

PRODUCTION AND EXPORT PERFORMANCE OF MAJOR SPICES IN INDIA

Thesis

**Submitted to Punjab Agricultural University
in partial fulfilment of the requirements
for the degree of**

**MASTER OF SCIENCE
in
AGRICULTURAL ECONOMICS
(Minor Subject: Statistics)**

By

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CERTIFICATE I

This is to certify that the thesis entitled, “**Production and Export Performance of major spices in India**” submitted for the degree of **M.Sc.** in the subject of **Agricultural Economics** (Minor subject: **Statistics**) of the Punjab Agricultural University, Ludhiana, is a bonafide research work carried out by **Anantha Venkata Prasad Babu (L-2017-BS-215-M)** under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

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ABSTRACT

The present study was conducted to examine production and export performance of major spices in India from 1995-96 to 2016-17. The total study period was divided into two periods i.e., pre-NHM period (1995-96 to 2005-06) and post-NHM period (2006-07 to 2016-17). The time series data on area, production, yield, export, import and prices of selected spices were retrieved mainly from Spice Board of India and various government websites. The study found that post-NHM period recorded highest growth rate in production coupled with lowest instability over pre-NHM period in case of chilli, cumin and coriander. Most of the spices registered instability in area on account of unfavourable weather conditions and price volatility in domestic and international markets. Positively, all the major spices showed positive growth rate in both export quantity and export value coupled with higher instability indices in these commodities as indicated by Cuddy-della Valle indices. The Markov Chain Analysis revealed that all the major spices except chilli have registered lesser retention probability in most of the major destinations after National Horticulture Mission. Lagged production and domestic consumption were registered as the major determinants of Indian spices exports by applying multiple regression analysis. Apart from this, India has enjoyed comparative advantage in turmeric exports in the world market and in chilli exports in the Asian market during the study period, which were reflected in the values of RCA and CEP indices. However, India has been facing challenges from major exporting countries in pepper, cumin and coriander exports in the world market. Hence, Government has to fix competitive price in advance to encourage the farmers and priority should be given for promotional programmes to augment and stabilize the area under spices cultivation. Further, India should explore new markets and should develop a network of market intelligence.

Key words: Spices, National Horticulture Mission, Markov Chain Analysis, Cuddy-Della Valle Index, Comparative Advantage

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ਮੌਜੂਦਾ ਖੋਜ ਦੌਰਾਨ ਭਾਰਤ ਵਿੱਚ 1995-96 ਤੋਂ 2016-17 ਤੱਕ ਪ੍ਰਮੁੱਖ ਮਸਾਲਿਆਂ ਦੇ ਉਤਪਾਦਨ ਅਤੇ ਨਿਰਯਾਤ ਦਾ ਅਧਿਐਨ ਕੀਤਾ ਗਿਆ। ਅਧਿਐਨ ਦੇ ਕੁੱਲ ਅੰਤਰਾਲ ਨੂੰ ਦੋ ਹਿੱਸਿਆਂ ਭਾਵ ਐਨ ਐਚ ਐਮ ਤੋਂ ਪਹਿਲਾਂ (1995-96 ਤੋਂ 2005-06) ਅਤੇ ਐਨ ਐਚ ਐਮ ਤੋਂ ਬਾਅਦ (2006-07 ਤੋਂ 2016-17) ਵਿੱਚ ਵੰਡਿਆ ਗਿਆ। ਸਪਾਇਸ ਬੋਰਡ ਆਫ ਇੰਡੀਆ ਅਤੇ ਵੱਖੋ-ਵੱਖਰੀਆਂ ਸਰਕਾਰੀ ਵੈਬਸਾਈਟਾਂ ਤੋਂ ਚੋਣਵੇਂ ਮਸਾਲਿਆਂ ਦੀ ਕਾਸ਼ਤ ਅਧੀਨ ਰਕਬੇ, ਉਤਪਾਦਨ, ਝਾੜ, ਨਿਰਯਾਤ, ਅਯਾਤ ਅਤੇ ਮੁੱਲ ਸਬੰਧੀ ਅੰਕੜੇ ਇਕੱਠੇ ਕੀਤੇ ਗਏ। ਅਧਿਐਨ ਤੋਂ ਪਤਾ ਚੱਲਿਆ ਕਿ ਐਨ ਐਚ ਐਮ ਤੋਂ ਪਹਿਲਾਂ ਦੇ ਮੁਕਾਬਲੇ ਐਨ ਐਚ ਐਮ ਤੋਂ ਬਾਅਦ ਦੇ ਅੰਤਰਾਲ ਦੌਰਾਨ ਮਿਰਚਾਂ, ਜੀਰੇ ਅਤੇ ਧਨੀਏ ਦੇ ਉਤਪਾਦਨ ਦੀ ਦਰ ਵਿੱਚ ਸਭ ਤੋਂ ਜ਼ਿਆਦਾ ਵਾਧਾ ਹੋਇਆ ਅਤੇ ਸਭ ਤੋਂ ਘੱਟ ਅਸਥਿਰਤਾ ਦਰਜ ਕੀਤੀ ਗਈ। ਅੰਤ੍ਰਿਕ ਅਤੇ ਵਿਦੇਸ਼ੀ ਮੰਡੀਆਂ ਵਿੱਚ ਮੁੱਲ ਅਸਥਿਰਤਾ ਅਤੇ ਮਾੜੇ ਮੌਸਮੀ ਹਾਲਾਤਾਂ ਕਾਰਨ ਜ਼ਿਆਦਾਤਰ ਮਸਾਲਿਆਂ ਦੀ ਕਾਸ਼ਤ ਅਧੀਨ ਰਕਬੇ ਵਿੱਚ ਅਸਥਿਰਤਾ ਦਰਜ ਕੀਤੀ ਗਈ। ਕਡੀ-ਡੀਲਾ ਵਲੋਂ ਸੂਚਕਾਂਕਾਂ ਤੋਂ ਸਾਰੇ ਦੇ ਸਾਰੇ ਪ੍ਰਮੁੱਖ ਮਸਾਲਿਆਂ ਦੇ ਨਿਰਯਾਤ ਦੀ ਮਾਤਰਾ ਅਤੇ ਨਿਰਯਾਤ ਮੁੱਲ ਵਿੱਚ ਉੱਚ ਅਸਥਿਰਤਾ ਸੂਚਕਾਂਕਾਂ ਨਾਲ ਸਾਕਾਰਆਤਮਕ ਵਿਕਾਸ ਦਰ ਵੇਖੀ ਗਈ। ਮਾਰਕੇਟ ਚੇਨ ਮੁਲਾਂਕਣ ਤੋਂ ਪਤਾ ਚੱਲਿਆ ਕਿ ਨੈਸ਼ਨਲ ਹੋਰਟੀਕਲਚਰ ਮਿਸ਼ਨ ਮਗਰੋਂ ਮਿਰਚਾਂ ਤੋਂ ਇਲਾਵਾ ਬਾਕੀ ਸਾਰੇ ਮਸਾਲਿਆਂ ਨੇ ਜ਼ਿਆਦਾਤਰ ਪ੍ਰਮੁੱਖ ਸਥਾਨਾਂ ਵਿੱਚ ਅਵਧਾਰਨ ਦੀ ਸੰਭਾਵਨਾ ਦਰਸਾਈ। ਬਹੁ ਪ੍ਰਤੀਗਮਨ ਵਿਸ਼ਲੇਸ਼ਣ ਤੋਂ ਪਤਾ ਚੱਲਿਆ ਕਿ ਵੱਡੇ ਪੈਮਾਨੇ ਤੇ ਉਤਪਾਦਨ ਅਤੇ ਘਰੇਲੂ ਖਪਤ ਨੂੰ ਭਾਰਤੀ ਮਸਾਲਿਆਂ ਦੇ ਨਿਰਯਾਤ ਦੇ ਪ੍ਰਮੁੱਖ ਕਾਰਕ ਸਨ। ਇਸ ਤੋਂ ਇਲਾਵਾ, ਭਾਰਤ, ਹਲਦੀ ਦੇ ਨਿਰਯਾਤ ਵਿੱਚ ਸੰਸਾਰ ਭਰ ਵਿੱਚ ਅਤੇ ਮਿਰਚਾਂ ਦੇ ਨਿਰਯਾਤ ਵਿੱਚ ਏਸ਼ੀਆ ਵਿੱਚ ਮੋਹਰੀ ਸੀ ਇਸਦਾ ਪਤਾ ਆਰ ਸੀ ਏ ਅਤੇ ਸੀ ਈ ਪੀ ਸੂਚਕਾਂਕਾਂ ਦੀਆਂ ਦਰਾਂ ਤੋਂ ਚੱਲਿਆ। ਹਾਲਾਂਕਿ ਕਾਲੀ ਮਿਰਚ, ਜੀਰਾ ਅਤੇ ਧਨੀਆ ਦੇ ਨਿਰਯਾਤ ਵਿੱਚ ਭਾਰਤ ਨੂੰ ਪ੍ਰਮੁੱਖ ਨਿਰਯਾਤਕ ਦੇਸ਼ਾਂ ਤੋਂ ਚੁਣੌਤੀ ਮਿਲ ਰਹੀ ਹੈ। ਕਿਸਾਨਾਂ ਨੂੰ ਪ੍ਰੋਤਸਾਹਿਤ ਕਰਨ ਲਈ ਸਰਕਾਰ ਨੂੰ ਪਹਿਲਾਂ ਹੀ ਮਸਾਲਿਆਂ ਦੇ ਮੁੱਲ ਨਿਰਧਾਰਤ ਕਰਨੇ ਚਾਹੀਦੇ ਹਨ ਅਤੇ ਮਸਾਲਿਆਂ ਦੀ ਕਾਸ਼ਤ ਅਧੀਨ ਰਕਬੇ ਵਿੱਚ ਵਾਧਾ ਕਰਨ ਅਤੇ ਸਥਿਰਤਾ ਲਿਆਉਣ ਲਈ ਪ੍ਰਚਾਰ ਕਰਨਾ ਚਾਹੀਦਾ ਹੈ। ਇਸ ਤੋਂ ਇਲਾਵਾ, ਭਾਰਤ ਨੂੰ ਨਵੀਆਂ ਮੰਡੀਆਂ ਦਾ ਪਤਾ ਲਗਾਉਣਾ ਚਾਹੀਦਾ ਹੈ ਅਤੇ ਮੰਡੀ ਦਾ ਜਾਲ ਵਿਕਸਤ ਕਰਨਾ ਚਾਹੀਦਾ ਹੈ।

