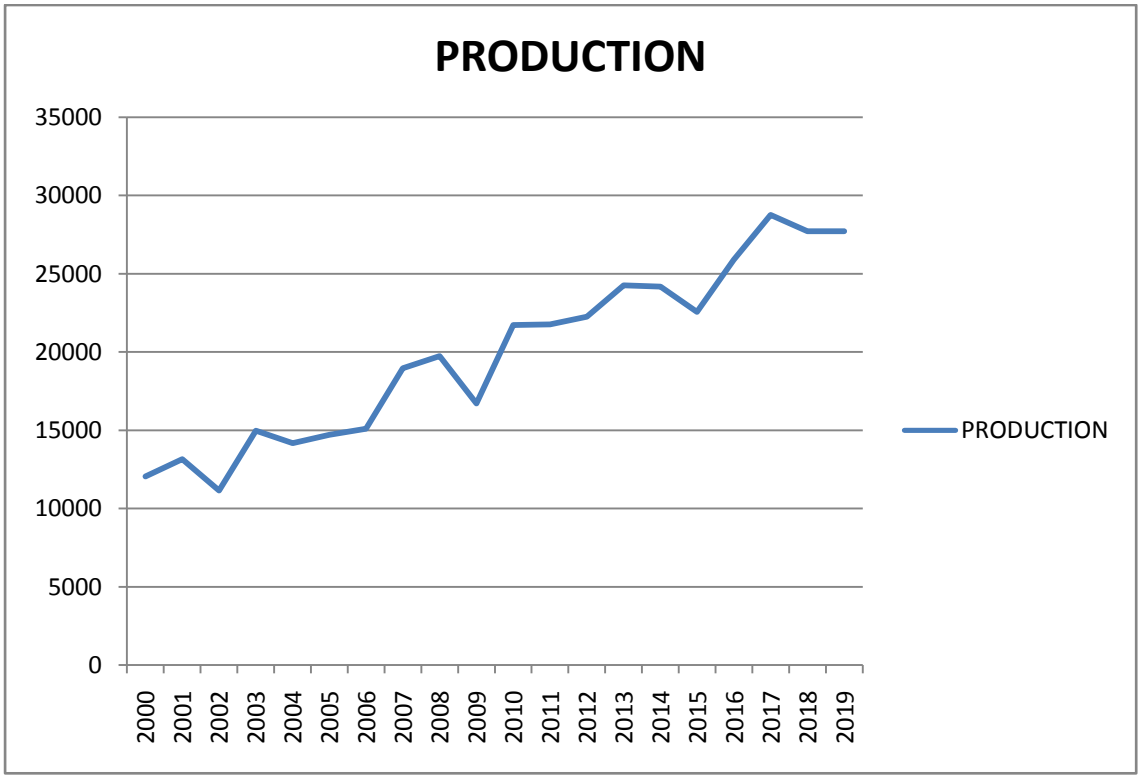

Fig 4.2 Maize Production in India

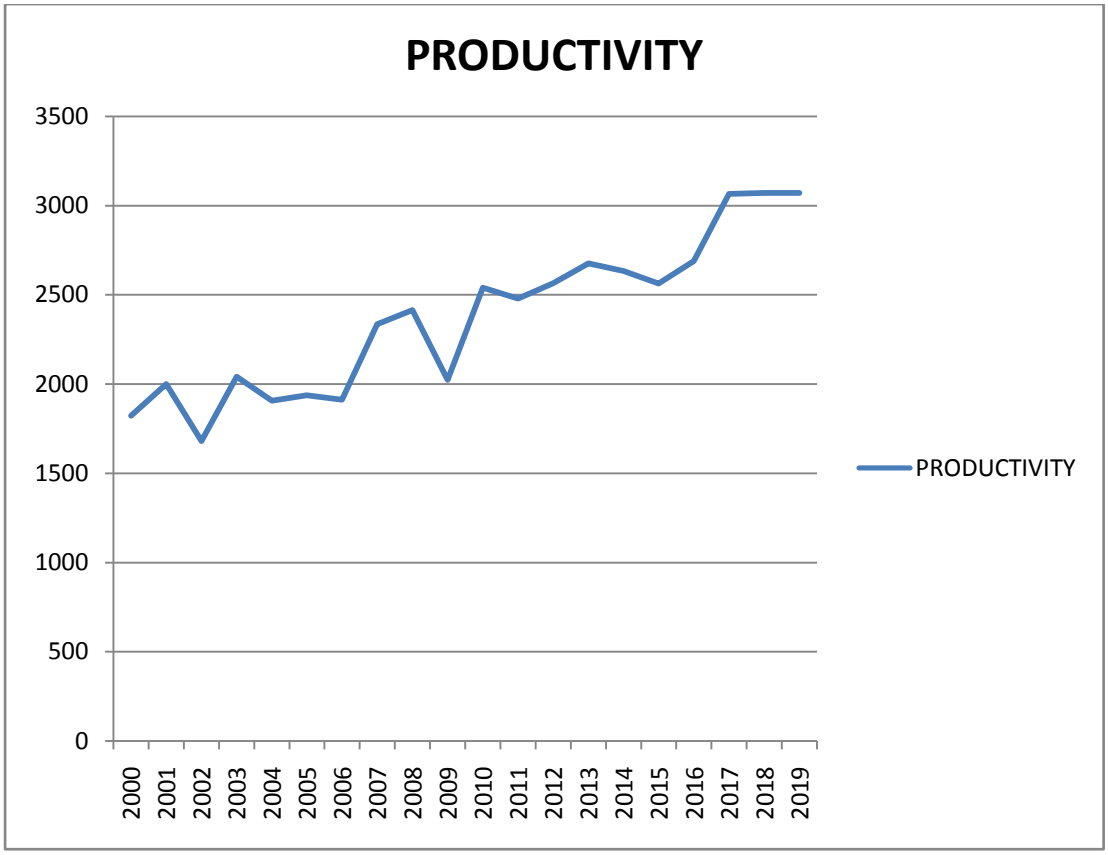

Fig. 4.3 Productivity of Maize in India

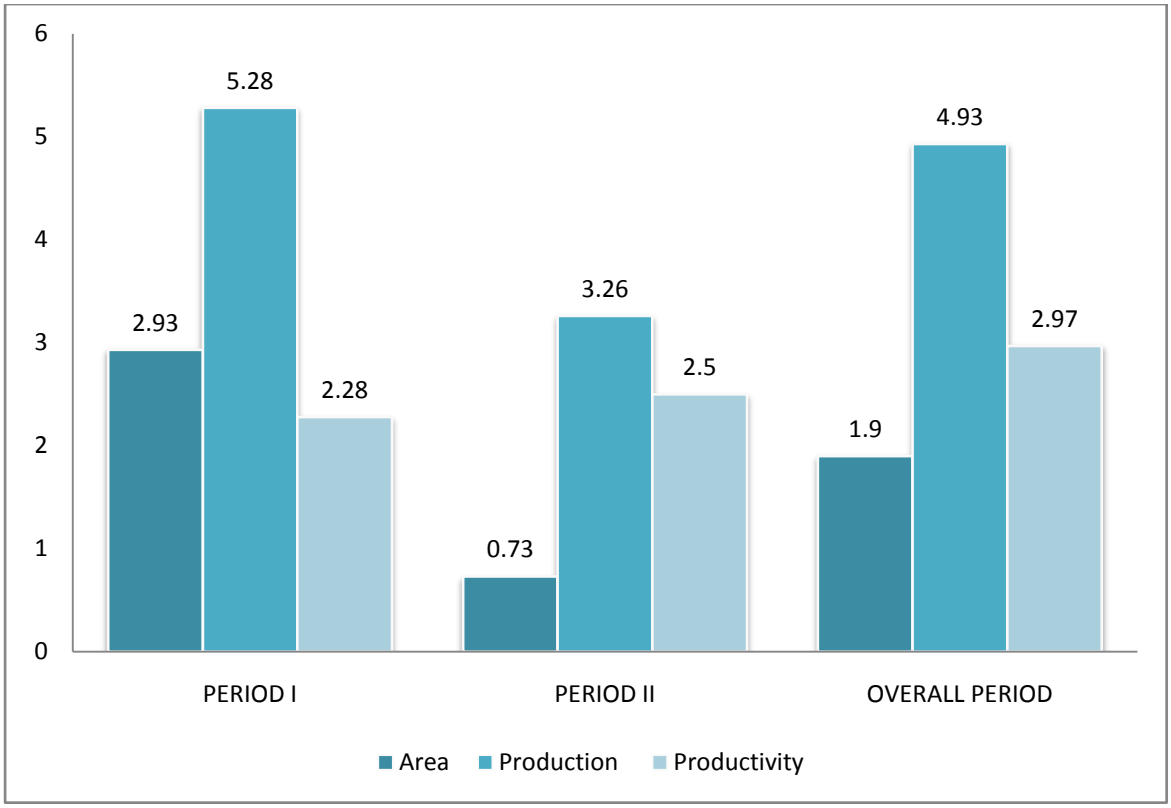

Fig. 4.4 Compound Growth Rate of Area, Production and Productivity of Maize in India

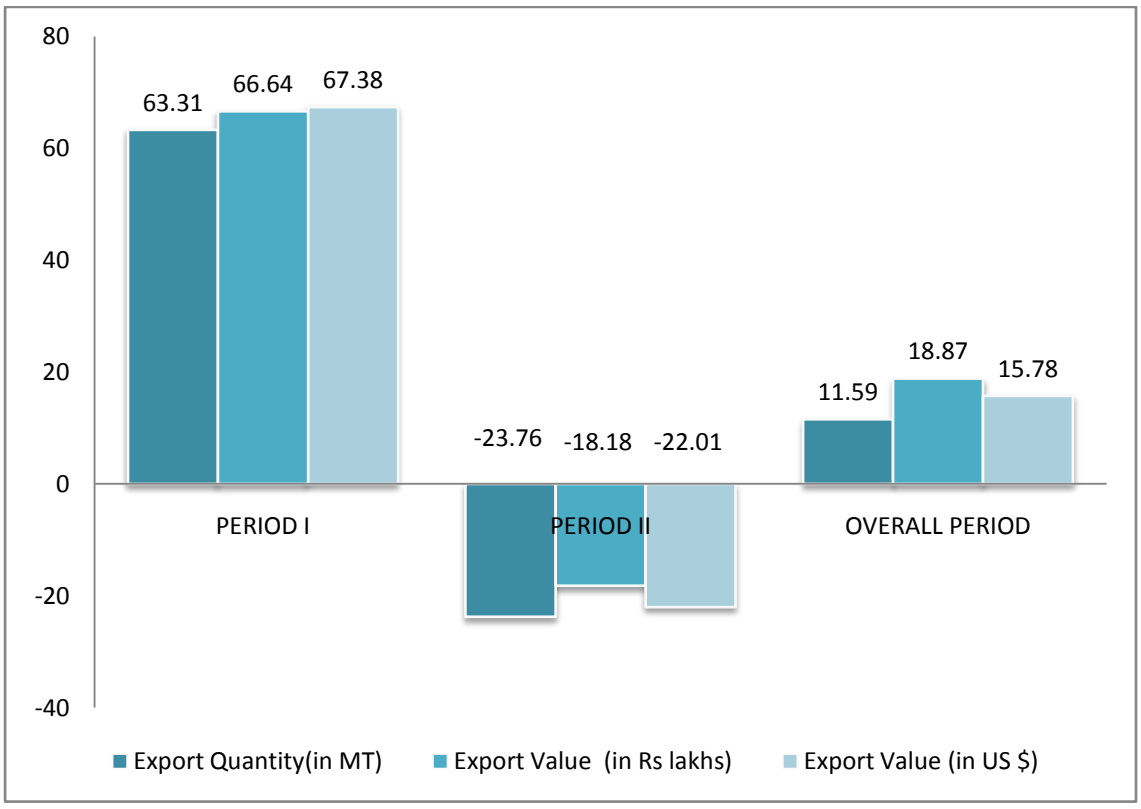

Fig. 4.5 Compound Growth Rate of Export quantity and Export Value of Maize

Table 4.1: 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)

In overall study period (1999-2000 to 2018-2019) area, production and productivity observed positive compound growth rate. Productivity observed highest and positive compound growth rate of 2.97 per cent per annum followed by production 4.93 per cent per annum and area 1.90 per cent per annum at one per cent level of significance which was found statistically significant. Hence, the hypothesis that is there is significant stable growth in production and export of maize in India has been accepted. The results were in close association with findings of Ayalew and Sekar (2016), Dhakre and Sharma (2010), Patil *et al*. (2018) and Swamy *et al*. (2019).

Table 4.2: Compound Growth Rate of Export Quantity and Export Value (in Rs. Lakhs and Million US $) of Maize from India

Particulars	CGR	R^2	SE	t value
Export Quantity				
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. Lakh)				
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)

The results presented in Table 4.2 shows that during period I (1999-2000 to 2008-2009) export quantity of maize compared to other two periods taken into consideration recorded the highest and significant compound growth rate of 63.31 per cent per annum. Similarly, Export value (in Rs. Lakhs and million US $) witnessed highest compound growth rate of 66.64 per cent per annum and 67.38 per cent per annum, respectively which was statistically significant at one per cent level of significance.

In period II (2009-2010 to 2018-2019) export quantity of maize witnessed a negative compound growth rate of -23.76 per cent per annum followed by export value (in Rs. Lakhs) at -18.18 per cent per annum and export value (in million US $) at -22.01 per cent per annum which was statistically significant at one per cent level of significance. Thus, period II showed that the export quantity and export value have been facing many challenges in the global market.

During overall study period (1999-2000 to 2018-2019) export quantity of maize recorded positive and significant compound growth rate of 11.59 per cent per annum this was statistically significant at five per cent level of significance. While the export value (in Rs. Lakhs) and export value (in Million US $) witnessed positive and significant compound growth rate of 18.87 per cent per annum and 15.78 per cent per annum, respectively at one per cent level of significance. Growth in export quantity, export value (in Rs. Lakhs) and export value (in Million US $) was comparatively low than period I. The results were in close association with findings of Adhikari *et al.* (2016).

Figure 4.6 showed the trend in export quantity of maize during the study period (1999-2000 to 2018-2019). It was clearly depicted that during the initial period of study, 1999- 2000 export quantity was 113504.15 MT which later increased to 3537302.96 MT in year of 2008. Export quantity reached its maximum in year of 2012 with 4788328.25 MT. Quantity of maize exported from India showed an increasing trend till 2012 and declined continuously after 2012. Quantity exported was 370066.11 MT in the year 2019.