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CHAPTER I

INTRODUCTION

Agriculture plays a pivotal role in the development of Indian economy. It has already shown a significant effect to the economic prosperity of developed countries and its role in the less developed countries is of vital importance. In other words, Agriculture is not merely a source of livelihood but also a way of life in developing countries like India. The Indian agriculture sector has undergone enormous transformation over the years and has now reached a stage of self-sufficiency in food grain production from severe food crisis. India has only 2.4 per cent of land of the world and serving a human population of 15 per cent and cattle population of 17 per cent of the world. Over, 58 per cent of population in India depends on agriculture sector in one form or the other (Babu, 2017). Another noteworthy feature is that agriculture being a single largest private sector contributes about 10 per cent of total export earnings and supply raw materials to a large number of industries (Renjini, 2012). But the haunting thing is that the share of agriculture to GDP has declined from 57 per cent in 1950-51 to 14 per cent in 2011-12 (Thakur, 2012). Apart from this, the water resources in the country are declining day by day. The demand on increasing the farmers' income also came up in a big manner. In order to overcome these challenges, government has looked at the diversification of agriculture which includes horticulture, fisheries, poultry and animal husbandry etc. In this connection, one of the prominent sectors in agriculture i.e., horticulture sector, which uses less water and gives more output per unit area has been given much preference in order to maintain a sustainable growth and development of the economy in an agrarian country like India.

According to Economic survey (2015-16), horticulture sector has emerged as the fastest growing sector in agriculture, contributing more than 33 per cent of agricultural GDP with an area growth of 2.7 per cent per annum and production growth of 7 per cent per annum since 2012-13 (Anonymous, 2016). The enhancement in horticulture sector is mainly because of National Horticulture Mission which launched in May 2005. The key objective of this mission is to enhance horticulture production to the maximum potential level in the state and it includes fruits, vegetables, spices, flowers, plantation crops, medicinal and aromatic crops. Moreover, establishing coordination among multiple on-going programmes and dissemination of technology in horticulture sector were also taken up by this mission in a big manner. Furthermore, it aimed at generating more employment opportunities for unemployed youth and income support to the farm households. The NHM led to an increase in area from 187.1 million hectares to 234.1 million hectares and production from 182.8 million tonnes to 281 million tonnes from 2005-06 to 2014-15 (Anonymous, 2016). Of all the products, spices

registered a notable remark in the horticulture sector owing to its low volume with high value in the international market.

Spices are the plants, the products of which are used as food adjunctive to add flavor and aroma. Primitive humans had found that spices have healing properties and were used in the treatment of wounds and illnesses. In addition to this, spices can improve the palatability and the appeal of dull diets. Moreover, the strong preservative quality of many spices made them ideal for embalming. The remarks about the importance and use of spices were mentioned in Vedic texts and biblical texts as well. Besides this, the ancient Egyptians used spices as a preservative to store mummies (Krishnadas, 2010). In the Ancient and Medieval period, spices were known with the name 'Treasures of the East' owing to its value in the international trade. During this period, Arabians spread mythological stories to acquire the monopoly on spice trade as people believed extensively in charms, omens, witchcraft and magic. Observing the inexpensive condition in some of the spices of today, it is impossible to imagine them being valued at one time as highly precious as silver and gold. The trade was mainly carried out by ships and caravans which were often prone to shipwrecks, storms, robberies and piracy. Nevertheless, the demand for spices was so high that the profits far outweighed the risks and the growth rate in spice trade continuously raised.

Since ancient times, India has been a major procurement centre for many spices as India is often referred as "Land of spices" owing to the cultivation of 75 varieties of spices in its agro-climatic regions, out of 109 shortlisted by ISO. Ancient Egyptians and Romans dominated the Indian spice trade in the beginning and later it was taken over by the Arabs in the middle ages. In order to curtail the monopoly of Arabs, the Europeans (which were the major importers of spices) searched for new maritime routes to India and South-east Asia. The visits of Vasco da Gama and Pedro Alvares Cabral to the Calicut, Kerala also stressed the importance of Indian spices and established supremacy of Portugal over Indian spice trade. Indian spices have remarkable significance in the world market on account of its taste and flavour. They are not only meant for dietary purpose but also used for medicinal and curative purposes since time immemorial. But gradually, the artificial chemicals, flavours and medicines dominated the natural ones like spices on account of lesser cost, easy preparation and availability. However, the conscious consumers in the world are now switched towards natural ones like chilli, cumin, pepper, cardamom etc., instead of synthetic chemicals, drugs and medicines owing to the growing awareness of ill effects of artificial ones (Gulf cooperation council, 2011).

Spice quality has to be focused in every stage of production including cultivation, handling, transportation, marketing and storage. In order to fetch better market value for the produce, adulteration of spices seems to be the best option. Nevertheless, India is the largest producer and exporter of spices in the world. Hence, India has been often referred as the

‘Spice Bowl of the World’ (Lamba *et al*, 2015). The other major spice producing countries are Bangladesh, Turkey and China. The spices produced in India are chilli, cumin, turmeric, ginger, garlic, pepper, coriander, fenugreek, cardamom, celery, fennel, nutmeg and mace etc., However, the major spices considered for the analysis include chilli, cumin, coriander, turmeric, pepper and processed products like mint products and spice oils and oleoresins on account of its importance and value in the international market. Chilli and coriander covered an area of 8.65 lakh ha and 6.73 lakh ha respectively and production of 23.94 lakh tones and 8.64 lakh tonnes respectively during 2016-17. Similarly, the spices like cumin, turmeric and pepper covered an area of 7.80 lakh ha, 2.48 lakh ha and 1.34 lakh ha respectively and production of 5.00 lakh tonnes, 12.16 lakh tonnes and 0.57 lakh tonnes respectively during 2016-17. Major producing states of spices are Andhra Pradesh, Rajasthan, Gujarat, Karnataka, Maharashtra, West Bengal and Uttar Pradesh. However, Andhra Pradesh, Rajasthan and Gujarat are the top three producers of spices in India contributing nearly 50 per cent of total spices production in India (Spice Board of India, 2017-18).

More than 90 percent of spices produced in our country is domestically consumed and the remaining is exported as raw and value added products. Yet, India is pioneer in export of spices and continued the monopoly of spices in the world market since ancient times. The top destinations for Indian spices are USA, Vietnam, China, UAE, Malaysia, UK and Sri Lanka. USA, China and Vietnam are the loyal customers of Indian spices over the recent years. The recent quantity and value of export in 2016-17 is estimated at 9.47 lakh tonnes and 17,664.6 crores as against 8.43 lakh tonnes and 16,238.23 crores during 2015-16, registering an increase of 12 percent in volume and 9 percent in value. Chilli occupies the largest share of export value among the Indian spices. Mint products and spice oils and oleoresins occupied second and third position respectively in terms of export value (Spice Board of India, 2017-18). It necessitates that there is a shift in dietary preferences from conventional spices to processed and value-added spices.

The processing of spices has become an important industry nowadays particularly in developed countries like USA and China owing to its importance and usage in several fields like beverages, confectionery, curry powder and soups etc., Most of the food industries rely mainly on the quality products in order to cope up with the demands of the conscious consumers, particularly in advanced countries. Apart from this, Spice oils and mint oils are used in perfumes along with fruit extracts in order to produce aromatic scent in Arab countries is gaining traction in the market. The raw spices are rapidly replaced by processed products like mint products and spice oils and oleoresins and export of these products instead of raw spices is attributing value addition for the market. Among the Indian agriculture exports, spices were seen as one of the most vulnerable commodity as their export products faced large number of rejections and losses. Besides this, the export competitiveness of a

country for a commodity depends largely on the export of other competing countries. For this reason, countries have given the subsidies, investment to the research and developments technologies. The competitiveness of a country refers to an increase in its production capability and capacity. If a firm's or country's economic performance is measured, we can compare to the International competitiveness. With regard to this measuring, we can decide the situation of firm's or country's economic performance. The presence of pesticides, salmonella, filth and labelling were registered as the major causes of rejections (Said Idris, 2013). Apart from this, lack of organized marketing system up to the remote areas of the country was also a major setback and might become a challenging factor in the near future. Moreover, several regulations have been incurred by different countries to export of spices, which caused the reduction of spices exports. Furthermore, volatility in international prices of spices and the raise of spices cultivation in the competing countries has led to a decrease in foreign exchange earnings from spice trade.

In order to maintain the status of monopoly in spice trade and same level of foreign exchange earnings as before, there is a necessity to examine the past performance and present scenario of area, production and yield of major spices in different states of India. In this context, the present study also highlights the safest destinations for Indian spices and the factors accountable for the export of these spices in an easy way.

Objectives

1. To estimate growth and instability in area, production and yield of major spices in India.
2. To analyse the direction of trade of spices export in India.
3. To examine the factors influencing change in export of major spices in India.
4. To suggest suitable measures to promote the export of major spices in India.

CHAPTER II

REVIEW OF LITERATURE

A review of past studies is needed to develop conceptual and methodological understanding of any research. This understanding will enrich the researcher to collect appropriate data and to make meaningful interpretation regarding the present study. A review of the relevant literature pertaining to the present study has been presented in this chapter. Keeping in mind the objectives of the study, the present chapter is dealt under the following sections:

- 2.1 Growth and instability analysis
- 2.2 Direction of trade of spices export from India
- 2.3 Factors influencing export of major spices in India
- 2.4 Comparative advantage of Indian spices exports

2.1 Growth and instability analysis

Rajur *et al* (2008) studied the growth performance of chilli in Karnataka during 1990-91 to 2003-04. The study period was divided into two periods i.e., period I (1990-91 to 1996-97) and period II (1997-98 to 2003-04). The study found that significant growth was registered in area, production and yield of chilli both at the district level and at the state as a whole. Although mean area of chilli was more in Gulbarga district, mean production was highest in the Raichur district owing to the increased yield in the district. Apart from this, growth rate in production was significant in period I at the state level owing to the increase of chilli area in the state. Regarding variability, Raichur district recorded highest in both area and production. In addition to this, variability in yield was also highest in Raichur district compared to other districts of the state.

Sakamma (2009) analysed the growth in production and export of major spices of India during the pre and post WTO period. The major spices selected for the study were chilli, pepper, cumin, turmeric and coriander. During pre-WTO period, increase in growth rate was observed in area and production of cumin, chilli and coriander compared to post-WTO period. The study noticed that positive growth rate was observed in area, production and productivity of pepper and turmeric during the study period. During the overall period, increasing trend was seen in growth of export of chilli, turmeric, cumin and coriander. The growth in export value of pepper was found increasing whereas it was found decreasing in term of quantity exported during the overall period. The highly loyal markets for chilli are UAE and Bangladesh during pre-WTO period while Malaysia and Sri Lanka during post-WTO period. Bangladesh and Malaysia were found to be highly loyal markets for turmeric and coriander during the overall period respectively.

Krishnadas (2010) used exponential growth function to study the performance of area, production and productivity of spices. To examine the dynamic structure of export, Markov chain analysis was used. Multiple regression analysis was employed to study the factors influencing changes in production export of major spices. There is positive significant response in term of quantity and values of chilli, cumin, coriander and turmeric. Instability was observed in the export of these spices. Based on the above results, it can be concluded that promotional programmes have to be taken up to increase the area under chilli and coriander.

Kannan and Sundaram (2011) analysed the trends in India's agricultural growth during 1967-68 to 2007-08. They used crop output growth model to examine the determinants in India as a whole. There is a significant decline in the area under coarse cereals about 13.3 per cent during 1970-71 to 2007-08. Growth in area and production of pulses was also not satisfactory over the decades. The accelerating factors in crop production after 1960's are introduction of modern varieties, fertilizers usage and use of technology in the country. A vast change in area and production of rice and wheat was due to the technological and institutional support from the government. But in productivity terms, India is behind the China and USA. Hence proper measures have to be taken to improve the productivity in India.

Ramachandra *et al* (2012) examined the production and export of chilli in India during 1970-71 to 2008-09. The study found that Andhra Pradesh contributed largest share in area (27.67%) and production (59.48%) that was reflected in the year 2008-09. The study also found that stability was observed in production and export of chilli during post liberalization period compared to pre liberalization period. The major factors which drive the increase in production are the use of high yielding hybrids in place of varieties, increase in productivity, favourable climatic conditions and changing consumption pattern. This paper also highlighted that India has the potential to increase its export as India exports only 20 per cent of its production.

Madisa *et al* (2012) discussed the trend in land allocated to Horticulture, total vegetable, fruit production and import of horticultural crops to Botswana during 1997 to 2009. In case of vegetables, total production and productivity exhibited an upward trend during the study period. But area of vegetables had no significant effect on yield as it is accounted for only 3 per cent of vegetables during that period. Total fruit production increased three fold 2003 to 2008 but lagged in 2009. Total fruit production accounted for more than 50 per cent variation in imports indicating that a significant proportion of national demand was met by local production. Hence farmers need to be trained on good management of crops especially horticulture crops.

Soumya *et al* (2014) carried out a study to critically analyse the growth and instability in production and export of pepper, cumin, and coriander in India during 2010-11. Statistical

tools like CGR and CV were employed for the study. The result showed that instability was high in export but low in area, production and productivity of pepper, cumin and coriander. Negative CGR was observed in area, production and productivity of pepper at the national level. But the export of pepper registered a positive but less significant growth rate. Strict measures should be taken to stabilize the prices and to ensure the farmer interests and MSP need to be announced.

Yogesh and Mokshapathy (2014) examined the growth in export and import of spices in India from 2005-06 to 2012-13. The major spices considered for study were cumin, ginger, chilli, cardamom, fenugreek, turmeric, curry powder, garlic, mint products, oils and oleoresins. Cumin showed highest CGR (21.63%) in export quantity followed by ginger. While pepper showed low growth rate in terms of export quantity. In terms of value of export, ginger recorded highest growth rate followed by turmeric. In case of imports, poppy seed showed highest growth rate in terms of both quantity and value. Pertaining to total spices, significant growth rate was observed in both exports and imports.

Yogesh and Mokshapathy (2014) analysed the spice production in India and the world. The major producing countries are India, Bangladesh, China, Turkey, Pakistan, Columbia, Nepal, Iran and others. It was observed that Ethiopia showed highest CGR (9.01%) followed by Iran (5.5%) during 2003 to 2012. Whereas Turkey and Nigeria registered negative growth rate in area. In case of production, Bangladesh registered highest growth rate (10.7%) followed by Turkey (9.92%). India is in 4th position in term of CGR in both area and production. In India, Gujarat showed positive CGR in both area and production followed by Madhya Pradesh during 2002-03 to 2011-12. Fennel showed positive CGR in area and production during the study period.

Joshi and Singh (2015) analysed the growth and instability in major spices in India during 1974-75 to 2012-13. The study period was divided into three sub-periods i.e. 1974-75 to 1989-90, 1990-91 to 1999-00 and 2000-01 to 2012-13. The study used Cuddy-Della Valle index for instability and exponential growth function for growth rate. More stability and high growth rate is observed in sub-period II. More fluctuations in growth rate in most of the spices are observed in sub-period III. Coriander showed highest growth in output but offsetting by high or increasing instability. The instability in most of the spices was due to high temperature, price volatility etc.

Ganesan (2015) studied the growth and instability in area, production and yield of turmeric in India during 1979-80 to 2010-11. The states selected for the study include Andhra Pradesh, Orissa, Tamil Nadu, Kerala and Karnataka. The results revealed that Andhra Pradesh and Orissa registered non-significant growth in area and production, while significant growth rate was registered in Tamil Nadu and Kerala. In case of yield, all the states showed significant growth rate except Andhra Pradesh. The study also found that instability in area

was reduced in Andhra Pradesh, whereas lower instability in production was recorded in Andhra Pradesh and Tamil Nadu and lower instability in yield was recorded in Tamil Nadu and Karnataka. The whole analysis found that the liberalization measures taken up in 1991 has a mixed impact i.e., vary from state to state regarding turmeric cultivation.

Tewari *et al* (2017) studied the growth and instability of wheat production in regions of Uttar Pradesh from 1990-91 to 2013-14, which was further divided into five sub periods. The study found that growth rate in area of wheat was positive in all the regions of the state during the overall period. Besides this, positive growth rate was recorded in production and yield in all the regions of the state except in sub period III. The results revealed that area, production and yield of wheat was highest in western region, while lowest in case of Bundelkhand region. Apart from this, instability was more pronounced in production and yield compared to area of wheat. The results also revealed that growth in production was mainly due to the dominance effect of yield.

Priscilla *et al* (2017) studied the performance of agriculture sector in India during 1985-86 to 2014-15. For food grains, there is a negative growth rate in terms of area but positive growth rate in terms of production and productivity. There is a positively significant response in production and availability of milk, meat and eggs. In case of fruits and vegetables, upward trend is observed in area, production and productivity. They also noted that the inefficient management of public distribution system lack of infrastructure facilities make the country in poverty and hunger even though there is positively significant response in agriculture sector.