Figure 4.7 displayed export value of maize in terms of Indian rupees. The period from 2000 to 2012 showed an increasing trend in value of export. Export value raised from Rs. 9112.2 Lakhs in 2000 to the highest value of Rs 709634.05

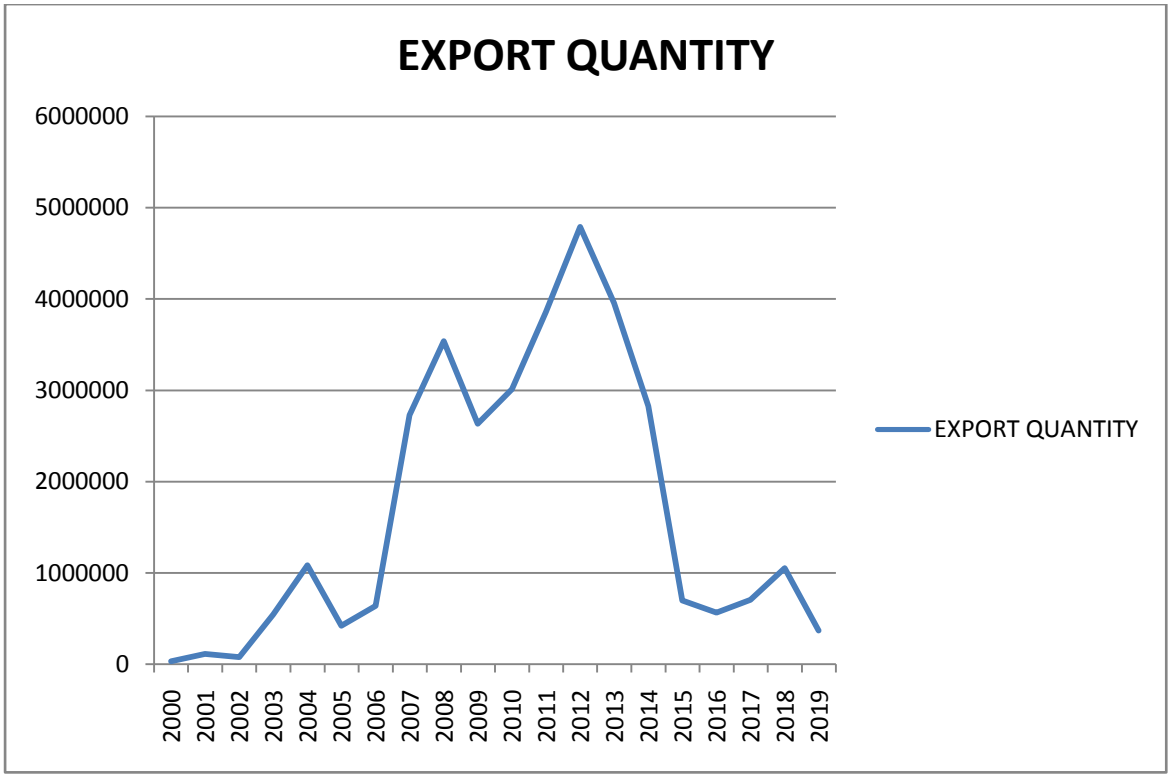

Fig. 4.6 Export quantity of maize from India

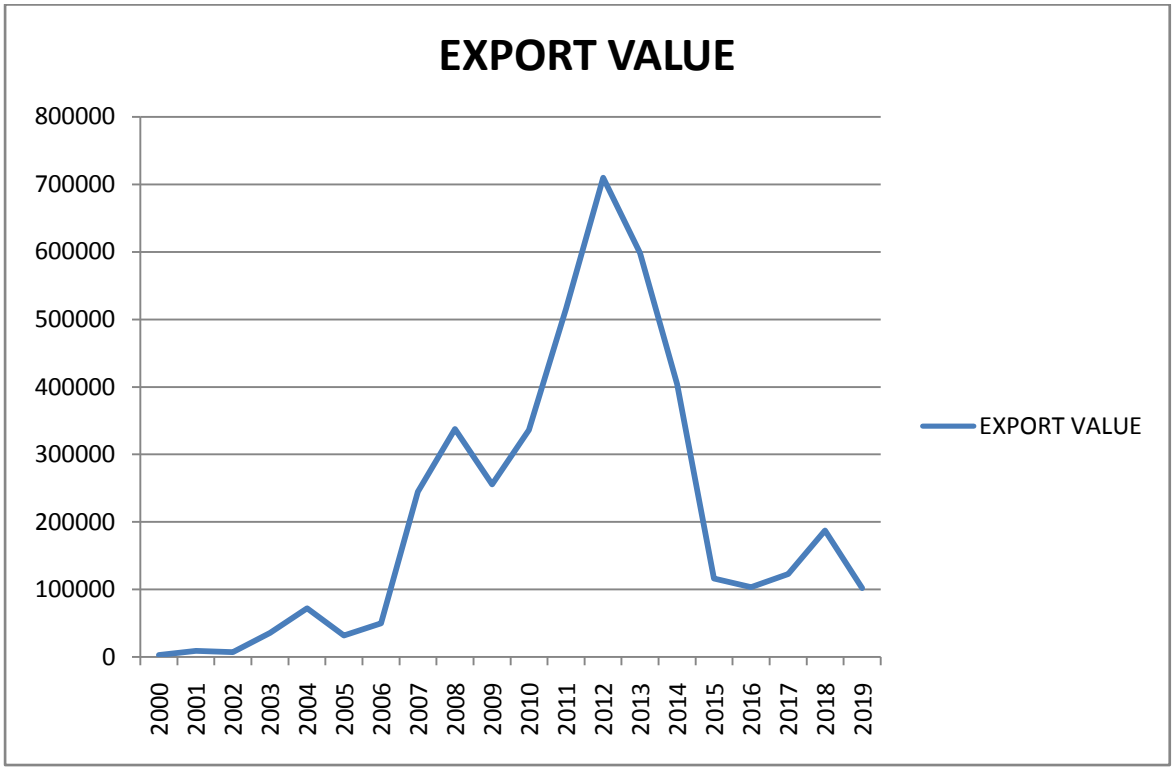

Fig. 4.7 Export value in Rs. Lakhs of maize from India

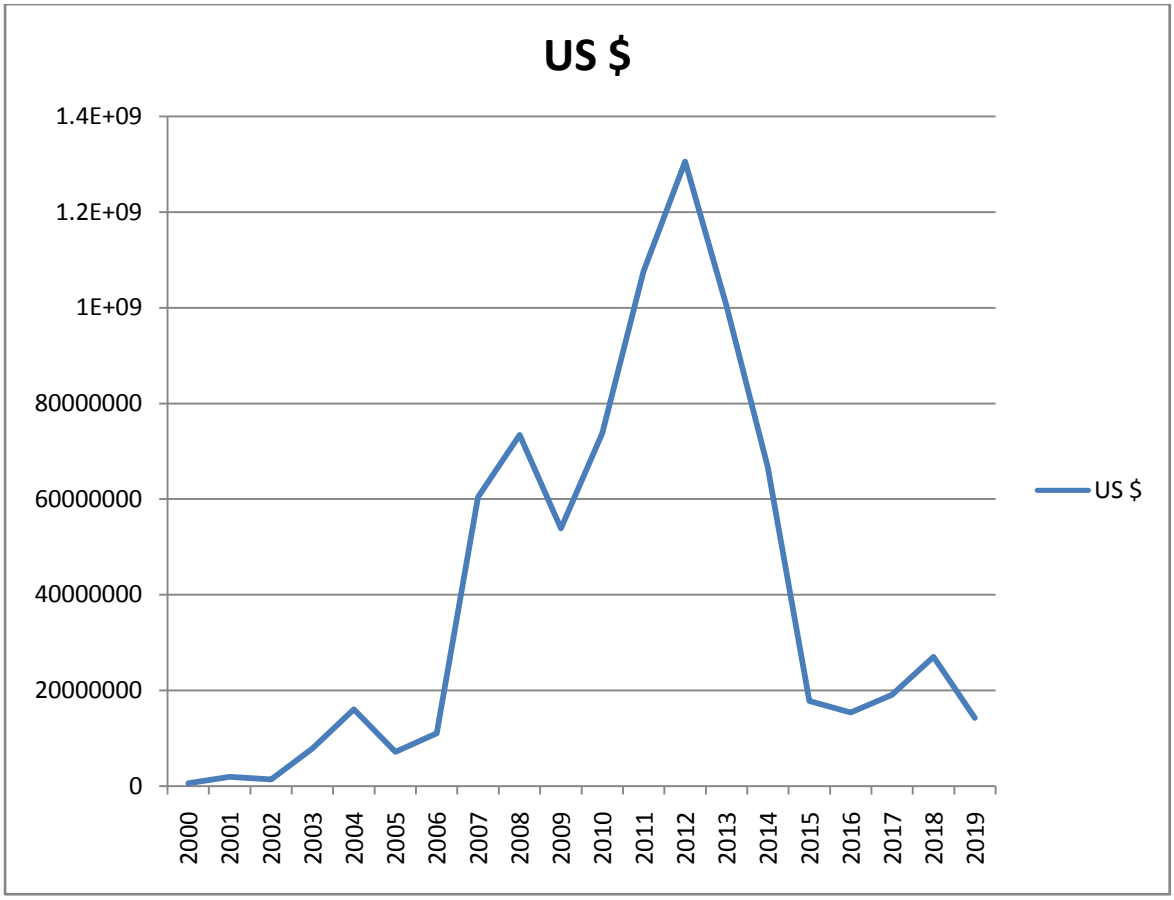

Fig. 4.8 Export value in million US $ of maize from India

Lakhs in 2012. The period from 2013 to 2019 exhibited declining trend in value of export.

Figure 4.8 showed the trend in export value in terms of Million US dollar. In the year 2012 the highest export value in Million US $ was observed with 1305294906 US $. After the year 2012 export value in US dollar declined continuously.

It clearly showed that India's share in export of maize declined in past few years and showed negative growth due to drought conditions which leads to low production, Increase of maize demand in the domestic market as well as from the starch industries and poultries within India, increased use in diversified industries such as bio-fuel, corn oil, alcoholic beverages, processed food, etc.

4.1.1 Country wise export performance of Maize

Country wise export performance of maize were analysed from 1999-2000 to 2018-2019 by using compound growth rate which is presented in the following Table 4.3.

The results in Table 4.3 revealed that export quantity exported to Bangladesh from India observed positive growth rate of 24.63 per cent at five per cent level of significance and export value also observed positive and significant growth rate of 32.00 per cent at one per cent level of significance during period I (1999-2000 to 2008-2009). During period II (2009-2010 to 2018-2019) growth rate of both export quantity and export value declined resulted in negative growth rate of -27.30 per cent at five per cent level of significance and -14.28 per cent at 10 per cent level of significance respectively. However, for the overall study period (1999-2000 to 2018-2019), negative growth rate of -1.09 was recorded which was statistically non-significant and 10.50 per cent at one per cent level of significance for export value. Figure.4.9 showed that the quantity exported to Bangladesh reached its maximum in the year 2010 with an export quantity of 735581.97 MT, later on it declined to 113735.96 MT in 2012. In year 2019, 9962.19 MT of export was recorded.

Table 4.3: Country wise Compound Growth Rate of Export quantity and value of maize from India

Sr. No.	Particulars	CGR	R^2	SE	t value
1.	**Bangladesh**				
Export quantity					
Period I		24.63**	0.50	0.07	2.83
Period II		-27.30**	0.50	0.11	-2.88
Overall Period		-1.09	0.00	0.04	-0.24
Export value					
Period I		32.00***	0.65	0.07	3.92
Period II		-14.28*	0.39	0.06	-2.30
Overall Period		10.50***	0.31	0.03	2.89
2.	**Vietnam**				
Export quantity					
Period I		375.40***	0.91	0.16	9.19
Period II		-50.54**	0.49	0.25	-2.78
Overall Period		46.60**	0.26	0.15	2.53
Export value					
Period I		247.98***	0.92	0.12	9.66
Period II		-44.39**	0.57	0.17	-3.29
Overall Period		43.80***	0.33	0.11	3.04
3	**Nepal**				
Export quantity					
Period I		208.32***	0.66	0.28	3.98
Period II		20.77***	0.80	0.03	5.68
Overall Period		66.96***	0.65	0.08	5.78
Export value					
Period I		136.10***	0.73	0.18	4.76
Period II		29.02***	0.91	0.02	9.22
Overall Period		66.76***	0.82	0.05	9.13
4.	**Malaysia**				
Export quantity					
Period I		279.24**	0.58	0.40	3.32
Period II		-55.55***	0.78	0.15	-5.37

Overall Period	23.21	0.08	0.16	1.29
Export value				
Period I	219.91**	0.64	0.30	3.83
Period II	-53.96***	0.77	0.14	-5.22
Overall Period	22.72	0.10	0.13	1.47
5. UAE				
Export quantity				
Period I	92.78***	0.80	0.11	5.71
Period II	-36.74***	0.94	0.04	-11.30
Overall Period	7.59	0.05	0.07	1.02
Export value				
Period I	94.83***	0.83	0.10	6.34
Period II	-32.62***	0.92	0.03	-10.03
Overall Period	14.13*	0.17	0.06	1.95
6. Yemen Republic				
Export quantity				
Period I	255.72**	0.49	0.45	2.78
Period II	-12.01***	0.60	0.03	-3.48
Overall Period	69.89***	0.46	0.13	3.91
Export value				
Period I	178.70**	0.51	0.35	2.90
Period II	-6.40	0.24	0.04	-1.60
Overall Period	59.09***	0.51	0.10	4.41
7. Singapore				
Export quantity				
Period I	153.55***	0.76	0.18	5.08
Period II	-53.96***	0.71	0.17	-4.48
Overall Period	10.19	0.03	0.11	0.83
Export value				
Period I	125.10***	0.88	0.10	7.88
Period II	-50.12***	0.70	0.15	-4.35
Overall Period	12.89	0.07	0.09	1.22
8. Oman				
Export quantity				
Period I	224.68***	0.64	0.31	3.79
Period II	-28.90***	0.80	0.05	-5.72

Overall Period	50.80***	0.41	0.11	3.54
Export value				
Period I	158.82***	0.65	0.24	3.93
Period II	-23.44***	0.72	0.05	-4.62
Overall Period	46.18***	0.48	0.09	4.10
9. Japan				
Export quantity				
Period I	111.06**	0.40	0.32	2.31
Period II	2.14	0.12	0.02	-1.04
Overall Period	45.83***	0.51	0.08	4.33
Export value				
Period I	66.86*	0.32	0.26	1.94
Period II	7.37***	0.63	0.01	3.71
Overall Period	38.77***	0.56	0.06	4.86
10. Saudi Arab				
Export quantity				
Period I	156.94**	0.52	0.32	2.94
Period II	37.16***	0.71	0.07	4.44
Overall Period	44.77***	0.47	0.09	4.00
Export value				
Period I	122.59**	0.40	0.34	2.31
Period II	44.81***	0.80	0.06	5.77
Overall Period	46.37***	0.49	0.09	4.20

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

Vietnam was the top most importer of maize from India. During period I (1999-2009) export quantity and export value witnessed the highest and positive growth rate of 375.40 per cent at one per cent level of significance and 247.98 per cent at one per cent level of significance, respectively. In period II (2010-2019) growth rate of both export quantity and export value decreased which resulted in negative growth rate of -50.54 per cent and -44.39 per cent at five per cent level of significance respectively. For the overall study period the export quantity and export value showed positive growth rate of 46.60 per cent at five per cent level of significance and 43.80 per cent at one per cent level of significance, respectively.Figure 4.10 displayed that, in Vietnam during initial period of the study i.e. from 2000-2006, it was witnessed that quantity of maize exported from India was very low. In 2006 quantity exported was at 11944 MT. From 2007 onwards quantity