Suvagiya *et al* (2017) analysed the growth performance of major vegetable crops in Gujarat state from 1994-95 to 2012-13. The rate of increase in area, production and productivity of vegetables was highest in south Gujarat region during the overall period. Highest instability was registered in Saurashtra region in all three parameters i.e., area, production and yield. The study also found that growth of brinjal in area, production and productivity was found to be significant in all the regions of state except productivity in Saurashtra. Dang district of Gujarat recorded highest growth rate in area (36.56%) and production (46.59%) of okra, while Gandhinagar district registered highest growth in area and production of cabbage. Regarding instability of vegetables, highest instability was observed in area and yield compared to production in Gujarat state.

Devi and Jadav (2018) examined the growth performance of spices in India. The study used compound growth rate and Cuddy-della Valle index in area, production and yield of total spices over the last ten years. The study revealed that positive growth rate was observed in production (1.79%) and productivity (3.04%) of total spices. But in terms of area, negative growth rate was observed owing to the diversification of agricultural field crops. Moreover, low instability was recorded in productivity of spices. The results also revealed that highest

positive growth rate was observed in export, while very less growth rate was recorded in import of spices for the period taken for analysis. Hence, policies have to be framed towards quality production of spices by employing advanced processing technology to boost the spices exports in a big manner.

2.2 Direction of trade of spices export from India

Mandanna *et al* (1998) examined the structural change in tobacco exports from India during 1980-81 to 1994-95 with the use of markov chain analysis. The total study period was divided into pre-auction period (1980-80 to 1984-85) and auction period (1985-86 to 1994-95). USSR appeared to be the most stable market for unmanufactured tobacco during the first period. But in second period, preference of Indian tobacco was more pronounced in West Europe, Asia and the Middle East. Even though the exports of tobacco products have not increased considerably, still the Middle East and Saudi Arabia are registered to be the major markets. The study found that none of the tobacco products from India exported during the study period had a stable market. However, the competition of market share was observed in cigarette, chewing tobacco, hookah and tobacco paste. Although cigarette tobacco has lost its share to hookah and tobacco paste, it has gained substantial shares from snuff, chewing tobacco, hookah, tobacco paste and other tobacco products. These shares also necessitate the importance of cigarette tobacco in the world market and measures need to be taken to boost the production and export of cigarette tobacco in the country.

Krishnadas and Mundinamani (2011) analysed the changing direction of trade of major spices export from India from 1994-95 to 2006-07. The analysis revealed that the loyal customer for Indian chilli and cumin was Malaysia. In case of black pepper, coriander and turmeric, USA, Singapore and Bangladesh were the major destinations respectively. The most unstable markets for Indian chilli were Bangladesh and USA. Similarly, UK and Australia for black pepper, Japan for turmeric, UK and USA for cumin, Saudi Arabia, UK and South Africa for coriander were the most unstable importers. The study suggested that production efficiency has to be increased in all the spices to make the product price competitive. The study also recommended that new markets should be explored by developing a network of market intelligence.

Rajur and Patil (2013) studied the export performance of chilli in India for the period 1984-85 to 2003-04. During the study period, the researchers worked out the export competitiveness during 1998-99 to 2003-04. The study period was divided into two periods, the first was from 1984-85 to 1993-94 and the second was from 1994-95 to 2003-04. There was a positive significant response observed in both the quantity and value of export in chilli. The growth in quantity was 19.37 percent and the growth in value was 27.57 per cent during the overall period. Sri Lanka was found to be the highly loyal market for Indian chilli's export. The United States also shared 19 per cent of its previous share of export of chilli from

India. Hence, sanitary measures need to be improved to enhance the standardization of packing and ease of doing export and to accelerate the export to Bangladesh, Malaysia, Uganda, Indonesia and others.

Mokashi and Hosamani (2014) conducted a study on direction of trade of Indian grapes. The study used Markov chain analysis with the use of secondary data from 2000-01 to 2010-11 obtained from APEDA and NHB. The study found that Germany was the most unstable importer of Indian grapes, whereas the most loyal customers were Bangladesh, UK and Netherlands. Hence, the researcher suggested that export promotion in these stable markets can improve the import potential for Indian grapes by organizing international trade fairs, exhibitions etc., to make the exporters aware of the quality standards prescribed by these countries.

Lamba *et al* (2015) opined that India is a premier destination of organic spices in the world as varieties of spices are cultivating under organic farming. The annual growth rate of spices is 3.6 per cent and 5.6 per cent in terms of area and production respectively. Mint products and spice oils & oleoresins registered the top position in terms of export value after chilli. It stressed the importance of processing i.e. value added products. During 2014-15, the total export of spices was 8.93 lakh tonnes and 0.148 lakh crores as against 8.17 lakh tonnes and 0.137 lakh crores in 2013-14 registered an increase of 9 per cent in quantity and 8 per cent in value and also exceeded the target for the financial year 2014-15 in terms of both quantity and value and the achievement percentage is 118 per cent in terms of quantity and 121 per cent in terms of rupee and 122 per cent in dollar terms.

Devi *et al* (2016) examined the direction of trade and export competitiveness of chillies in India. The study used Markov chain analysis and revealed that UAE and Sri Lanka are the most stable markets of chilli next only to USA. The unstable importers are Malaysia, Bangladesh, and Pakistan. During 2006-07 to 2010-11, the estimated NPC's varied from 0.46 to 0.69 indicating the global price competitiveness of the Indian red chillies. When Indian red chillies are compared to Chinese red chillies, it is discovered that Indian red chillies are more globally price competitive for 3 years out of 5 years' study period.

Babu (2017) attempted to study empirically the export performance of spices in India. The study used Shapiro-wilks test to test the normality of two variables namely quantity and value of spices. The study revealed that significant relationship is present between quantity and the value of spices. The India spices export have increased 8 times in terms of value during 2001 to 2015. There is a significant growth in terms of export in terms of quantity during 2001-15. Even then, some of the developing countries are slowly shifting towards processing to make the products more valuable.

2.3 Factors influencing export of major spices in India

Okoruwa *et al* (2003) examined the determinants of traditional agricultural exports in Nigeria. The study revealed that the major factors affecting exports were lagged producer prices, lagged world prices, quantity supplied by other competing countries, population growth, index of industrial production of important countries and the time trend. The cocoa export in Nigeria was mostly influenced by lagged producer prices and lagged population growth rate. However, population growth in Germany and the Netherlands had a negative impact on Nigerian cocoa exports, whereas it had positive impact on cocoa exports to USA. The palm kernel products instead of exporting to other countries were mostly used as raw material in small scale enterprises in Nigeria such as soap and vegetable oil manufacture and livestock keeping etc., but particularly it special reference to the international market of Nigerian palm kernel, the lagged producer prices, population growth rate in Germany, the import of palm kernel by Netherlands from other competing countries and the index of industrial production has a pronounced effect on the palm kernel export of Nigeria. In case of rubber, a producer price has positive and significant impact on exports to France and UK. The production of rubber in Nigeria also has a significant effect on the export of rubber to all the importing countries except UK. But lagged world prices of rubber showed significant influence on rubber exports particularly to USA. Nevertheless, exports from Nigeria have to be expected to increase to countries like Germany and Netherlands.

Kumar and Rai (2007) studied the determinants of tomato exports from India using regression analysis for the period 1985-2004 the factors considered in this study were volume of international trade in tomato, ratio of Indian and Non-Indian international export price, domestic production of tomato and exchange rate. These variables explained about 98 per cent of the total variation in the export quantity of tomato. All the variables except exchange rate have shown positive effect on tomato exports. The study also found that demand for Indian tomato increases with increase in the international trade in tomatoes viz., with one per cent increase in international trade in tomatoes, the demand for Indian tomato in the international market raises by 10.8 per cent. The results also revealed that the price realization for exports from India in relation to export price of world was increased with the raise in Indian tomato exports. However, domestic production had a negative impact on tomato exports. This might be due to the fact that increase in domestic production was coincided with the increased world production, causing depression in the international prices and in turn results in lower tomato exports from India.

Kumar *et al* (2008) examined the export of cucumber and gherkin from India and its performance, competitiveness and determinants. With special reference to determinants of cucumber and gherkin, world export quantity has a major impact (5.96) on the exports of cucumber and gherkin from India. Another major determinant influencing the exports of

cucumber and gherkin was exchange rate. The results also revealed that Indian export price has not played any significant role in determining exports of cucumber and gherkin from India.

Abolagba *et al* (2010) analysed the factors effecting Nigerian agricultural exports with special reference to cocoa and rubber. The results revealed that domestic rubber production, producer price and interest rate had a significant influence on Indian rubber exports, while, domestic consumption and exchange rate registered negative influence on rubber exports from India. In case of cocoa, domestic consumption (0.850), cocoa output (0.847) and rainfall (44.674) have a significant impact on cocoa exports.

Kannan (2013) examined the factors influencing production and export of natural rubber in India. The study found the domestic price; export quantity and stock had positive and significant relation with the natural rubber production. However, the import of natural rubber showed negative and non-significant relation with the production of natural rubber. Regarding the export of natural rubber, except production all the other variables such as world market price, stock, domestic price and world population have shown significant effect on export of natural rubber from India.

Adhikari *et al* (2016) studied the determinants of rice export from India. The researcher found that export price had shown negative and significant (-2.00) relation with export quantity of rice from India. However, international market price had positive and significant effect (1.2) on Indian rice export. Apart from this, domestic consumption had shown negative value, whereas, exchange rate and lagged production had shown positive values. But the results were non-significant representing that these variables did not play any major role in the determination of Indian rice exports.

Yanita *et al* (2016) analysed the factors determining rubber exports in Indonesia. The results revealed that production, crumb rubber price, crumb rubber export quantity in Malaysia and crumb rubber export quantity in lag time have found positive correlation with crumb rubber exports in Indonesia. But exchange rate and crumb rubber export quantity in Thailand had shown negative association with Indonesian rubber exports. The results also revealed that crumb rubber export played a substantial role in foreign exchange earnings in Indonesia. But still, major alterations in the export earnings of Indonesian crumb rubber have raised concern about the country's future growth potential and self-sustainability. Hence, long term strategies need to be devised to raise the products quality through adoption of advanced technology and encouragement of foreign direct investment in moderately high-tech industries.

2.4 Comparative advantage of Indian spices exports

Shinoj P and Mathur V C (2008) examined the changes in comparative advantage of India in agricultural exports vis-à-vis other Asian countries during post-reforms period (1991-

2004). The present study used revealed comparative advantage (RCA) index and systematic revealed comparative advantage (RSCA) index to determine the comparative advantage. The results revealed that India has been able to maintain its competitive status in cashew and oil meals. But in other commodities like tea, spices, coffee etc., India has faced stiff competition and losing its comparative advantage to other exporting countries in Asia after economic reforms period.

Boansi D (2014) conducted a study to compare the export performance of seven agricultural commodities prior to, during and after initiation of the Agricultural Diversification project (1991-1999) in Ghana. The impact of the project on agricultural exports in Ghana was studied in detailed manner. The time frame covered under the study was 1987 to 2011 with aggregate agricultural export values of the world as a reference group. The study uses CEP index, SCEP index, Log CEP index and the commodities were classified into highly competitive, competitive, weakly competitive and uncompetitive. The study found that cocoa and pineapples were registered as the highly competitive commodities among all the seven agricultural commodities export from Ghana. Besides this, rubber was also witnessed major improvement in export competitiveness, next to cocoa and pineapple. The researcher also found that the growth observed is possibly due to the improvement in fewer subsectors. Hence. Efforts are needed in the direction of increasing growth and involvement of stakeholders in all the promotion activities to enhance exports from the country.

Rao and Ankalam (2018) analysed the comparative export performance and revealed comparative advantage of paddy with reference to India during 1995-2014. Developing countries like India, China, Brazil and Turkey compete with developed countries like USA and Australia for exports. United States of America registered as the largest exporter of rice in the last five years, contributing one third of global rice trade. However, rice exports from United States of America has declined from 41 per cent in 2004 to 25.66 per cent in 2013. India has a weak comparative advantage in rice exports against Pakistan and great comparative advantage against Thailand to Saudi Arabia. Besides this, India has comparative advantage in Iran rice market over Thailand and Pakistan during the study period. However, Thailand has great advantage in Nigerian market over India and Pakistan. The study also found that India, Pakistan and Thailand are in comparative disadvantage position in the world market, which was reflected in the values of log CEP indices. However, Pakistan gained commendable advantage in rice trade among the competing countries during the study period.

It is understood from the above literature that most of the researchers had investigated different aspects of growth rate in area, production, yield and export of various crops by computing the compound growth rate using exponential growth function. An increase of growth rate in area, production, yield and export was observed in almost all the crops that are reviewed earlier. Pertains to instability, coefficient of variation, Coppock's instability index

and Cuddy-Della Valle index were used by the researchers in order to calculate instability indices. The instability of the variables varied from state to state and crop to crop. Regarding direction of trade, almost all the researchers employed Markov chain analysis and the export destinations of various crops have been shifted as indicated by the transitional probability matrix. With reference to determinants of export, multiple regression analysis was used by many researchers. From the past studies, the major factors influenced the export of agricultural commodities are domestic price, export price, lagged production, domestic consumption and exchange rate. In case of comparative advantage, revealed comparative advantage (RCA) index and comparative export performance (CEP) index was mostly employed by the researchers. Exponential growth function, Cuddy-Della Valle index, Markov chain analysis, power regression model, RCA and CEP are employed to accomplish the objectives of the present study.

CHAPTER III

MATERIALS AND METHODS

A good systematic design is mandatory for any researcher to meticulously plan the research work to solve a particular research problem. In this chapter, a detailed information about the study area, data base and different analytical tools and techniques employed to accomplish the various objectives of the study were studied and were presented under the following sub headings:

3.1 Description of the study area

3.2 Data base

3.3 Analysis of data

3.1 Description of the study area

The present study was carried out at the state level and the country as a whole. The major spices considered for the analysis were based on the coverage of 80 per cent of export value of total Indian spices during recent years, which include chilli, pepper, cumin, turmeric, coriander and processed products like mint products and spice oils and oleoresins. The major states which covered 70 per cent of production of respective spice during recent years were selected for the analysis. The domestic market selected for pepper and turmeric was Cochin market. Similarly, Mumbai market was selected for cumin and coriander and Guntur market was selected for chilli for analysis. Time frame considered for the analysis was 1995-96 to 2016-17. The total study period was further divided into two periods based on National Horticulture Mission (NHM) which started in May 2005 viz., pre-NHM period (1995-96 to 2005-06) and post-NHM period (2006-07 to 2016-17). The main purpose of classifying the total study period into two periods was to examine the impact of National Horticulture Mission on Indian spice industry.

3.2 Data base

Time series data on area, production and yield of chilli, pepper, cumin, coriander and turmeric was collected from 1995-96 to 2016-17. Besides this, direction of trade of spices export and determinants of spice export from India were also systematically studied with the use of data from 1995-96 to 2016-17. The data pertaining to the present study was retrieved mainly from the publications of Spice Board of India. Data regarding domestic prices, export, import and international prices of spices, the exchange rates between Indian rupee and US dollar, total agricultural exports and total exports for different countries and the world was collected and compiled from secondary sources such as Spice Board of India, comtrade.un.org, faostat.com and unctadstat.org.

3.3 Analysis of data

The data collected for the present study was analysed by employing suitable tools to accomplish the various objectives of the study and were elaborated under the following sub headings.

3.3.1 Compound Growth Rate

3.3.2 Instability analysis

3.3.3 Markov chain analysis

3.3.4 Multiple Regression Analysis

3.3.5 Revealed Comparative Advantage

3.3.6 Comparative Export Performance

3.3.1 Compound Growth Rate

The linear, exponential, log-linear and linear-log functions are some of the important functional forms which were tried in this study to analyse the growth rates. Among all the functional forms, exponential growth model was accepted as it gave the best results because of its suitability in real situations. Hence, the compound growth rates in area, production, yield and export of chilli, pepper, cumin, turmeric and coriander were computed by fitting exponential function of the form,

$$Y_t = ab^t e^u$$

Log transformation of the above function is

$$\ln Y_t = \ln a + t (\ln b) + u$$

$$\ln b = \ln (1+r)$$

$$b = 1+r$$

$$r = b - 1$$

$$r = [\text{Antilog} (\ln b) - 1]$$

The compound growth rates were calculated by using the formula

$$\text{CGR (\%)} = r \times 100$$

Where,

Y_t = area/production/yield/export of major spices for the year 't'

t = Time variable

a = Constant

$\ln b$ = Regression coefficient of time

u = Error term

r = CGR

The significance of these compound growth rates was tested at 1 per cent, 5 per cent and 10 per cent level of significance by using student's t-test. If the calculated value of 't' was greater than table value of 't' then the growth rate was significant and vice versa.

3.3.2 Instability analysis

Several techniques are available to measure the instability index. Some of the techniques followed by the researchers are Coppock's instability index (1962), Massel's instability index (1970), Cuddy-Della Valle index (1978), Webs and Sievers index (1985) and Singh and Byerlee index (1990). For calculating instability, Co-efficient of Variation (CV) can be used. But, CV does not describe exactly how the trend value inherit in the time series data. Hence, Cuddy-Della Valle (1978) suggested an instability index, which explains clearly the trend value inherited in the time series data. The present study utilizes Cuddy-Della Valle index owing to its usage in recent years by many researchers as a better measure of variability in time series data.

$$\text{Instability Index (II)} = \text{CV} \times (1 - \bar{R}^2)^{0.5}$$

$$\text{CV} = (\text{Standard deviation} / \text{Mean}) \times 100$$

Where,

CV = Coefficient of Variation

\bar{R}^2 = Co-efficient of multiple determination adjusted from trend value

3.3.3 Markov Chain Analysis

Export data from 1995-96 to 2016-17 was used to examine the direction of trade and changing pattern of Indian spices exports with the use of first order Markov chain analysis. The top six major destinations in each spice was selected for the analysis. The transitional probability matrix (P) estimation is Central to Markov chain analysis. The elements P_{uv} of the matrix P represents the probability that export will switch from u^{th} country to v^{th} country with the passage of time. In the transitional probability matrix, diagonal elements represent the probability of retention of trade. The row elements represent the probability of loss of trade to other competing countries and the column elements represent the probability of gain in trade from other competing destinations.

$$E_{vt} = \sum_{i=1}^r E_{ut-1} * P_{uv} + e_{vt}$$

Where,

E_{vt} = Exports from India to v^{th} country in the year t.