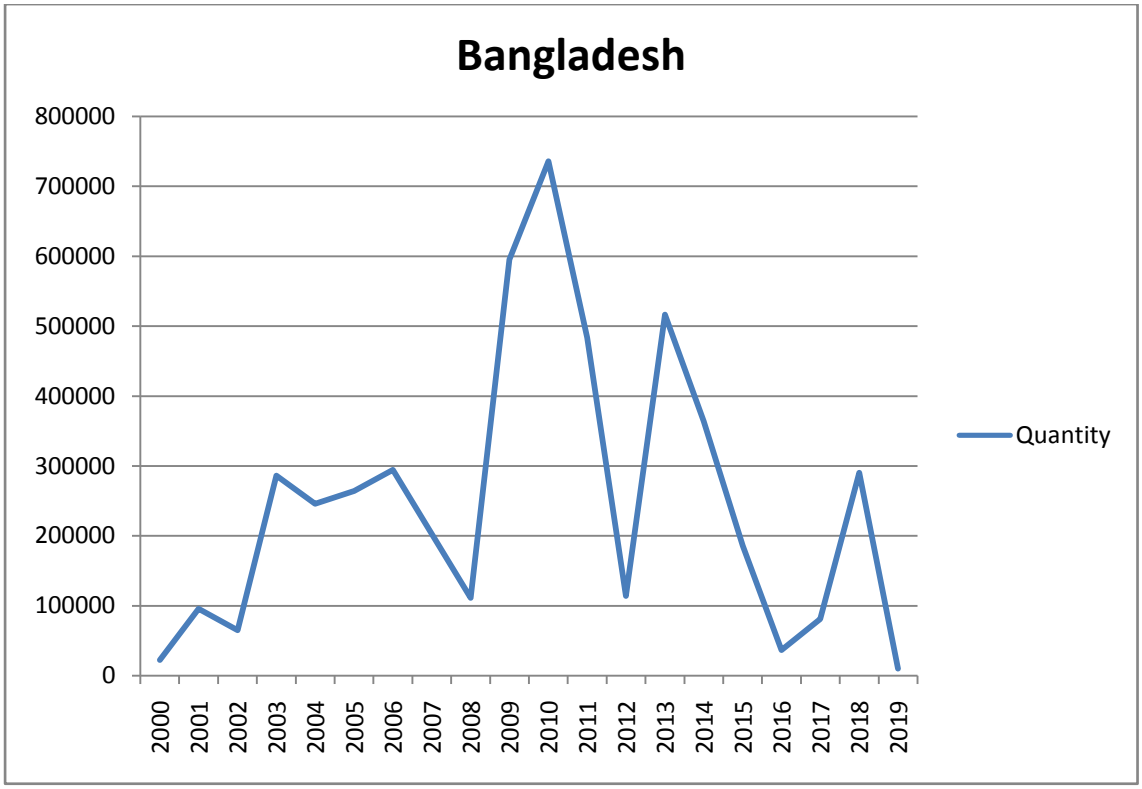

Fig. 4.9 Quantity of maize exported to Bangladesh from India

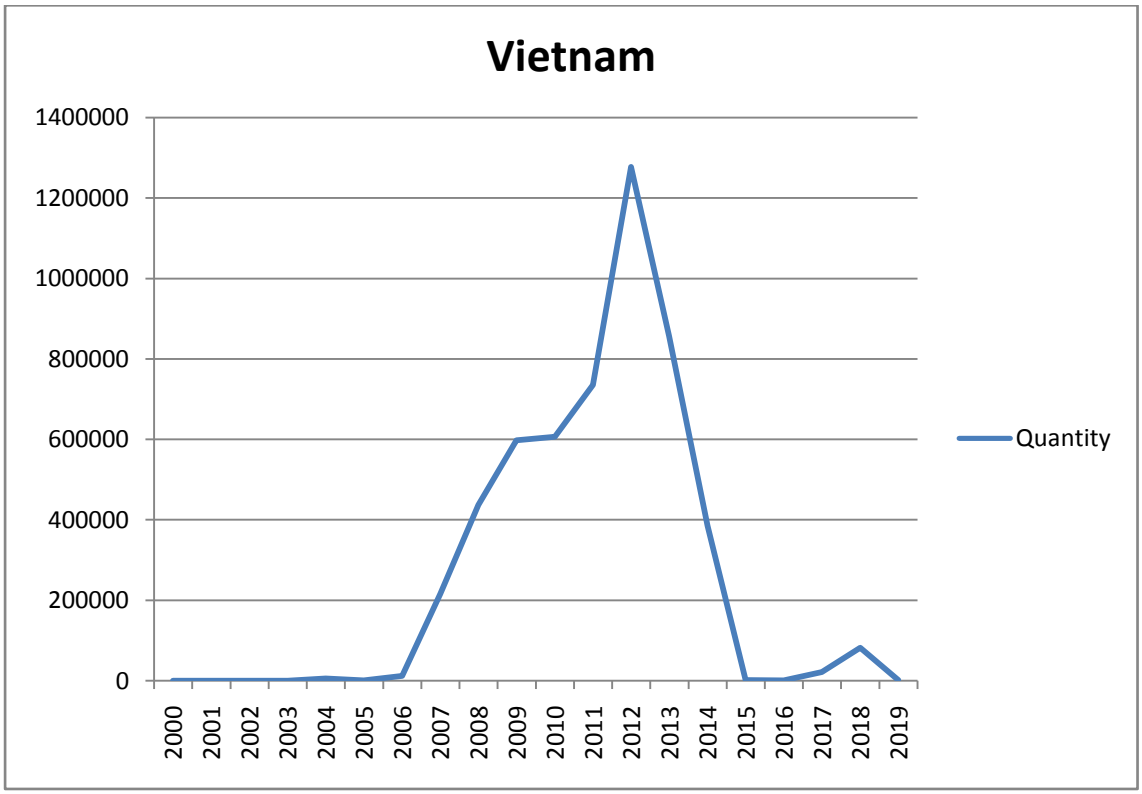

Fig. 4.10 Quantity of maize exported to Vietnam from India

exported displayed increasing trend. It was highest in the year of 2012 with 1277521.8 MT, after 2012 export quantity showed sudden decline.

Table 4.3 displayed that for the overall study period (1999-2000 to 2018-2019) Nepal observed a positive growth rate of 66.96 per cent for export quantity and 66.76 per cent for export value at one per cent level of significance, a remarkable fall in export quantity and export value was observed from period II to overall period. For the period I (1999-2000 to 2008-2009) export quantity and export value observed the highest and significant growth rate of 208.32 per cent and 136.10 per cent at one per cent level of significance. During period II (2009-2010 to 2018-2019) growth rate of 20.77 per cent and 29.02 per cent observed at one per cent level of significance which was comparatively low than both the periods. Figure 4.11 demonstrated that there was an increasing trend in quantity exported to Nepal with 484927.21 MT in the year 2018. Gradual decline was observed in 2019 with export quantity of 313322.69 MT. Least quantity of maize was exported to Nepal during 2007 i.e., 58831.83 MT

In Malaysia, during period I (1999-2000 to 2008-2009) export quantity and export value witnessed the highest growth rate compared to the other periods at 279.24 per cent at five per cent level of significance for export quantity and 219.91 per cent at one per cent level of significance for export value. While in period II (2009-2010 to 2018-2019) a sharp declined in growth rate of export quantity and export value was recorded at -55.55 per cent at one per cent level of significance and -53.96 per cent at one per cent level of significance, respectively. In overall study period (1999-2000 to 2018-2019) compound growth rate of 23.21 per cent for export quantity and 22.72 per cent for export value was observed which was statistically non-significant. Figure 4.12 Malaysia recorded highest export quantity in 2008 with 1284347.28 MT and it steadily decrease to 550690.42 MT in the year of 2009. Export quantity gained its momentum during 2012 with 966747.56 MT and after that sudden a drop was observed in export quantity. In the year 2019 only 192.27 MT of maize was exported to Malaysia.

The results presented in Table 4.3 revealed that in UAE during period I (1999-2000 to 2008-2009) export quantity and export value recorded positive growth rate of 92.78 per cent and 94.83 per cent at one per cent level of significance. During

period II (2009-2010 to 2018-2019) displayed negative growth rate of -36.74 per cent for export quantity and -32.62 per cent for export value at one per cent level of significance. For the overall study period (1999-2000 to 2018-2019) growth rate of 7.59 per cent in export quantity was observed which was comparatively low than period I and statistically non-significant while growth rate of 14.13 per cent at ten per cent level of significance was observed in export value. Figure 4.13 showed that the export quantity reached its maximum in the year 2008 with 199296.07 MT. Steady decline was observed in export quantity during 2009. In 2011 quantity exported raised to 123745.79 MT. Export quantity showed continuous decline after 2011.

The results presented in Table 4.3 showed that during period I (1999-2000 to 2008-2009) both export quantity and export value witnessed higher growth rate compared to other periods. Growth rate of 255.72 per cent for export quantity and 178.70 per cent for export value at one per cent level of significance was observed. In period II (2009-2010 to 2018-2019) negative growth rate of -12.01 per cent at one per cent level of significance for export quantity and -6.4 per cent for export value which was statistically non-significant was observed. However, for the overall study period (1999-2000 to 2018-2019) positive compound growth rate of 69.89 per cent for export quantity and 59.09 per cent for export value at one per cent level of significance was recorded. Figure 4.14 revealed that quantity of maize exported to Yemen Republic reached its maximum in the year 2008 with 167789.14 MT and then sudden reduction was observed in export quantity in 2009 with 17709 MT. Export quantity increased during 2013 with 35611 MT and later on decreased to 8494 MT in 2019.

In period I (1999-2000 to 2008-2009) export quantity exported to Singapore from India observed positive compound growth rate of 153.55 per cent and export value of 125.10 per cent at one per cent level of significance. During II period (2009-2010 to 2018-2019) export quantity and export value showed negative growth rate of -53.96 per cent and -50.12 per cent at one per cent level of significance. While in overall study period export quantity and export value observed growth rate of 10.19 per cent and 12.89 per cent which was statistically non-significant. Figure 4.15 indicated quantity of maize exported to Singapore and viewed continuous fluctuations throughout the study period. Limited quantity of maize was exported to Singapore during initial year of the study. Increase in export quantity was observed after 2005 and it reached its maximum in 2014 with 46269.8 MT. A sudden fall in quantity

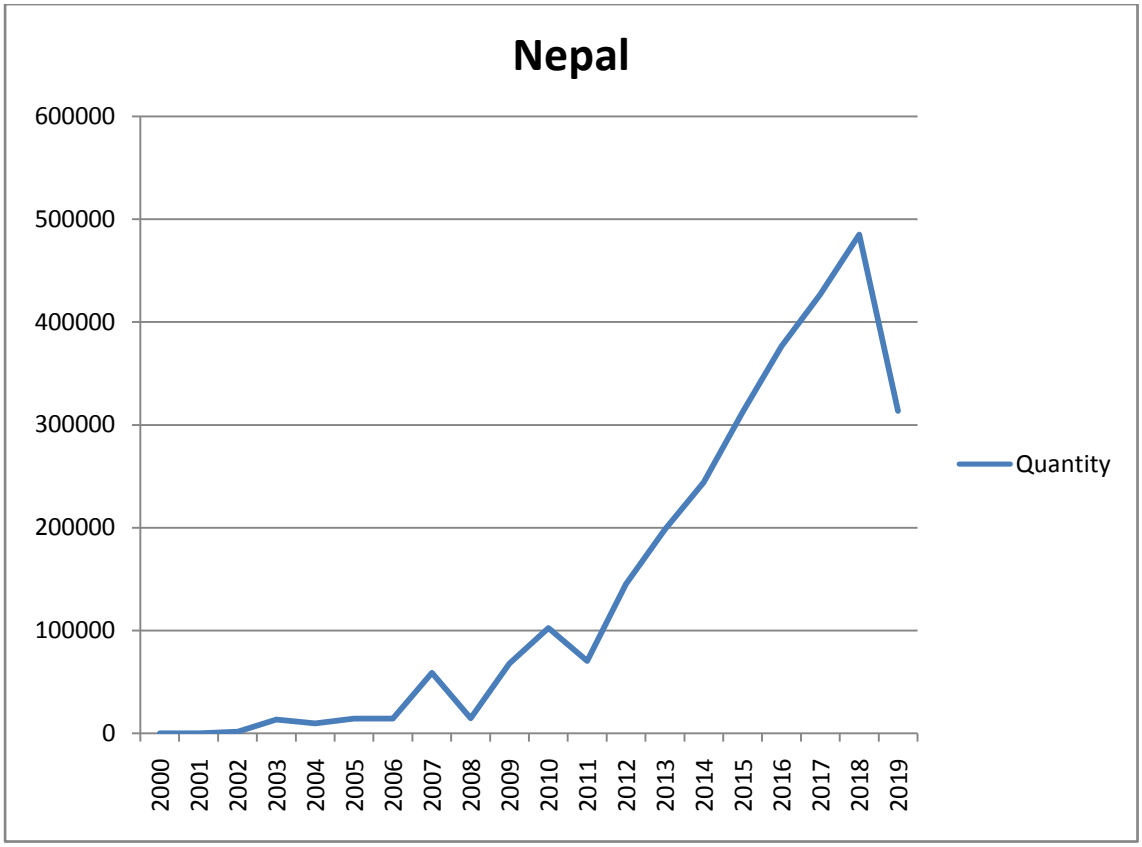

Fig. 4.11 Quantity of maize exported to Nepal from India

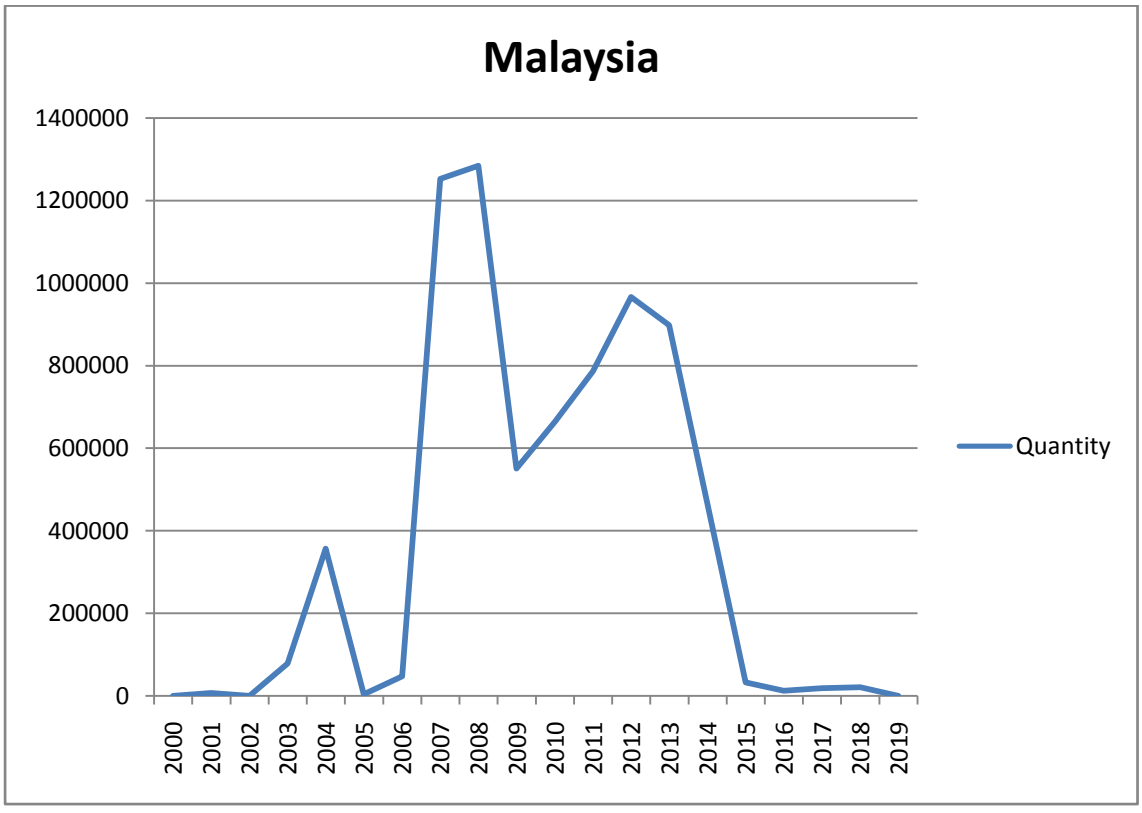

Fig. 4.12 Quantity of maize exported to Malaysia from India

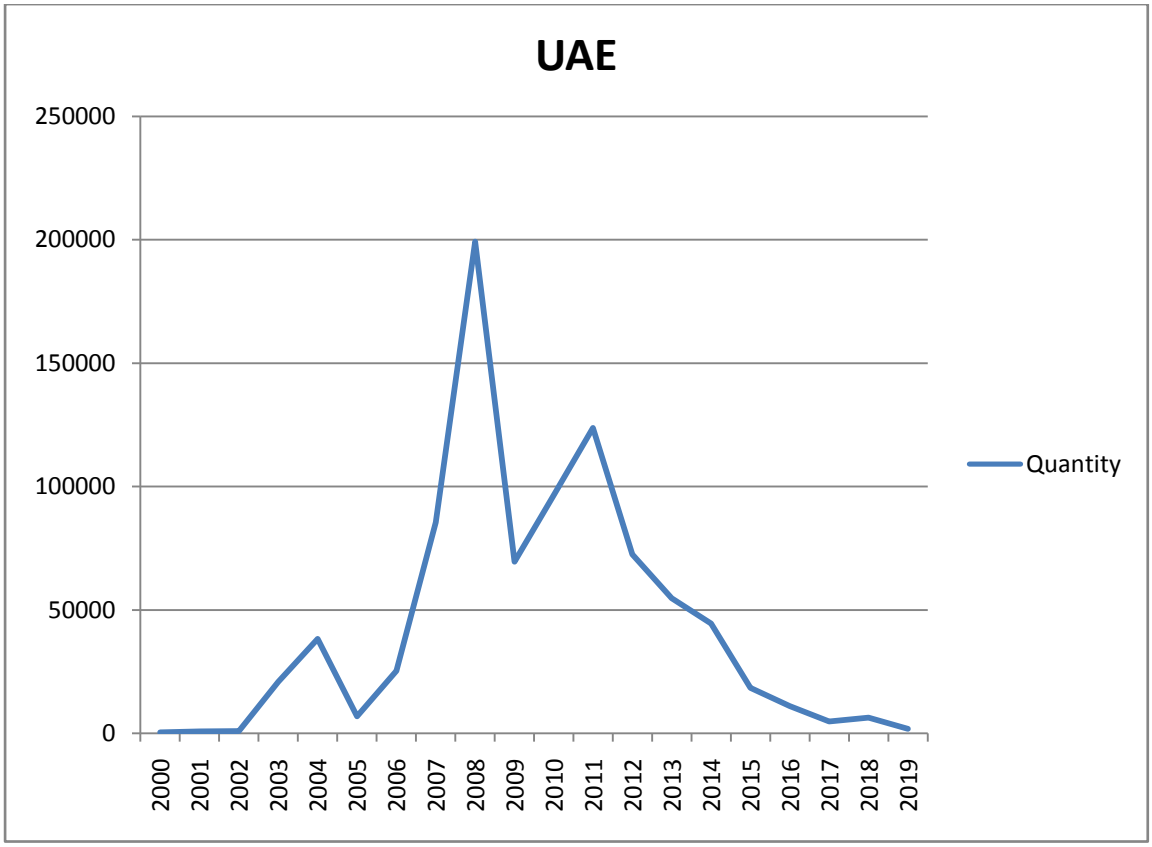

Fig. 4.13 Quantity of maize exported to UAE from India

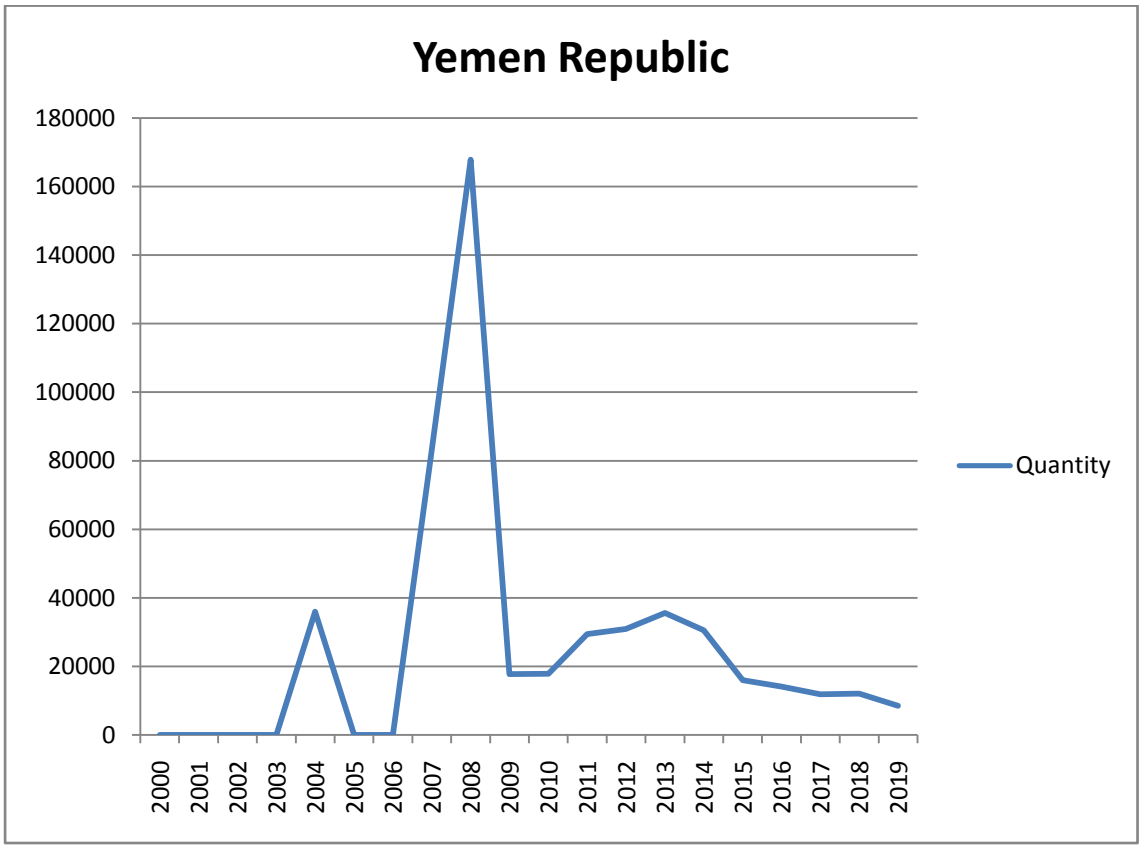

Fig. 4.14 Quantity of maize exported to Yemen Republic from India

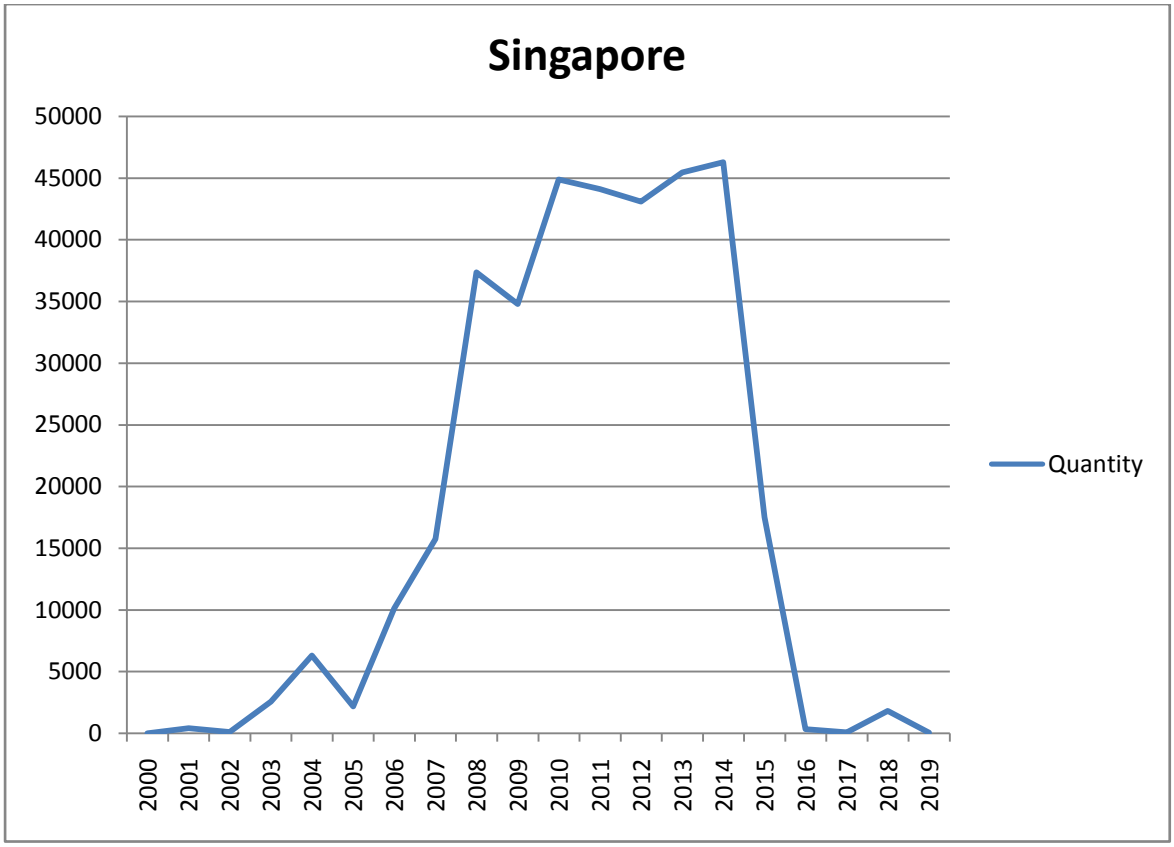

Fig. 4.15 Quantity of maize exported to Singapore from India

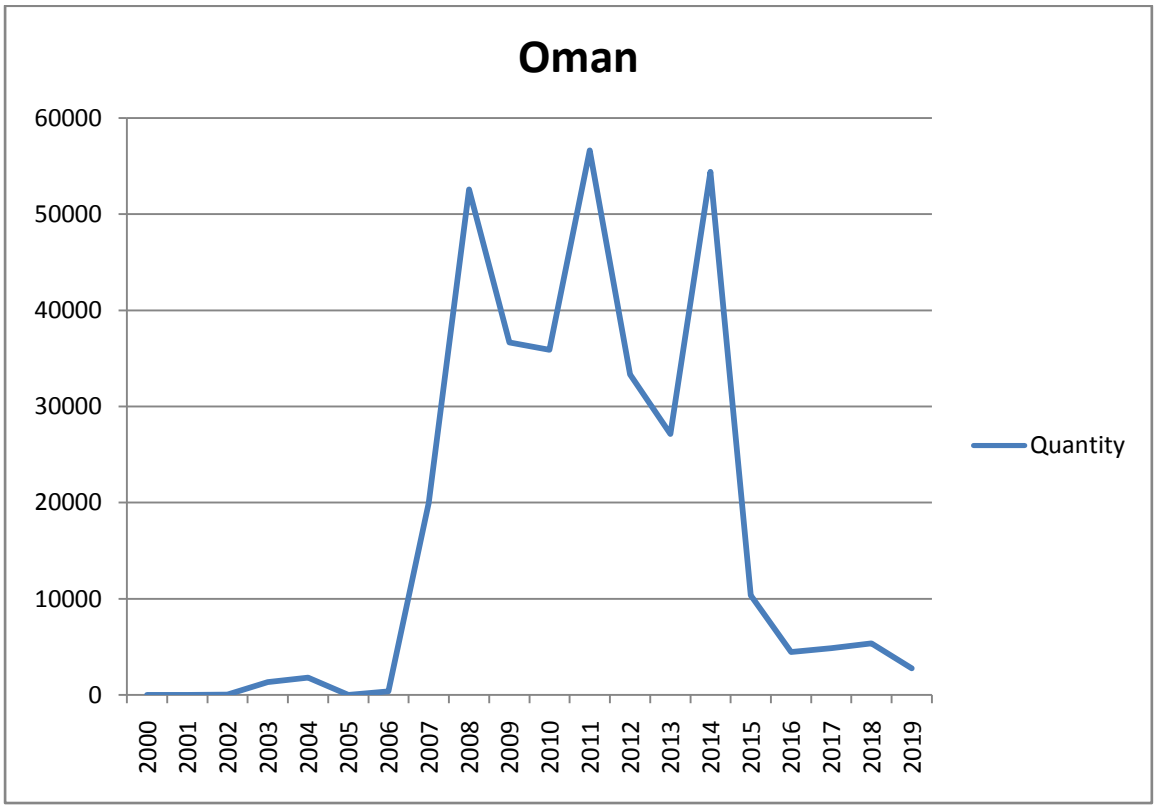

Fig. 4.16 Quantity of maize exported to Oman from India

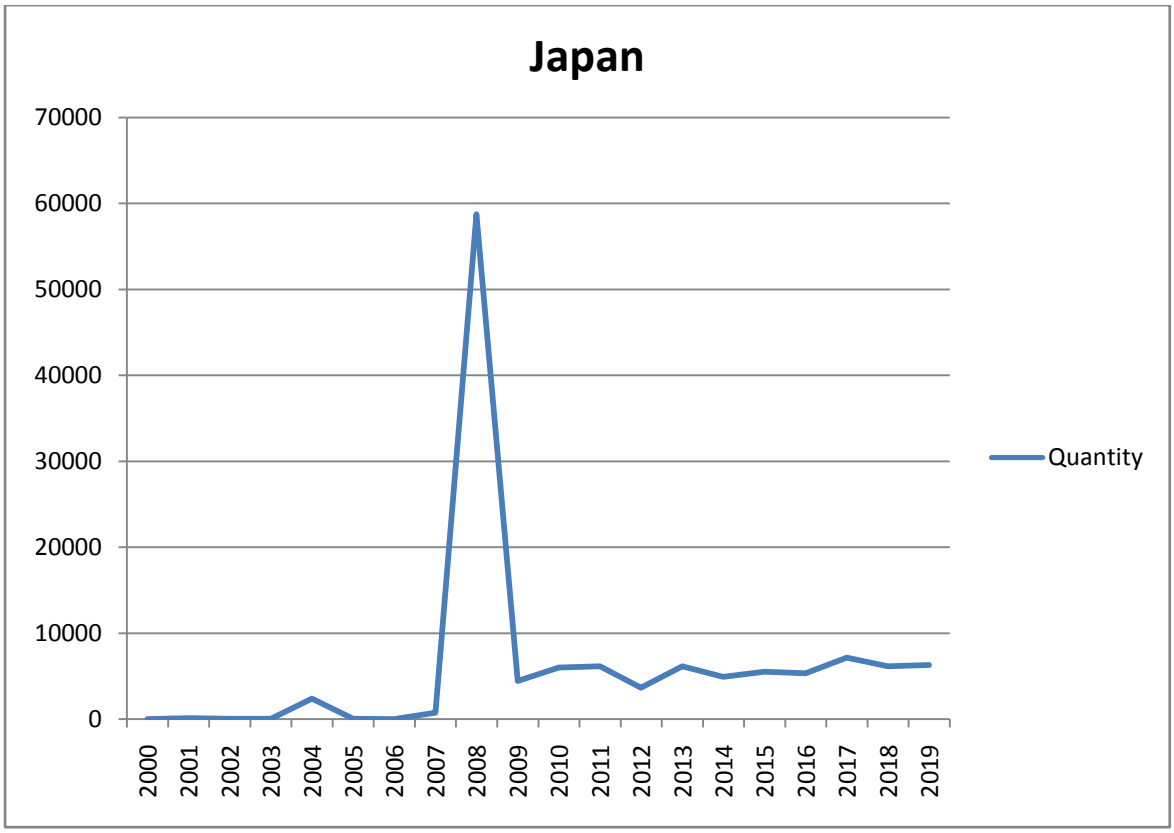

Fig. 4.17 Quantity of maize exported to Japan from India

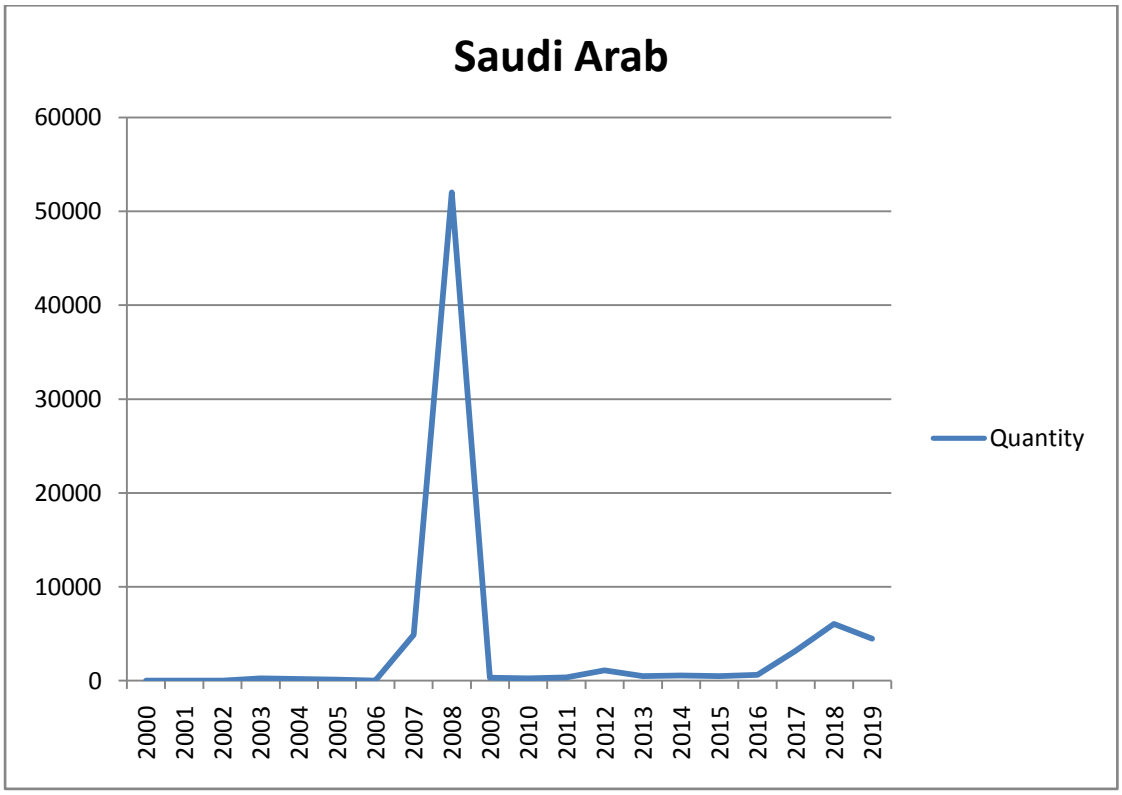

Fig. 4.18 Quantity of maize exported to Saudi Arab from India

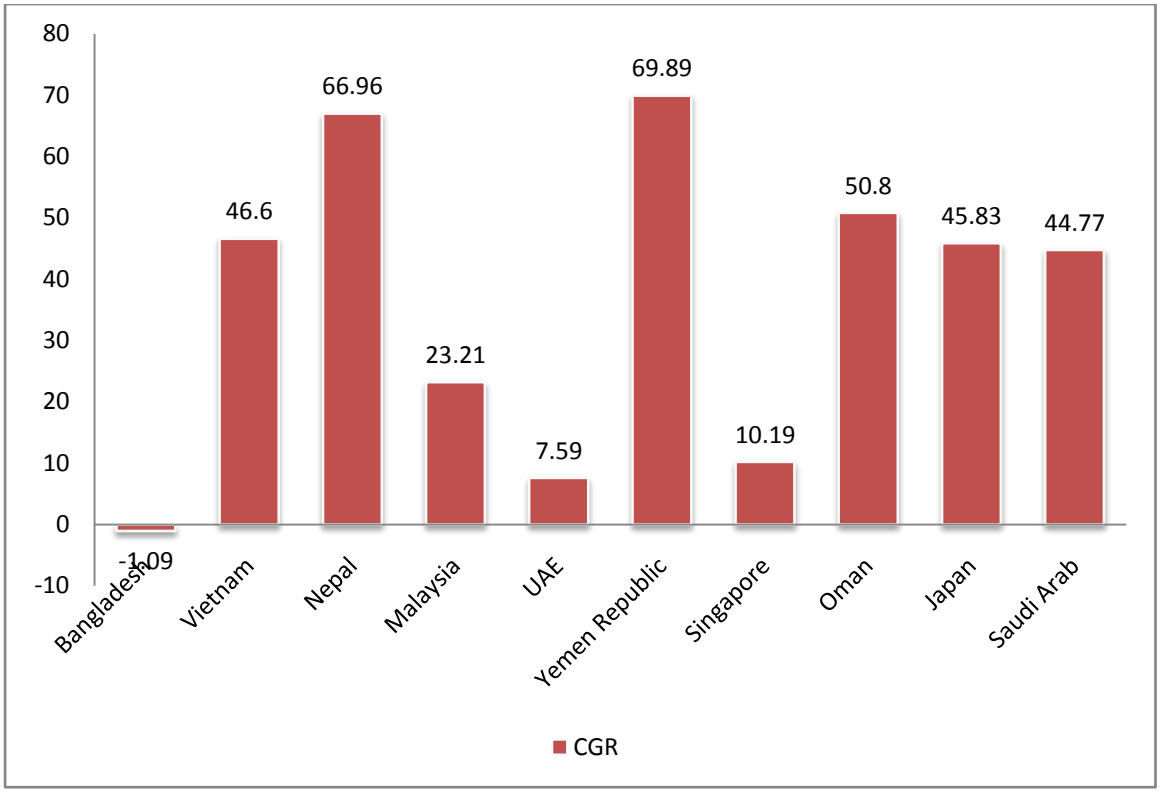

Fig. 4.19 Compound Growth Rate of Maize exported from India in quantity during the study period

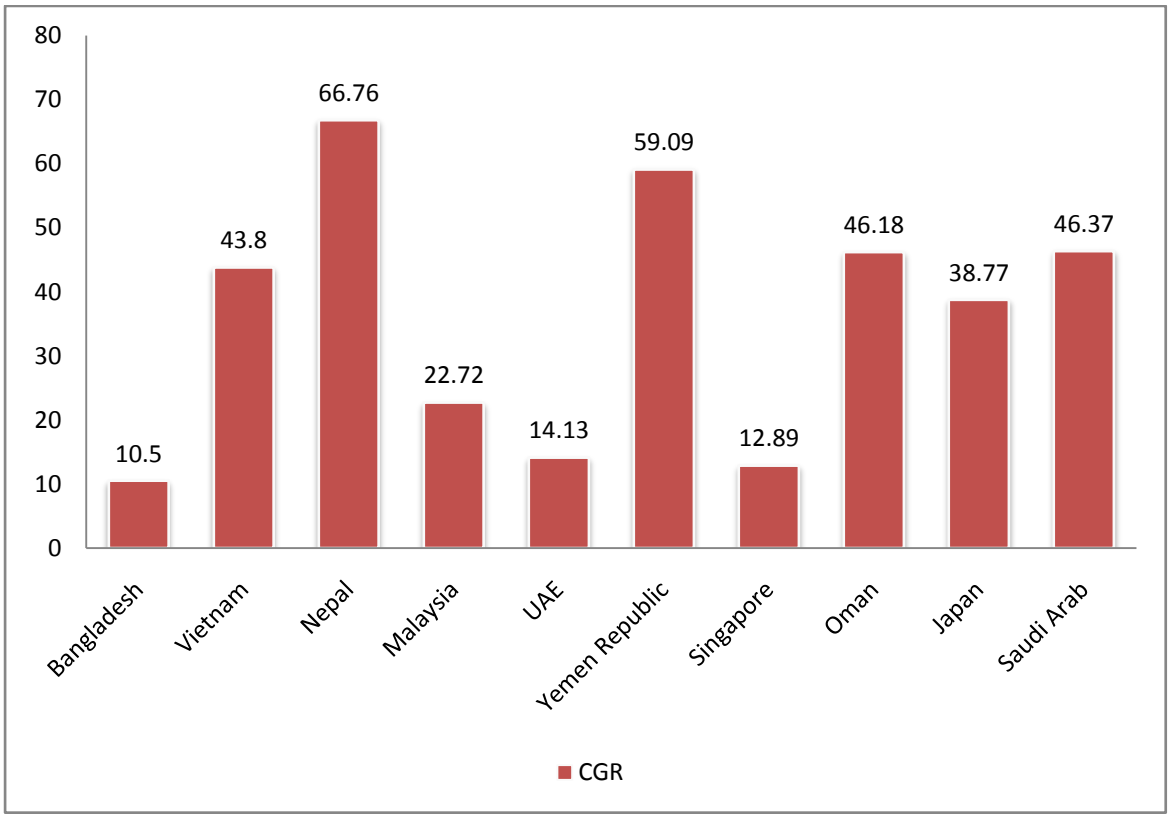

Fig. 4.20 Compound Growth Rate of Maize exported from India in value measured in Indian Rupees during the study period.

exported was observed after 2015. From 2016 onwards limited quantity was exported to Singapore.

From Table 4.3 it was observed that, in Period I comparatively higher growth rate was obtained than other periods in export quantity and export value with growth rate of 224.68 per cent and 158.82 per cent, respectively at one per cent level of significance. Growth rate of -28.90 per cent in export quantity and -23.44 per cent in export value was observed at one per cent level of significance in period II. During overall study period growth rate of 50.80 per cent for export quantity and 46.18 per cent for export value at one per cent level of significance was observed. Figure 4.16 revealed that quantity of maize exported to Oman from India showed high fluctuating tendencies. From 2000 to 2006 very negligible quantity was exported to Oman. However, after 2006 sudden fall and rise in quantity exported was viewed. Export quantity showed the highest peak during 2011 with 56638.48 MT. Steady rise in quantity exported was observed during 2008 and 2014. An impulsive drop in export quantity was observed after 2014. From 2015 onwards quantity exported showed declining trend.