E_{ut-1} = Exports to u^{th} country in the period t-1

P_{uv} = Probability that the exports will switch from u^{th} country to v^{th} country

e_{vt} = Error term which is statistically independent to E_{ut-1}

t = Number of years selected for analysis

r = Number of importing destinations

The transitional probabilities P_{uv} which can be arranged in a (c * r) matrix, have the following properties.

$$0 < P_{uv} < 1$$

$$\sum P_{uv} = 1, \text{ for all } u$$

Hence, the expected export shares of each country in the period 't' were secured by multiplying the export to these destinations in the previous period (t-1) with the values of transitional probability matrix. Several techniques are used to approximate the transitional probabilities of the Markov chain model such as weighted restricted least squares, unweighted restricted least squares, Bayesian maximum likelihood, unrestricted least squares etc.,

Estimation of P_{uv}

In the present study, minimum absolute deviation (MAD) estimation procedure was used to estimate the transitional probability indices which minimises the sum of absolute deviations. The conventional linear programming technique was employed owing to the fulfillment of the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is expressed as

$$\text{Min } OM^* + Ie$$

Subject to,

$$XM^* + V = Y$$

$$GM^* = 1$$

$$M^* > 0$$

Where,

O = The vector of zeros

M^* = The vector in which probability P_{uv} are arranged

I = An appropriately dimensioned identity matrix

e = A vector of absolute errors $\|V\|$

Y = The vector of exports to each country

X = The block diagonal matrix of lagged values of Y

V = The vector of errors

G = The grouping matrix to add the row elements of P arranged in P^* to unity

3.3.4 Multiple Regression analysis

In statistical modelling, regression analysis is a set of statistical processes for estimating the relationships among variables. The regression analysis also depicts the changes in the dependent variable when any one of the independent variables is varied ceteris paribus. In order to determine the factors affecting export of major spices from India, multiple regression analysis was accomplished with the use of Ordinary Least Squares (OLS) estimation procedure. Cobb-Douglas form was used in the present study owing to its best fit for the data.

3.3.4.1 Theoretical framework

The present study takes into account quantitative analysis of the variables by adopting the method of Ordinary Least squares (OLS). In the present econometric model, export

quantity of respective spice was taken as dependent variable and domestic market price, export price, lagged production, world export quantity and exchange rate were taken as independent variables.

Spice export = f (Domestic market price, export price, lagged production, world export quantity and exchange rate)

3.3.4.2 Estimation procedure

The present econometric model was estimated with the use of OLS method of estimation using statistical software named as Statistical Package for the Social Sciences (SPSS).

3.3.4.3 Model specification procedure

The determinants of spice exports from India were identified using Cobb-Douglas production function, as used by Shende and Bhole (1999) and Kumar (2004), which is specified as follows:

$$Y = b_0 (\text{WEQ})^{b_1} (\text{LGP})^{b_2} (\text{DMC})^{b_3} (\text{DMP})^{b_4} (\text{EP})^{b_5} (\text{EXC})^{b_6} U_i$$

Taking Ln on both the sides,

$$\text{Ln}Y = b_0 + b_1 \text{LnLGP} + b_2 \text{LnDMC} + b_3 \text{LnDMP} + b_4 \text{LnEP} + b_5 \text{LnEXC} + \mu$$

Where,

Y: Export quantity of chilli, cumin, pepper, turmeric and coriander (MT)

WEQ: World export quantity of chilli, cumin, pepper, turmeric and coriander (MT)

LGP: Lagged production of spice (MT) in India

DMC: Domestic consumption of a particular spice (MT)

DMP: Domestic price of a particular spice in respective market (Rs. /tonne)

EP: Export price of a particular spice (Rs. /tonne)

EXC: Exchange rate of Indian rupee with dollar (Rs. /\$)

μ : Error term and b_1 , b_2 , b_3 and b_4 are the regression coefficients; b_0 is constant

The spices exports were also determined largely by the policies of the government. The unavailability of secondary data on the impact of government policies on Indian spices export in the secondary sources forced to leave this qualitative variable while governing the determinants of spices export from India.

3.3.4.4 Theoretical expectation and justification of the variables involved in the model

Lagged production

The lagged production means the production of a crop in the previous year. The current year exports of any crop has been determined by the production of a crop in the previous year. The increase in production of a crop in the previous year can increase the current year exports of that particular crop. Thus, lagged production has a positive impact on export of crop in the current year. This hypothesis was in conjunction with the findings of Adhikari *et al* (2016).

World export quantity

If the increase in international exports was due to the increase in export quantity of other major exporting countries then it has negative impact on Indian exports. In contrast, the improvement in international exports was due to the increase in exports from India then international export quantity has positive impact on Indian exports. Kumar and Rai (2007) found that demand for Indian tomato increases with increase in the international trade in tomatoes. The same trend was also observed in cucumber and gherkin products export by the aforementioned researchers in 2008.

Domestic consumption

Domestic consumption can be used synonymous with domestic demand of spices. A raise in domestic demand increases the domestic price of spices to a large extent. This increase in the domestic demand leads to a decline in exports from the country. Therefore, a negative association is expected between domestic consumption and export quantity. This hypothesis was conjunction with the findings of Abolagaba *et al*, 2010 and Adhikarai *et al* (2016). The data on domestic consumption of spices is not available from the secondary sources. Therefore, it was computed as follows:

$$\text{Domestic consumption} = \text{Production} + \text{Import} - \text{Export}$$

Export price

Increase in export price of a commodity will lead to a decrease in the export competitiveness of a country with respect to other competing nations. Hence, a negative impact of export price is assumed on spices exports from India. This apriori expectation is in line with the findings of Abolagba *et al* (2010) in cocoa and Adhikari (2016) in rice. Nevertheless, Kannan (2013) has found positive and significant effect of export price on export of natural rubber from India. Other findings like Abolagba *et al* (2010) in rubber and Kumar *et al* (2013) in cucumber and gherkin have found positive and non-significant values specifying that export price has not played any key role in determining export quantity of these crops.

Domestic market price

The increase in domestic market price (wholesale price) of any crop can increase the export to a larger extent. Therefore, a positive relationship is expected between domestic market price and export quantity of a crop. In the empirical literature, Abolagba *et al* (2010) has found positive and significant influence of domestic price on rubber exports. However, Kannan (2013) has found negative relation between domestic price and exports of rubber. But the results of the present study were significant at 10 per cent level indicating that domestic price has played a minor role in determining exports of rubber.

Exchange rate

Devaluation of currency makes the exports of a country cheaper than earlier. Conversely, the exports of spices from India increases with the increase in exchange rate of Indian rupee with US dollar. Therefore, exchange rate has a positive impact on export of spices from India. This theoretical expectation is in accordance with the findings of Kumar *et al* (2008). Nonetheless, negative relation was found between exchange rate and export quantity in the findings of Kumar and Rai (2007) in tomato and Abolagba *et al* (2013) in cocoa. But the results of the present study were found to be non-significant indicating that export quantity of a spice remains same irrespective of the level of changes in exchange rate.

3.3.5 Revealed Comparative Advantage (RCA)

In this study, two indices have been used namely revealed comparative advantage (RCA) and comparative export performance (CEP). Revealed Comparative Advantage was used to evaluate the comparative advantage on the basis of a country's specialization in exports relative to some reference group countries and was estimated by using the formula

$$RCA = \text{Ln} \left[\frac{X_{iR}/X_R}{X_{iS}/X_S} \right]$$

Where,

X_{iR} : India's exports of good i to Asian market

X_R : India's total merchandise export to Asian market

X_{iS} : The rival country's exports of good i to Asian market

X_S : The rival country's total merchandise export to Asian market

A positive value of RCA is an indication of India's comparative advantage against the rival country. In contrast, the negative value of RCA represents the rival country's comparative advantage against India in that particular commodity exports in the Asian market.

3.3.6 Comparative Export Performance (CEP)

The strength of competition can be measured using different indices. Among them, Balassa Comparative Export Performance (CEP) index is the most commonly used index. CEP index measures the export specialization of a country with respect to the world exports.

$$CEP = \text{Ln} \left[\frac{X_{iZ}/X_Z}{X_{iW}/X_W} \right]$$

Where,

X_{iZ} : Country Z 's exports of goods i

X_Z : Country Z 's total agricultural exports

X_{iW} : Total world exports of goods i

X_W : Total world agricultural exports

An index value of India higher than the index value of any other country indicates relative comparative advantage of India against that country.

CHAPTER IV

RESULTS AND DISCUSSION

In order to meet the objectives of the study, the data was collected from different sources and were critically analysed by employing suitable techniques. The results of the study were presented under the following sections.

- 4.1 Growth in area, production and yield of major spices
- 4.2 Instability in area, production and yield of major spices
- 4.3 Growth and Instability in export of major spices
- 4.4 Direction of trade of spice export from India
- 4.5 Factors influencing export of major spices
- 4.6 Measures to promote Indian spices exports

4.1 Growth in area, production and yield of major spices

This section comprises of the analysis on area, production and yield of major spices across the major producing states of India during 1995-96 to 2016-17. The major spices considered for the analysis include chilli, pepper, cumin, coriander, turmeric, mint products and spice oils and oleoresins, which constitute 80 per cent of export value of total spices. The states which covered 70 per cent of the production of respective spices were taken into consideration for the analysis. Based on the National Horticulture Mission, the study period has divided into three groups namely pre-NHM (1995-96 to 2005-06), post-NHM (2006-07 to 2016-17) and overall period (1995-96 to 2016-17). In order to find out the growth in area, production and yield of major spices, triennium ending values were taken and compound growth rates were calculated for the study period and were presented for each spice.