During the study period I (1999-2000 to 2008-2009) positive compound growth rate of 111.06 per cent in export quantity at five per cent level of significance and 66.86 per cent at ten per cent level of significance was recorded. Comparatively lower growth rate of 2.14 per cent in export quantity was observed which was statistically non-significant and 7.37 per cent in export value at one per cent level of significance was observed in period II, 45.83 per cent of growth rate in export quantity and 38.77 per cent in export value at one per cent level of significance was observed in the overall study period. Figure 4.17 displayed that in the year 2008 quantity exported to Japan was the maximum with 58729.01 MT which was followed by sudden fall in export quantity with 4435 MT in 2009 and continuous reduction was seen up to 2019 with 6304.96 MT. During the initial period of study i.e. from 2000 to 2007 quantity exported to Japan was observed to be the least.

The results presented in Table 4.3. Revealed that during overall study period positive compound growth rate of 44.77 per cent for export quantity and 46.37 per cent for export value at one per cent level of significance was noted. In period I (1999-2000 to 2008-2009) export quantity and export value observed positive growth

rate of 156.94 per cent and 122.59 per cent at 5 per cent level of significance. During II period (2009-2010 to 2018-2019) 37.16 per cent and 44.81 per cent of growth rate was observed for export quantity and export value at one per cent level of significance. Figure 4.18 showed that during initial period of the study quantity of maize exported to Saudi Arab from India was very low. 2008 showed the highest quantity of maize exported to Saudi Arab with 51997.18 MT, followed by rapid fall in export quantity with 303 MT in 2009. From 2010 onwards export quantity displayed declining trend.

4.2 Instability in production and export of maize:

To study the variability in terms of area, production, productivity, export quantity, export value (in Rs. Lakhs.) and value (in Million US $) of maize export for the secondary data from (1999-2000to 2018-2019) the co-efficient of variation (CV) and Coppock's Instability index were worked out. For examination, the study period was sub-divided into three periods *viz*.,

- Period I (1999-2000 to 2008-2009)
- Period II (2009-2010 to 2018-2019)
- Overall Period (1999-2000 to 2018-2019)

Table 4.4: Instability of Area, Production and Productivity of Maize in India

Period	**Particulars**	**Area**	**Production**	**Productivity**
Period-I	Mean	7463.7	15072.3	2007.4
	SD	664.7862	2761.783	220.86
	CV (%)	8.90	18.32	11.00
Period -II	Mean	9013.7	24682.5	2734.8
	SD	328.7356	2677.557	238.5404
	CV (%)	3.64	10.84	8.72
Overall Period	Mean	8238.7	19877.4	2371.1
	SD	944.86	5595.81	435.08
	CV (%)	11.4686	28.15166	18.3495

The results presented in Table 4.4 shows that coefficient of variation for area of maize in India was comparatively less in Period II than period I and overall period. Period II recorded 3.64 per cent of co-efficient of variation while 8.90 per cent

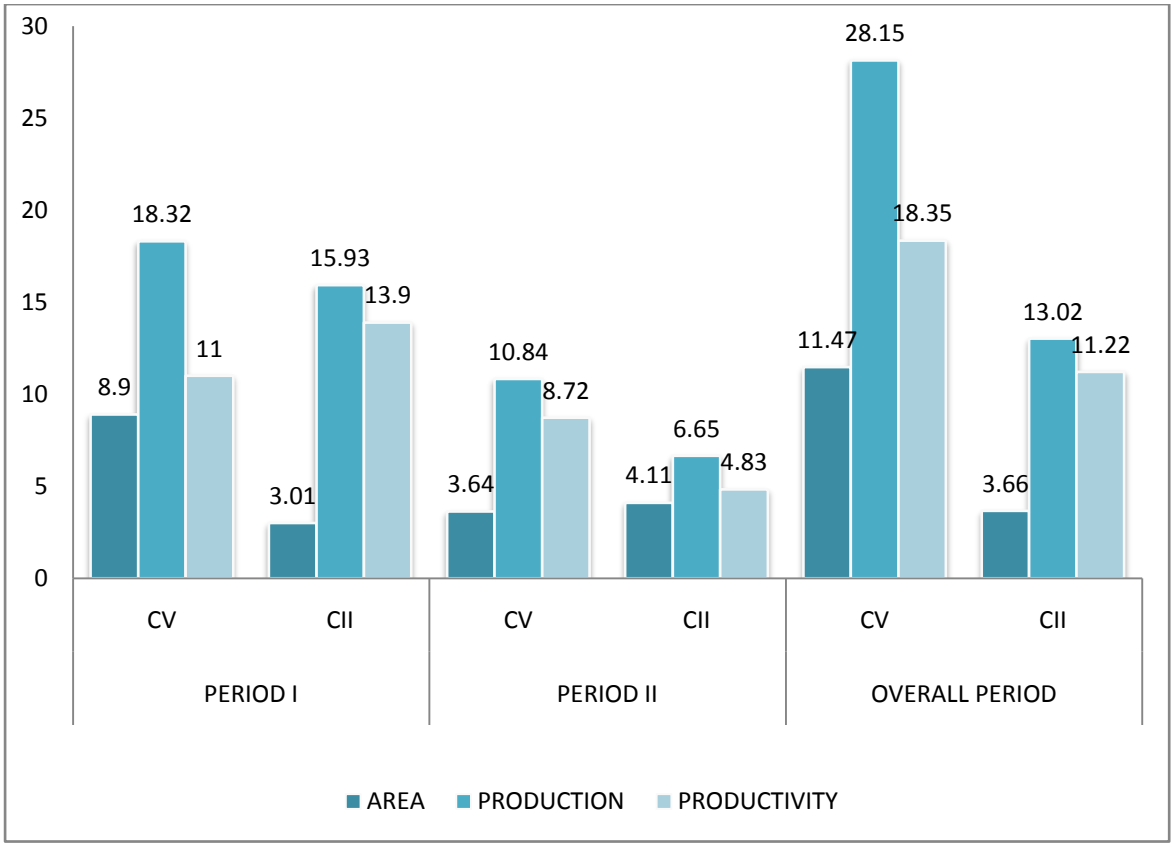

Fig. 4.21 Instability in Area, Production and Productivity of Maize

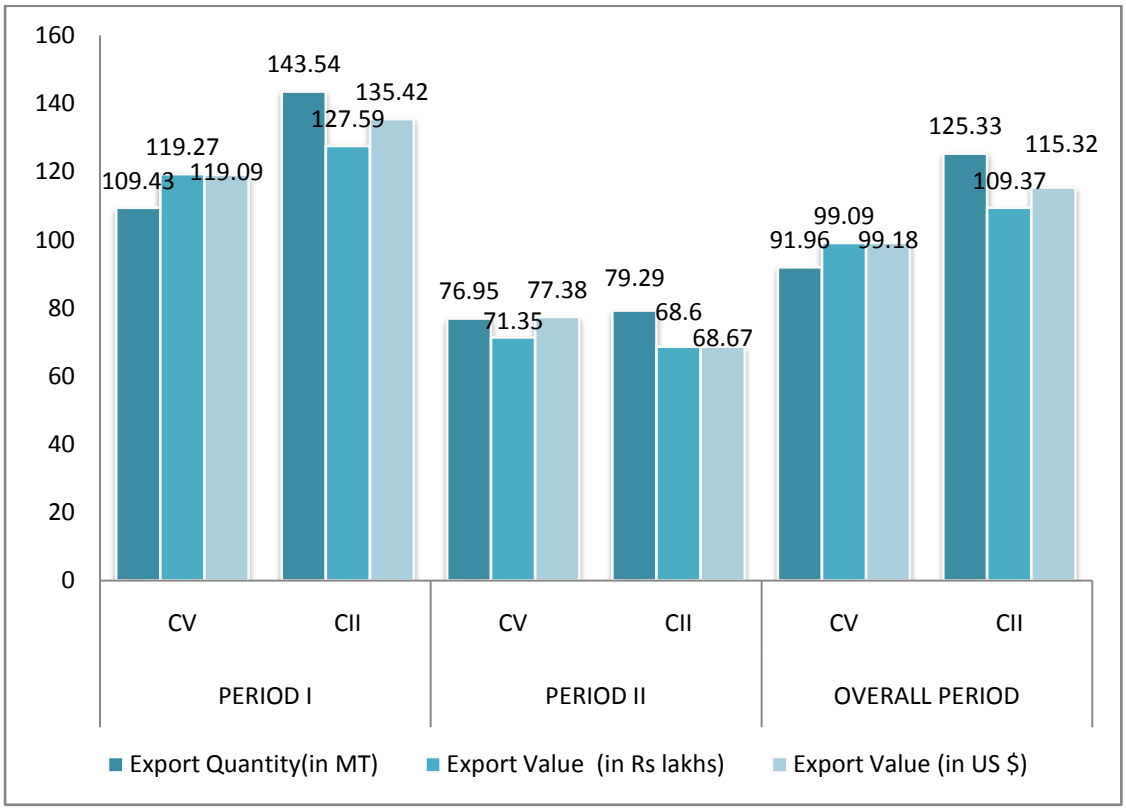

Fig. 4.22 Instability in export quantity and export value of Maize

and 11.46 per cent of co-efficient of variation in Period I and overall period, respectively. While production revealed highest co-efficient of variation at 28.15 per cent during overall period and period I and Period II observed co-efficient of variation at 18.32 per cent and 10.84 per cent respectively. Productivity witnessed variability with co-efficient of variation at 11.00 per cent, 8.72 per cent, 18.34 per cent in Period, Period II and overall Period, respectively. Thus, the results revealed that overall period (1999-2000 to 2018-2019) was the most instable period during the study. The results obtained are in close association with the findings of Punia *et al*. (2021)

Table 4.5: Instability of Export Quantity, Export Value (in Rs. Lakhs and Million US $) of Maize from India

Period	Particulars	Export Quantity	Export Value (in Rs. Lakhs)	Export Value (in Million US $)
Period I	Mean	1180493	104475.8	233711361
	SD	1291789	124605	278330028
	CV (%)	109.4279	119.2669	119.09136
Period II	Mean	2182606	319469	572391589
	SD	1679573	227925.5	442928364
	CV (%)	76.95268	71.34512	77.382053
Overall Period	Mean	1681549	211972.4	403051475
	SD	1546274	210062.4	399763071
	CV (%)	91.95535	99.09897	99.184123

From Table 4.5 with regard to the export quantity of Maize, the co-efficient of variation was recorded to be highest with coefficient of variation at 109.42 per cent in period I. In period II 76.95 per cent variation and in overall period 91.95 per cent co-efficient of variation was observed. While export value (in Rs. Lakhs) and (in Million US $) recorded coefficient of variation at 119.26 per cent and 119.09 per cent in period I respectively which was highest variation. In Period II, export value (in Rs. Lakhs) observed 71.34 per cent of variation and export value (in Million US $) 77.38 per cent of variation was observed. During overall study period (1999-2000 to 2018-2019) 99.09 per cent of variation was observed in export value (in Rs. Lakhs.)

and 99.18 per cent co-efficient of variation was observed in export value (in Million US $).

Table 4.6: Coppock's Instability Index of Area, Production and Productivity of Maize

Sr. No	Periods	Coppock's Instability Index (%)		
		Area	Production	Productivity
1.	Period I	3.01	15.93	13.90
2.	Period II	4.11	6.65	4.83
3.	Overall Period	3.66	13.02	11.22

From Table 4.6 unlike CV, this study organized another index that is Coppock's Instability Index (CII) to estimate the instability in maize which is close approximation of the average year to year percentage variation adjusted for the trend and is more pronounced than the absolute variation.

The results of Coppock's Instability Index are presented in Table 4.6. The result showed that highest variation observed in production of maize was 15.93 per cent in period I followed by overall period 13.02 per cent and in period II 6.65 per cent, respectively. In case of Area, variation of 3.01 per cent in period I, 4.11 per cent in Period II and 3.66 per cent in Overall period was observed, which shows that highest variation was observed in period II. In case of Productivity, in period I, 13.90 per cent of variation of recorded which was comparatively higher than other periods. 4.83 per cent in period II and 11.22 per cent in overall period. Above results revealed that highest instability was observed in production of maize than area and production.

Table 4.7: Coppock's Instability Index of Export Quantity, Export Value (in Rs. Lakhs and Million US $) of Maize

Sr. No.	Periods	Coppock's Instability Index (%)		
		Export Quantity	Export Value (in Rs. Lakhs)	Export Value (in Million US $)
1.	Period I	143.54	127.59	135.42
2.	Period II	79.29	68.60	68.67
3.	Overall Period	125.33	109.37	115.32

Results presented in Table 4.7 revealed that highest variation observed in export quantity was 143.54 per cent in period I followed by export value (in Rs. Lakhs and in Million US $) in period I with instability at 127.59 per cent and 135.42

per cent, respectively. Least variation was observed in period II with CII at 79.29 per cent, 68.60 per cent and 68.67 per cent in export quantity and export value (in Rs. Lakhs and in Million US $) respectively and for overall period it was 125.33 per cent, 109.37 per cent and 115.32 per cent, respectively.

4.2.1 Country wise instability of Export Quantity and Export Value of Maize

By using Coefficient of Variation (CV) and Coppock's Instability Index (CII) the country wise instability in export quantity and export value was worked out. For the analysis the study period was divided into three periods *viz*., period I (1999-2000 to 2008-2009), Period II (2009-10 to 2018-19) and overall period (1999-2000 to 2018-2019).

Table 4.8: Country wise Coefficient of variation of Export Quantity and Export Value of Maize

Sr. No.	Country	Coefficient of Variation (%)					
		Export Quantity			Export Value		
		Period I	Period II	Overall Period	Period I	Period II	Overall Period
1.	Bangladesh	75.44	85.36	81.29	94.47	63.11	80.45
2.	Vietnam	173.05	114.39	142.70	178.76	116.77	156.11
3.	Nepal	123.31	52.16	111.70	124.92	60.93	126.83
4.	Malaysia	143.47	106.48	121.75	149.86	108.71	124.01
5.	UAE	138.15	98.55	117.38	150.16	90.22	113.19
6.	Yemen Republic	181.03	47.66	152.10	188.81	41.74	119.60
7.	Singapore	129.25	90.73	109.47	137.84	90.82	118.83
8.	Oman	168.31	89.15	117.56	168.16	82.61	115.97
9.	Japan	276.02	16.61	204.51	276.44	26.94	150.14
10.	Saudi Arab	282.67	118.20	305.97	281.93	121.92	252.36

From Table 4.8 it was observed that in Bangladesh, during period II Export quantity showed the highest variation compared to the other periods with CV at 85.36 per cent and for export value the highest variation was observed at 94.47 per cent in period I. 75.44 per cent variation in period I and 81.29 per cent in overall period was observed with regard to export quantity. For export value 63.11per cent variation in period II and 80.45 per cent in overall period was observed.

In Vietnam, it was observed that in export quantity and export value highest instability was recorded in period I at 173.05 per cent and 178.76 per cent, respectively, 114.39 per cent and 142.70 per cent instability was recorded in export

quantity in period II and overall period, respectively. In period II and overall period, instability of 116.77 per cent and 156.11 per cent was recorded in export value.

In Nepal, during period II lowest instability was recorded at 52.16 per cent compared to other periods in export quantity. 123.31 per cent, 111.70 per cent instability was recorded during I and overall period in export quantity. In export value highest instability was recorded during period I at 124.92 per cent and instability at 60.93 per cent and 126.83 per cent during period II and overall period was observed, respectively.

In Malaysia, instability at 143.47 per cent was recorded during period I, whereas, instability at 106.48 per cent and 121.75 per cent was recorded during period II and overall period in export quantity, respectively. In export value highest instability was recorded during period I at 149.86 per cent and instability at 108.71 per cent was recorded during period II and for overall period instability recorded at 124.01 per cent.

In UAE, export quantity was recorded during period I at 138.15 per cent, while during period II and overall period it was recorded at 98.55 and 117.38 per cent, respectively. Export value recorded instability during period I at 150.16 per cent, in period II it was recorded at 90.22 per cent and for overall period export value recorded at 113.19 per cent.

For export quantity instability recorded at 181.03 per cent during period I and it was recorded 47.66 per cent and 152.10 per cent during period II and overall period, respectively. Export value recorded during period I was highest at 188.81 per cent whereas, 41.74 per cent and 119.60 per cent instability recorded during period II and overall respectively in Yemen republic.

In Singapore, during period I 129.25 per cent export quantity was recorded while, it was at 90.73 per cent and 109.47 per cent during period II and overall period, respectively. Export value recorded highest instability during period I 137.84 per cent, in period II it was recorded at 90.82 per cent and for overall period export value recorded at 118.83 per cent.

Instability was recorded at 168.31 per cent during period I, in period II instability was at 89.15 per cent and overall instability recorded at 117.56 per cent for

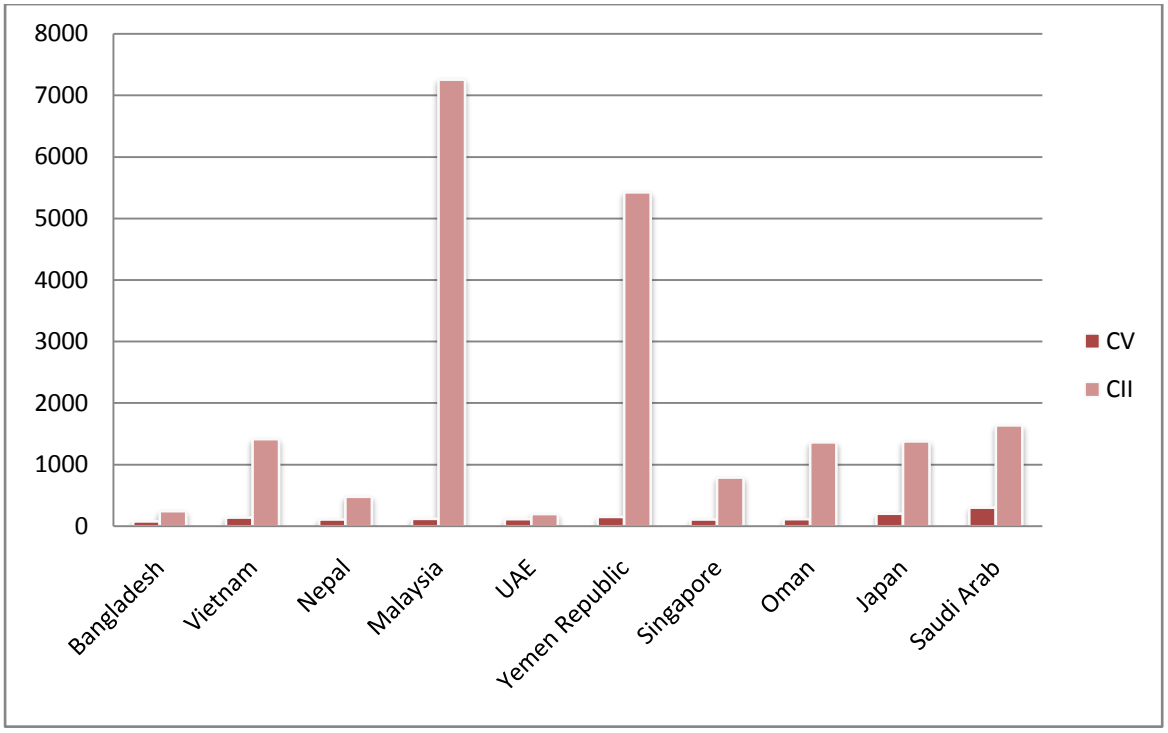

Fig. 4.23 Instability in export of Maize from India measured in quantity during the study period.