4.1.1 Chilli

The growth in area, production and yield in four major producing states of chilli i.e., Andhra Pradesh, Madhya Pradesh, West Bengal and Karnataka, which accounts for more than 70 per cent production of the country has been presented in the table 4.1.1. Chhattisgarh and Telangana were carved out of Madhya Pradesh and Andhra Pradesh in the years 2000 and 2014 respectively. Hence, the area, production and yield figures of Madhya Pradesh and Andhra Pradesh include Chhattisgarh and Telangana respectively. At present, chilli occupied 8.93 lakh ha of area in the country, with impressive productivity growth from 980 kg/ha to 2079 kg/ha during TE 1997-98 to TE 2016-17, which occurred at the rate of 3.83 per cent per annum. Andhra Pradesh accounted for maximum area under chilli cultivation (2.57 lakh ha), followed by Karnataka (0.95 lakh ha) and Madhya Pradesh (0.81 lakh ha) during TE 2016-17. During the span of 22 years, a dramatic increase in area from 0.44 lakh ha to 0.81 lakh ha was observed in Madhya Pradesh, which is mainly due to the raising demand in the state as well as in the International market. In addition to this, Madhya Pradesh recorded highest

significant growth rate in area (2.59%), whereas negative and significant growth rate was observed in Karnataka. The declined growth rate in chilli area of Karnataka was mainly due to lower productivity because of unfavourable climatic conditions. The results of the study were in par with the findings of Devi and Jadav (2018), who found that the decrease in spices area was mainly due to the diversification of agricultural field crops. In case of production, Andhra Pradesh equipped highest contribution (10.19 lakh tonnes), followed by Madhya Pradesh (1.37 lakh tonnes) and Karnataka (1.11 lakh tones) during TE 2016-17. Highest production in Andhra Pradesh during TE 1997-98 to TE 2016-17 was mainly due to highest productivity and also reasonable prices compared to other crops which prevailed in the domestic markets of the state. But Madhya Pradesh registered highest growth rate in production (12.24%), followed by West Bengal (4.4%) and Andhra Pradesh (3.26%) during the overall period. It was mainly due to the fact that huge yield gap exists between potential and actual yield in Madhya Pradesh, while Andhra Pradesh has nearly reached the potential yield level and in turn has an effect on production of the state. Average yield of chilli in the country has become doubled i.e., from 980 kg/ha to 2079 kg/ha during TE 1997-2017. Highest yield was recorded in Andhra Pradesh during all the periods. But pertaining to growth rate, Madhya Pradesh recorded highest growth rate in yield during all the periods. During the overall period, all the states showed positive and significant growth rate in chilli yield.

4.1.2 Pepper

The major pepper growers of the country are Karnataka, Kerala and Tamil Nadu, which accounts for more than 70 per cent of area and production (Table 4.1.2). Total area under pepper cultivation was 1.30 lakh ha in the country and Kerala accounted for highest contribution in area i.e., 0.85 lakh ha, followed by Karnataka (0.33 lakh ha) and Tamil Nadu (0.04 lakh ha). But Karnataka recorded a dramatic increase in area from 0.036 lakh ha to 0.33 lakh ha during 1997-2017. Growth rate in area was highest and significant in Karnataka (11.68%), whereas negative and significant in Kerala (-4%) during the overall period. These results were in line with the findings of Soumya *et al.* (2014). The negative growth rate in Kerala was mainly due to shifting of area to other crops like coffee, coconut, rubber and tea. Growth rate in area was more in pre-NHM period compared to post-NHM period in all the major states as well as at the national level owing to its shift from pepper area to other commercial crops and more incidence of phytophthora foot rot and other pest attacks mainly in the highest pepper growing state i.e. Kerala. Similar conclusions were also drawn by Jayesh (2001), Soumya *et al* (2014) and Joshi and Singh (2015). Pertaining to production, Kerala holds largest share (30.39 thousand tonnes), followed by Karnataka (23.29 thousand tonnes) and Tamil Nadu (1.26 thousand tonnes) during TE 2016-17. But the production increased rapidly in Karnataka from 900 tonnes in TE1997-98 to 23297 tonnes in TE 2016-17. A noteworthy point is that the production in Kerala decreased from 56.4 thousand tonnes

to 30.39 thousand tonnes during TE 1997-2017 owing to the reduction in area and also stagnated yield over the decades. The results were in agreement with the findings of Soumya *et al* (2014). Besides this, growth rate in production was highest in Karnataka and negative and non-significant in Kerala during both pre-NHM and post-NHM periods. Tamil Nadu showed positive and significant growth during pre-NHM period and negative growth rate during post-NHM period. This was mainly due to price fluctuations, pest attacks and large production costs of pepper in the state. On looking at the yield, Karnataka showed superiority with an average yield of 692 kg/ha, which is more than the national average (454 kg/ha) during the overall period. The increase in yield was mainly due to high yielding varieties and also suitability of soil for pepper in this region of the country. In addition to this, growth rate in yield was highest and significant in Karnataka (4.24%), followed by Tamil Nadu (2.79%) during the overall period. However, Kerala registered negative growth rate in yield (-3.65%) during pre-NHM period, which improved during post-NHM period (8.15%).

Table 4.1.1: Growth in area, production and yield of chilli in major producing states of India, 1995-96 to 2016-17

States	Variables	Average (Triennium Ending)			Compound Growth Rate		
		1997-98	2007-08	2016-17	Pre-NHM	Post-NHM	Overall Period
Andhra Pradesh	Area	2.14	2.03	2.57	-0.30	2.25	0.10
	Production	388.80	692.00	1019.64	5.72**	1.20	3.26**
	Yield	1833.65	3389.74	4022.18	6.04***	-1.03	3.15***
Madhya Pradesh	Area	0.44	0.50	0.81	1.45	5.86***	2.59***
	Production	18.37	42.33	137.88	10.43***	12.16***	12.24***
	Yield	409.89	849.94	1702.72	8.85***	5.96**	9.41***
West Bengal	Area	0.61	0.56	0.66	-1.24*	1.52**	0.40
	Production	51.70	72.67	103.45	2.57***	3.01**	4.40***
	Yield	854.13	1295.77	1561.53	3.86***	1.47**	3.98***
Karnataka	Area	1.81	1.13	0.96	-9.94***	-4.22***	-3.15***
	Production	120.27	132.50	111.96	-2.26	-3.80***	-0.65
	Yield	670.74	1203.72	1177.78	8.53***	0.44	2.58***
India	Area	8.94	7.41	8.01	-2.72***	0.28	-0.75**
	Production	875.10	1184.87	1665.80	2.63**	2.92***	3.05***
	Yield	979.95	1596.52	2078.90	5.50***	2.64***	3.83***

(Note: Area in lakh hectares, Production in Thousand Metric Tonnes, Yield in Kg/ha and CGR in per cent per annum and *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

Fig 1: Trends in area, production and yield of chilli in India, 1995-96 to 2016-17

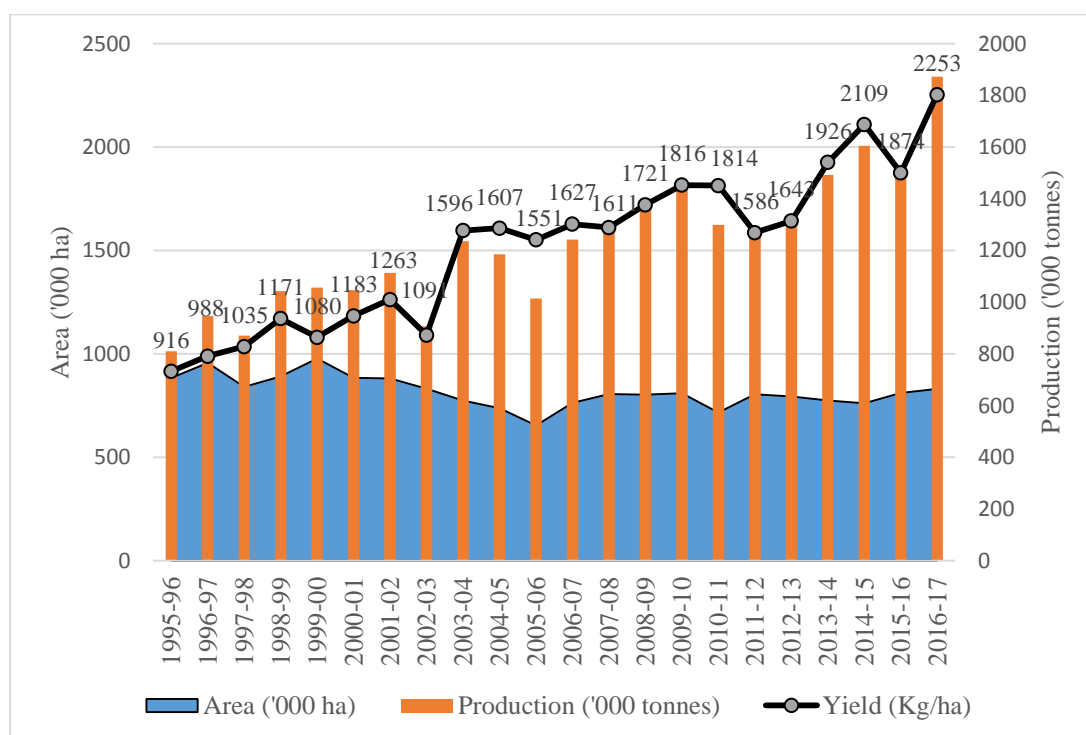


Fig 2: State wise trend in chilli production in India ('000MT)