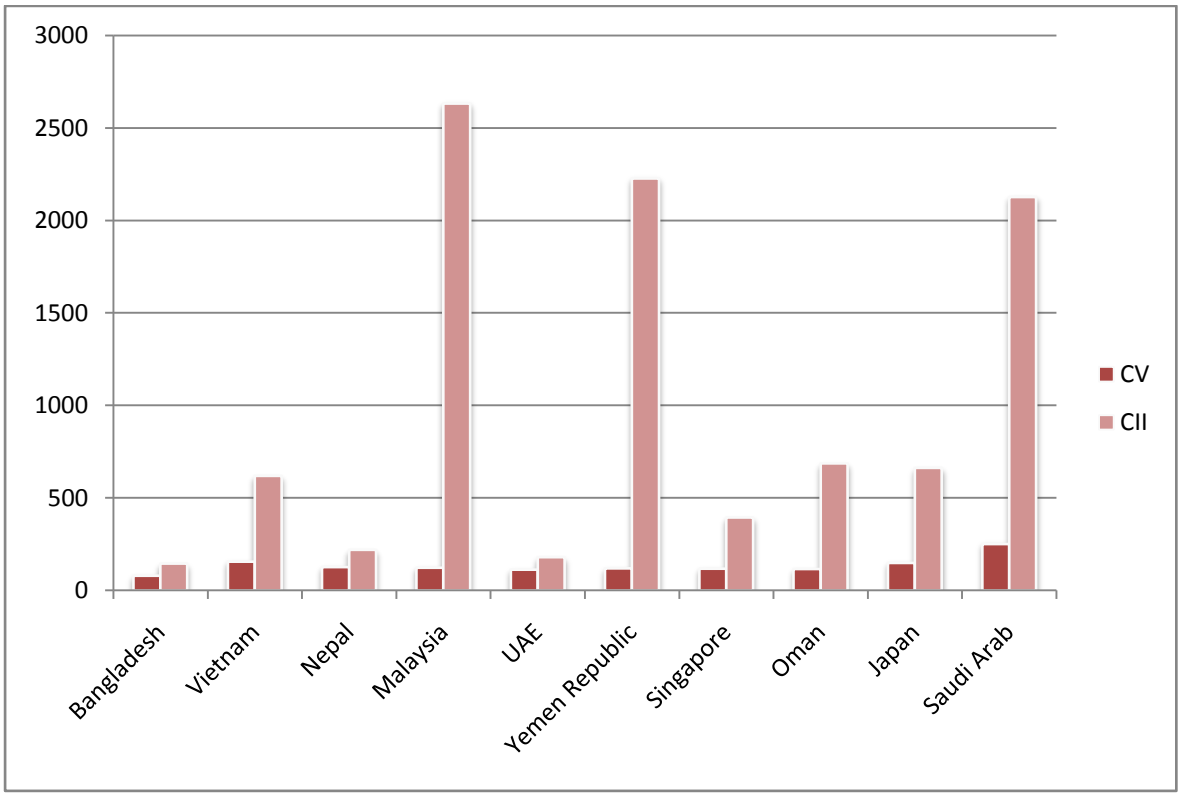

Fig. 4.24 Instability in export of Maize from India in value measured in Indian rupees during the study period

export quantity. Export value is highest during period I at 168.16 per cent whereas, during period II and overall period export value recorded at 82.61 and 115.97 per cent, respectively in Omen.

In Saudi Arab, export quantity was highest during period I at 282.67 per cent whereas, it was at 118.20 per cent and 305.97 per cent during period II and overall period, respectively. Export value recorded highest during period I at 281.93 per cent, in period II it was recorded at 121.92 per cent and for overall period export value recorded at 251.36 per cent.

Table 4.9: Country wise Coppock's Instability Index of Export quantity and Export Value (in Rs. Lakhs) of Maize

Sr. No	Country	Coppock's Instability Index(%)					
		Export Quantity			Export Value		
		Period I	Period II	Overall Period	Period I	Period II	Overall Period
1.	Bangladesh	135.36	333.78	245.67	128.53	146.74	145.36
2.	Vietnam	1171.58	1274.91	1415.24	531.78	520.07	620.49
3.	Nepal	1007.66	39.34	479.64	396.37	26.95	220.56
4.	Malaysia	32779.70	400.44	7255.68	7380.02	364.44	2632.34
5.	UAE	276.78	61.69	198.09	255.35	54.30	180.54
6.	Yemen Republic	31606.46	35.29	5421.60	9111.02	36.88	2228.12
7.	Singapore	742.33	602.90	793.89	213.01	457.98	395.30
8.	Oman	3924.33	98.04	1362.98	1583.46	90.24	687.36
9.	Japan	4602.05	32.64	1381.45	1729.43	34.39	663.22
10.	Saudi Arab	5784.80	103.69	1637.40	8504.85	94.57	2127.73

From Table 4.9 it is revealed that in all the top ten importing countries both in terms of export quantity and export value lower instability was witnessed during period II. Japan showed lowest instability during period II with CII at 32.64 per cent and 34.99 per cent for export quantity and export value, respectively. Followed by Nepal, with CII at 39.34 per cent in export quantity and 26.95 per cent in export value during period II and UAE also witnessed lowest instability at 276.78 per cent, 61.69 per cent, 198.09 per cent during period I, period II and overall period in export quantity, respectively and in export value instability at 255.35 per cent in period I, 54.20 per cent in period II and 180.54 per cent during overall period. Bangladesh with regard to the export quantity of maize, instability was observed in period II at 333.78 per cent followed by overall period at 245.67 cent and in period I,

instability of 135.36 per cent was observed. Export value witnessed instability at 146.74 per cent in period II, 128.53 per cent in period I and 145.36 per cent in overall period. The results concluded that Bangladesh showed lowest instability in terms of export value in the entire study period.

Among all the countries, Malaysia showed the highest instability in terms of export quantity during period I at 32779.70 per cent, 7255.68 per cent in overall period and 400.44 per cent in period II. In terms of export value recorded instability at 7380.02 per cent, 364.44 per cent,2632.34 per cent during period I, period II and overall period respectively. Followed by Yemen republic showed the highest CII at 31606.46 per cent, 35.29 per cent, 5421.60 per cent during period I, period II and overall period, respectively in export quantity and in terms of export value CII at 9111.02 per cent in period I, 36.88 per cent in period II and 2228.12 per cent during overall period. Oman, Saudi Arab, Singapore and Vietnam witnessed higher instability during the overall study period.

4.3 Trend in Domestic and International Price of Maize (1999-2019)

Linear, Quadratic and exponential model were used to analyze the trend in domestic and international price of maize for the time series data from 1999-2000 to 2018-2019. The best fitted model was selected on the basis of R^2 values of domestic and international prices of maize. Table 4.10 revealed the results of trend analysis in domestic and international price of maize

Table 4.10: Trend in Domestic and International Price of Maize (1999-2019)

Sr. No	Particulars	Function	Intercept (a)	X(b)	X^2(c)	R^2	Adjusted R^2
1.	Domestic Price	Linear	3.30	0.70		0.83***	0.82
		Quadratic	3.52	0.64	0.00	0.83*	0.81
		Exponential	1.55	0.07		0.90***	0.89
2.	International Price	Linear	3.91	0.81		0.80***	0.79
		Quadratic	8.30	-0.38	0.06	0.91	0.89
		Exponential	1.78	0.06		0.87***	0.86

The results showed that the best fitted model for domestic price was exponential model with R^2 value of 0.90 at 1 per cent level of significance. In case of international price, quadratic model was found to be the best fit with R^2 value of 0.91 which was statistically non-significant. Figure 4.25 indicates the fluctuations in domestic price of maize and showed that domestic price of maize in India was the

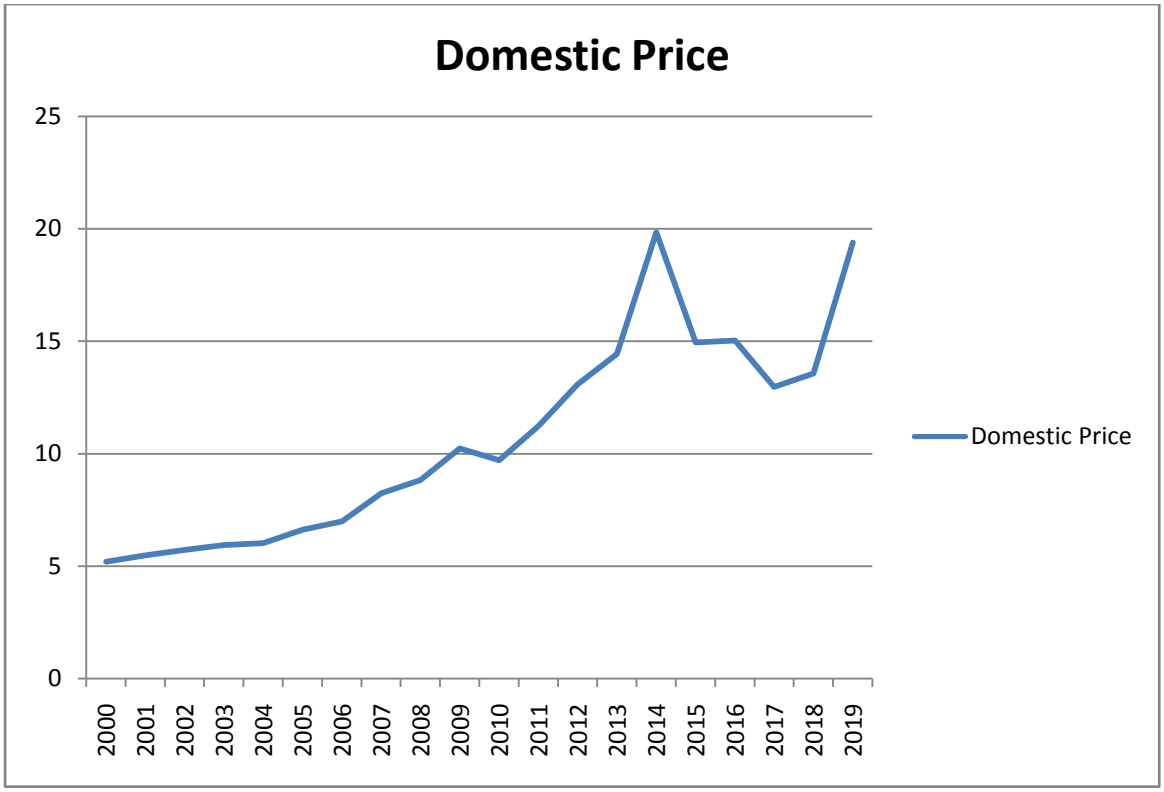

Fig. 4.25 Domestic Price of Maize

Fig. 4.26 International Price of Maize

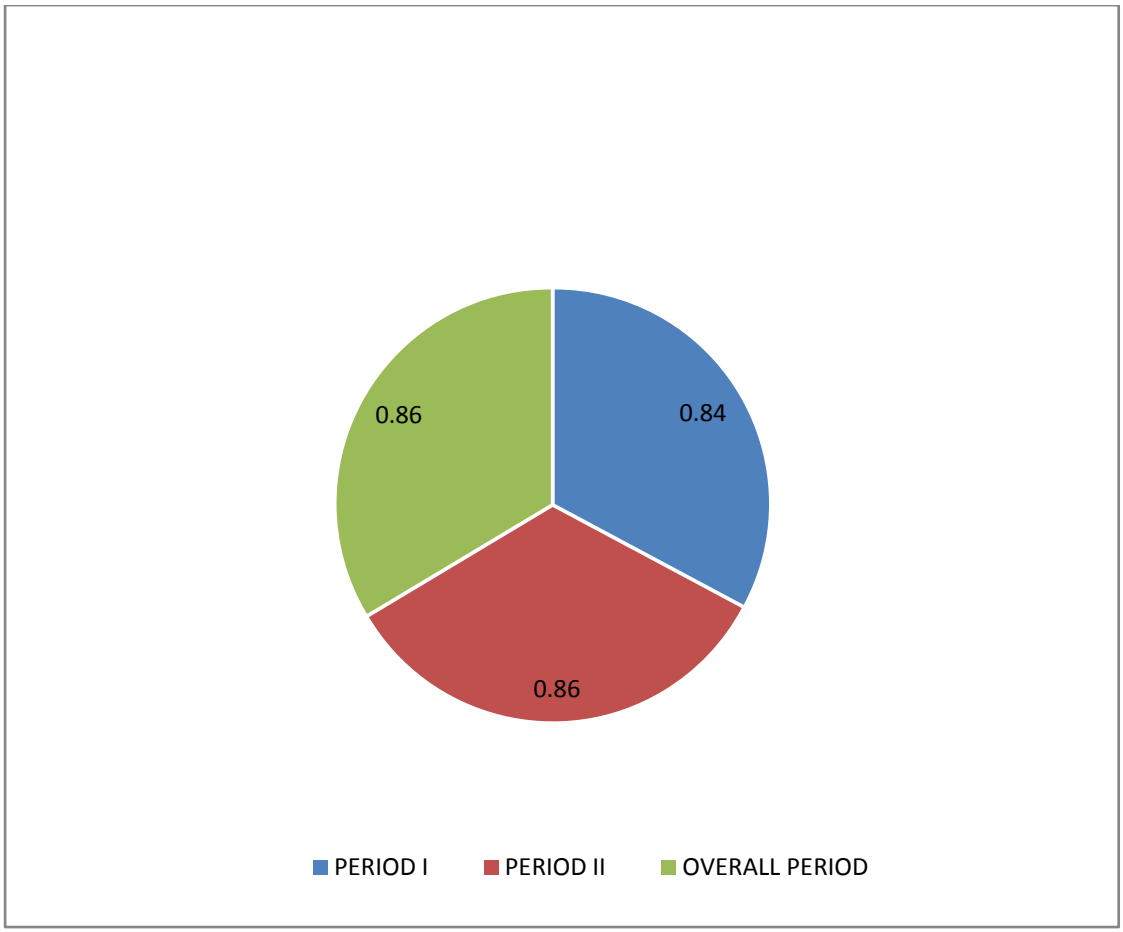

Fig. 4.27 Export Competitiveness of Maize

highest in 2014. Domestic price declined showed steep fluctuations after 2014. Figure 4.26 revealed international prices of maize and it was observed that price trend in international market showed gradual increase. The highest price for maize in international market was in 2019 at Rs 27.54 per kg. The results are in close association with the findings of Mittal *et al*. (2018).

4.4 Export Competitiveness of Maize

Export competitiveness of maize was analysed during the study period (1999-2000 to 2018-2019) by using Nominal Protection Coefficient (NPC) and the results are presented in Table 4.11.

Table 4.11: Export competitiveness of Maize

Sr.No	Particulars	NPC(Pd/Pr)
1.	Period I	0.84
2.	Period II	0.86
3.	Overall Period	0.86

When NPC ratio is less than 0.5, market is highly competitive, when NPC ratio is 0.5 to 1, market is moderately competitive and when NPC ratio is greater than one, then the market is non-competitive.

The results presented in Table 4.10 from the analysis of the study showed that during the overall period, the NPC value of maize export was worked out to be 0.86, which clearly shows that in international market maize experience moderately export competitiveness and the commodity is protected in international market. During period I (1999-2000 to 2018-2019) and period II (2009- 10 to 2018-19) crop observed NPC value of 0.84 and 0.86, respectively, which shows that crop was protected and indicates that moderate competitiveness of maize crop in the entire study period. Therefore, the hypothesis Indian Maize have better competitiveness in International market is accepted. The results obtained are in close association with the findings of Goverdan *et al*. (2014) and Pachpor *et al*. (2021).

CHAPTER – V

SUMMARY AND CONCLUSIONS

CHAPTER-V

SUMMARY AND CONCLUSION

The present chapter is a vital part of any research work, as it gives brief review about the entire research work. The following chapter displayed the results of the research work regarding the growth and instability in area, production, productivity, export quantity and value earned from export during (1999-2000 to 2018-2019). Agriculture is the most vital part of the Indian economy. Maize contributes around 9 per cent to India's food basket. Maize is emerging as one of the most important cereal crop in the world. India exported nearly 14 per cent of the total maize produced to different countries of the world. Major maize export destinations from India are Bangladesh, Nepal, Myanmar, Pakistan and Bhutan. During 2018-19, India exported around 370066.11 MT of maize worth Rs.101929.83 Lakhs (APEDA).

There is a high demand for ethanol production which leads to higher maize prices in the recent years which triggered the growth of area under maize cultivation. The top maize producing states in India are Andhra Pradesh (20.9 per cent), Karnataka (16.5 per cent), Bihar (8.9 per cent), Rajasthan (9.9 per cent), Maharashtra (9.1 per cent), Uttar Pradesh (6.1 per cent) and Himachal Pradesh (4.4 per cent). The strong demand for cereals in the global market creates favourable environment for the export of Indian cereals and it's the best chance for the country to increase its production, productivity and export.

The study was totally based on secondary data. The secondary data on production, export quantity, export value and international prices were gathered from government portals like Agricultural and Processed food products Export Development Authority (APEDA), Ministry of Commerce and Industry and Directorate of Economics and Statistics. The data on domestic price was collected from Agmarknet. The data concerned about production and export of maize in India for the last 20 years from period (1999-2000 to 2018-2019) was collected. To derive meaningful results, the following analytical toolswere used viz., Compound Growth Rate (CGR), instability analysis, trend analysis and Nominal Protection Coefficient (NPC).

Compound Growth Rate:

Compound Growth Rate was used to analyse the changes in production and export of maize from India.

Instability analysis:

To work out the instability analysis coefficient of variation (CV) and Coppock's Instability Index (CII) were used.

Trend analysis:

The trend in domestic and international prices of maize was worked out by using exponential or non-exponential function.

Nominal Protection Co-efficient:

The Nominal Protection Co-efficient (NPC) is the ratio of the domestic price to the world reference prices of the commodity under consideration. NPC value indicates the export competitiveness of the commodity in the international market.

The time series data has been divided into two sub-periods and overall period for the better comparison.

Period I (1999-2000 to 2018-2019)

Period II (2009-2010 to 2018-2019)

Overall period (1999-2000 to 2018-2019)

For better understanding, the chapter was divided into following subheadings:

1. To estimate the growth in production and export of maize
2. To work out the instability in production and export of maize
3. To study the trends in domestic and international price of maize
4. To study the export competitiveness of maize in India

5.1 Growth in Production and export of maize:

During period I, production witnessed growth rate of 5.2 per cent at one per cent level of significance and in area and productivity growth rate of 2.9 per cent and 2.2 per cent at one per cent level of significance was observed. Growth rate in area, production and Productivity during overall period showed 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. In period II, production and productivity showed positive and

significant growth rate of 3.2 per cent and 2.5 per cent at one per cent level of significance and area in period II, witnessed growth rate of 0.73 per cent at ten per cent level of significance. In overall study period (1999-2000 to 2018-2019) area, production and productivity observed positive compound growth rate. Productivity observed highest and positive compound growth rate of 2.97 per cent per annum followed by production 4.93 per cent per annum and area 1.90 per cent per annum at one per cent level of significance which was found statistically significant.

During period I, export quantity of maize recorded the highest and significant compound growth rate of 63.31 per cent per annum. Similarly, Export value (in Rs. Lakhs and million US $) witnessed highest compound growth rate of 66.64 per cent per annum and 67.38 per cent per annum, respectively which were statistically significant at one per cent level of significance. In period II, export quantity of maize witnessed a negative compound growth rate of -23.76 per cent per annum followed by export value (in Rs. Lakhs) at -18.18 per cent per annum and export value (in million US $) at -22.01 per cent per annum which were statistically significant at one per cent level of significance. During overall study period, export quantity of maize recorded positive and significant compound growth rate of 11.59 per cent per annum which was statistically significant at five per cent level of significance. While the export value (in Rs. Lakhs) and export value (in Million US $) witnessed positive and significant compound growth rate of 18.87 per cent per annum and 15.78 per cent per annum respectively at one per cent level of significance.

5.2 Instability in production and export of maize

Production witnessed highest variation than area and productivity during the entire study period. Instability in area, production and productivity of maize in India witnessed highest variation during overall period. With regard to export quantity of Maize, the highest variation was recorded in period I compared to other periods and in case of export value (in Rs. Lakhs and In Million US $) highest variation was observed during period I. With regard to top ten export countries, the highest variation in export quantity was observed in the following countries viz., Japan, Saudi Arab, Vietnam, Yemen Republic etc. In case of export value Japan, Saudi Arab, Vietnam witnessed the highest variation.

Coppock's Instability Index was the other measure to estimate the Instability. In production and productivity highest instability was recorded in period I than period II and overall period. In case of area, highest instability was observed in period II compare to period I and overall period. With respect to export quantity period I observed the highest instability. Period II and overall period observed lowest instability in case of export value (in Rs. Lakhs) and (in Million US $) witnessed highest instability in period I.

In country wise Instability analysis highest instability was observed in following countries as Japan, Malaysia, Oman, Saudi Arab, Singapore, Vietnam, Yemen Republic and Bangladesh, Nepal, UAE showed the lowest instability.

5.3 To study the trends in domestic and international price of maize

For trend analysis in domestic and international prices of maize, linear, quadratic and exponential model were used. The results showed that the best fitted model for domestic price was exponential model with R^2 value of 0.90 at one per cent level of significance and for international price the best fitted model was quadratic model with R^2 value of 0.91 per cent which was statistically non-significant.

5.4 To study the export competitiveness of maize in India

Export competitiveness of maize was analyzed by using Nominal Protection Coefficient (NPC). During overall period NPC value of maize was worked out to be 0.86 which shows that in the international market maize experience moderate export competitiveness.

Conclusions:

1. Overall period of study witnessed growth rate of 11.90 per cent, 4.93 per cent and 2.97 per cent for area, production and productivity, respectively.
2. Amongst area, production and productivity, production recorded comparatively higher growth rate than area and productivity.
3. During overall period export quantity and export value witnessed positive and significant compound growth rate with 11.59 per cent and 18.87 per cent, respectively.

4. Among the top ten countries the highest growth rate in terms of export quantity was observed in Yemen Republic and in terms of export value Nepal showed the highest growth rate during the overall period.
5. During the overall period instability observed in area, production and productivity were 3.66 per cent, 13.02 per cent and 11.22 per cent, respectively.
6. Export quantity showed 125.33 per cent instability during the overall period of study.
7. Export value in terms of Indian rupees and in Million US $ observed 109.37 per cent and 115.32 per cent instability, respectively during overall period of the study.
8. Among the top ten countries to which maize is exported from India, Malaysia witnessed the highest instability in quantity exported and value of export with 7255.68 per cent and 2632.34 per cent, respectively during the overall period of study.
9. In trend analysis, it was observed that for the domestic price exponential model was best fitted with R^2 value 0.90 while for the international price quadratic model was best fitted with R^2 value 0.91.
10. Export competitiveness of maize was analyzed by using Nominal Protection Coefficient (NPC) and it was observed that in the international market maize experience moderate export competitiveness.

Policy Implications:

1. New and high yielding varieties of maize should be promoted.
2. Warehousing, processing and transportation are the key issues in India's distribution system. Therefore government should take initiatives to improvise the system.
3. Government should implement farmer friendly policies and provide incentives to boost maize production in the country.
4. Government interventions are also necessary to promote export of maize from India.

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APPENDIX

APPENDIX - I

Area, Production and Productivity of Maize in India

Year	Area('000ha)	Production ('000 tonnes)	Productivity (kg/ha)
2000	6611	12043	1822
2001	6582	13160	2000
2002	6635	11152	1681
2003	7343	14984	2041
2004	7430	14172	1907
2005	7588	14709	1938
2006	7894	15097	1912
2007	8118	18955	2335
2008	8174	19731	2414
2009	8262	16720	2024
2010	8553	21726	2540
2011	8782	21759	2478
2012	8677	22258	2565
2013	9066	24260	2676
2014	9185	24172	2632
2015	8806	22567	2563
2016	9633	25900	2689
2017	9380	28753	3065
2018	9027	27715	3070
2019	9028	27715	3070

(Source: indiastat)

APPENDIX - II

Export quantity and Export value of Maize in India

Year	Export Quantity (MT)	Export Value (in Rs. Lakh)	Export Value (in million US $)
2000	32464.16	2728.7	5973529.37
2001	113504.2	9112.2	19387632.85
2002	78178.26	6773.77	13978012.76
2003	543270.9	35445.21	78749592.92
2004	1082256	71992.33	160446405.4
2005	419947.8	31600.37	71380965.99
2006	637411.3	49885.6	110660185.3
2007	2727715	244343.8	603914450.4
2008	3537303	337499.3	733853525.2
2009	2632875	255376.7	538769306.1
2010	3010423	335946.4	737047922.1
2011	3855721	515751.4	1075699152
2012	4788328	709634.1	1305294906
2013	3954237	598365.8	1004178455
2014	2825611	403750.8	666717230
2015	697947.2	116201.1	177989729
2016	566352.2	103013.4	153567036
2017	705513.8	122846	190341584
2018	1051856	187250.8	270302048
2019	370066.1	101929.8	142777826

(Source: APEDA)

APPENDIX - III

Quantity of maize exported to top ten countries from India

Year	Bangladesh	Vietnam	Nepal	Malaysia	UAE	Yemen Republic	Singapore	Oman	Japan	Saudi Arab
2000	22540.36	0	0	0	371.5	0	0	0	0	0
2001	95655.92	0	0	6666.39	713.44	0	410.5	0	100	0.45
2002	65033.86	291.4	1643.02	0	870.13	0	111	18	21.5	1.74
2003	285929.4	62.53	13338.05	78251.9	20870.4	20	2564.05	1348.3	35.5	241.8
2004	245797.9	5617.25	9523.57	357151	38315.97	35950	6313.06	1800	2400	180
2005	264092.9	592.42	14388.96	4104.9	6884.04	0	2180.62	0	49	105.5
2006	294167.2	11944	14350.14	46946.13	25225.9	0	10113.28	365	0	1
2007	202034.2	215566.9	58831.83	1252302	8552.87	83467.09	15756	19977.14	732.98	4874
2008	111144.2	436854.9	14560.51	1284347	199296.1	167789.1	37337.47	52576.6	58729.01	51997.18
2009	595161.1	597694.2	67802.36	550690.4	69563.21	17709	34771.47	36660.23	4435	303
2010	735582	606800.6	102413.2	664158.6	96450.69	17836.92	44871.35	35881.49	6003.23	251.46
2011	483274.3	735603.2	70205.99	786164.9	123745.8	29385.12	44083.9	56638.46	6148.56	333
2012	113736	1277522	145191.1	966747.6	72493.36	30911.65	43085.7	33338.61	3643	1089
2013	516258.8	856660.1	198217.60	898103.4	54784.98	35611	45446.25	27128.02	6129.7	477
2014	363950.5	385023.5	243947.1	464158.8	44454.09	30563	46269.8	54409.39	4932.56	559
2015	185877	1498.28	312629.2	32736.58	18469.74	15979	17514	10358.07	5519	480
2016	36337.77	403.05	376391.2	12459.6	10999.07	14094	331.16	4476.11	5317	613
2017	81033.26	21828.61	426667.9	18920.8	4825.11	11897	86.57	4852	7156	3171
2018	290195.7	81834.07	484927.2	21050.73	6404.38	12060.8	1826.16	5372.5	6147	6034.09
2019	9962.19	1893	313322.7	192.27	1846.16	8494	64.31	2756.06	6304.96	4476

(Source: APEDA)

APPENDIX - IV

Value of maize exported to top ten countries from India

Year	Bangladesh	Vietnam	Nepal	Malaysia	UAE	Yemen Republic	Singapore	Oman	Japan	Saudi Arab
2000	1420.14	0	0	0	36.49	0	0	0	0	0
2001	5713.23	0	0	340.99	62.4	0	18.97	0	50.21	0.08
2002	3755.53	100.75	96.8	0	79.9	0	21.73	1.63	17.51	0.17
2003	16742.16	36.26	703.41	4937.8	1398.81	3	207.62	248.75	27.4	26.52
2004	14899.04	431.38	477.96	23305.4	2545.22	2349	422.1	129.89	161.1	25.95
2005	18652.66	123.07	681.62	293.74	480.49	0	156.14	0	4.46	16.11
2006	21645.58	1006.54	747.85	3460.54	2106.35	0	799.98	31.96	0	0.05
2007	16542.68	19799.22	4245.08	111491.2	7716.37	7389.1	1426.63	1803.61	102.04	496.66
2008	10317.22	29446.96	1305.32	123060.4	19873.89	16187.05	3531.25	5036.99	6371.27	5424.07
2009	57256.97	57239.57	3008.01	53494.71	6991.73	1884.87	3449.45	3412.3	464.81	41.65
2010	77393.2	67869.31	8557.76	73357.89	11270.79	2149.21	5002.65	4021.01	833.78	32.42
2011	61374.46	99101.02	8881.83	106540	16754.53	4170.64	5884.87	7404.1	1032.08	49.36
2012	21048.13	183982.9	18770.57	140284.5	11067.78	5128.08	6300.44	5064.87	699.19	188.88
2013	85976.28	122908.3	28412.24	131841.9	8422.03	6026.38	6601.68	4210.87	1265.2	87.59
2014	54545.19	53973.36	30168.06	64986.68	6731.9	5184.31	6257.27	8353.43	947.65	121.66
2015	33397.38	1206.44	45381.84	5352.4	3170.65	3099.98	2441.09	1681.28	1091.18	91.64
2016	13861.34	388.92	57910.1	2172.97	1937.77	2763.23	56.09	957.8	1110.15	152.5
2017	19294.54	3751.05	61561.97	2862.84	855.22	2198.89	19.14	899.35	1482.88	614.05
2018	50298.83	12457.42	72982.4	3028.25	1152.23	2430.63	274.19	1021.73	1291.1	1162.38
2019	10892.31	653.54	69270.98	35.08	476.96	2138.56	21.41	716.77	1747.75	1098.42

(Source: APEDA)

APPENDIX – V

Domestic price of maize in India

Year	Domestic Price (Rs. /kg)
2000	5.19814
2001	5.48732
2002	5.72495
2003	5.935682
2004	6.02778
2005	6.617609
2006	6.986235
2007	8.237609
2008	8.82556
2009	10.23129
2010	9.715526
2011	11.22644
2012	13.08519
2013	14.43364
2014	19.84
2015	14.93807
2016	15.035
2017	12.96174
2018	13.56356
2019	19.3847

(Source: Agmarknet)

CURRICULUM VITAE

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Academic Qualification

Course/ Degree	Name of the College/ Institute	University/ Board	Year of passing	Percentage (%) CGPA	Class/ Grade
SSC	L. N. Hoshing Vidyalay, Jamkhed	Maharashtra state Board of Secondary and Higher Secondary Education, Pune	2013	86.80	A
HSC	L. N. Hoshing Vidyalay, Jamkhed	Maharashtra state Board of Secondary and Higher Secondary Education, Pune	2015	80.92	A
B.Sc. (Agri)	College of Agriculture, Parbhani VNMKV, Parbhani.	VNMKV, Parbhani University	2019	7.66	Ist

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Date: 30 / 09/ 2021

(Kolhe Prajakta Ram)