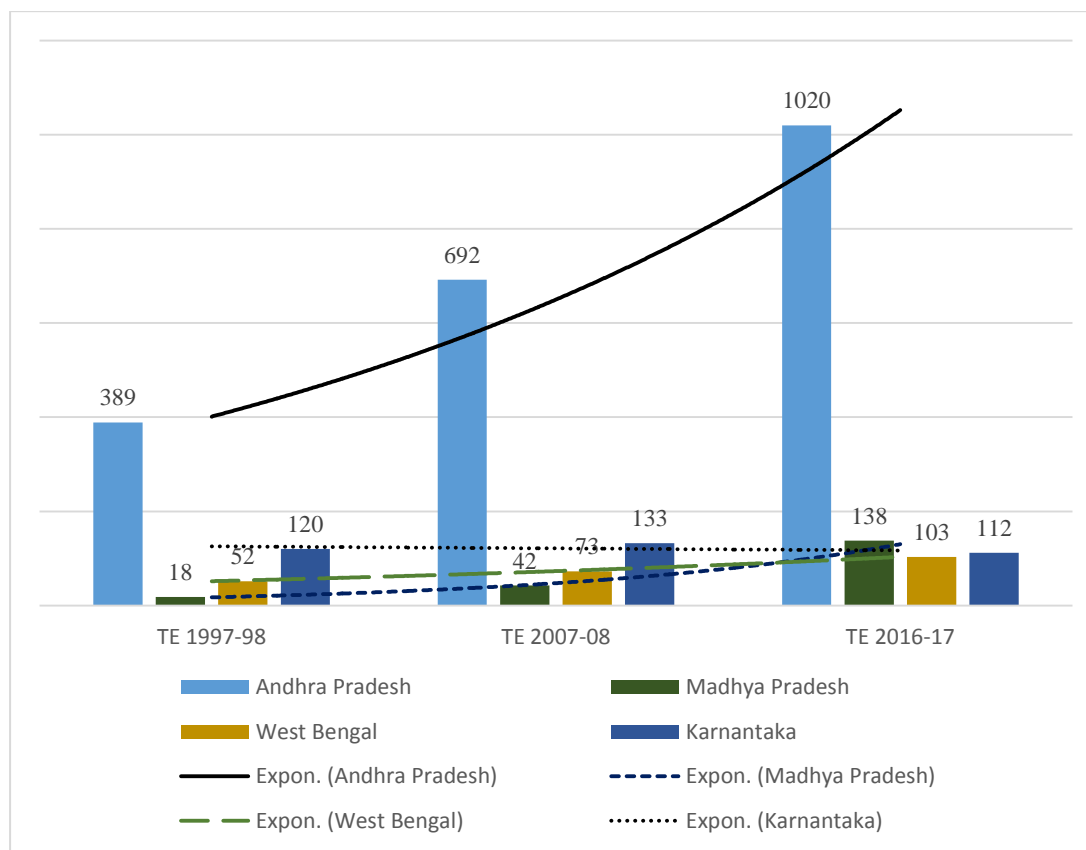


Fig 3: Trends in area, production and yield of pepper in India, 1995-96 to 2016-17

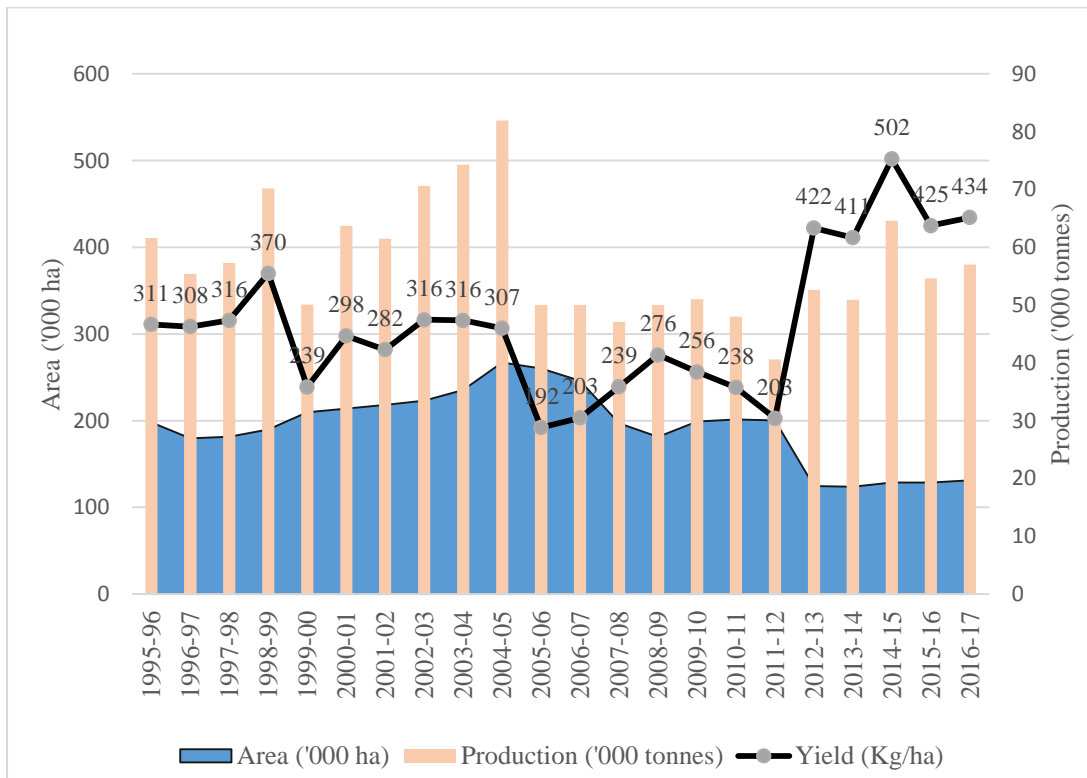


Fig 4: State wise trend in pepper production in India ('000 MT)

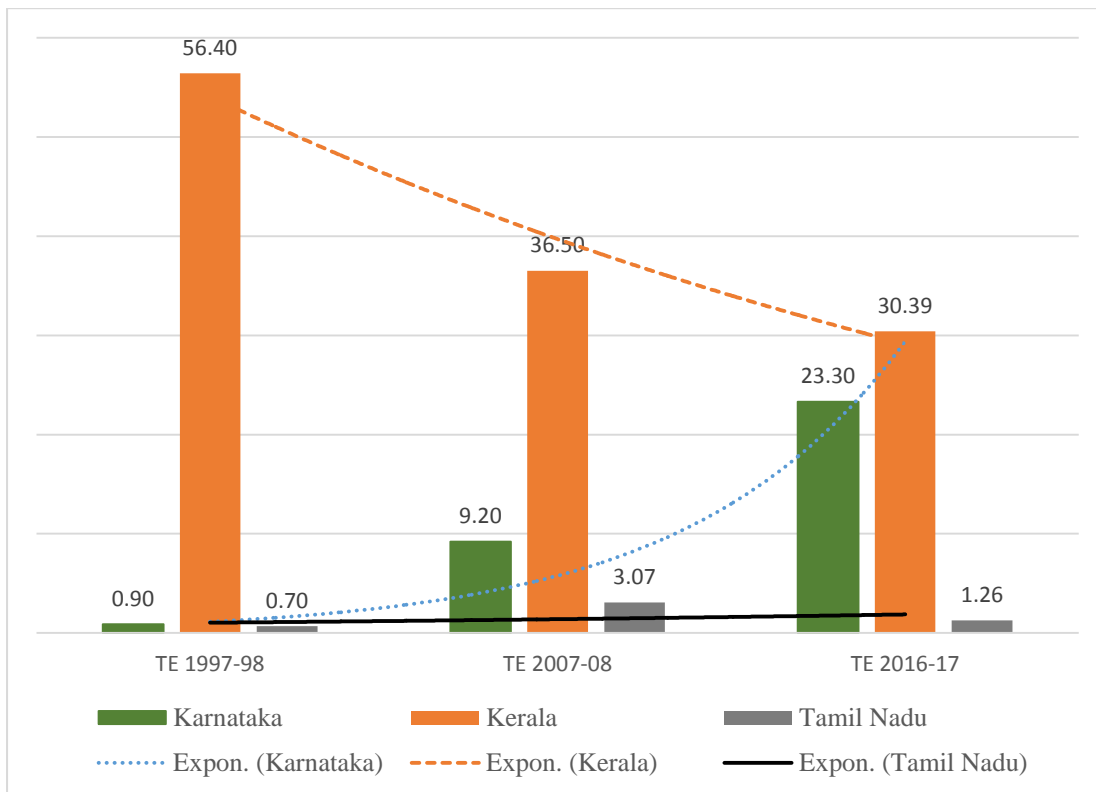


Table 4.1.2: Growth in area, production and yield of pepper in major producing states of India, 1995-96 to 2016-17

States	Variables	Average (Triennium Ending)			Compound Growth Rate		
		1997-98	2007-08	2016-17	Pre-NHM	Post-NHM	Overall period
Karnataka	Area	0.04	0.15	0.33	20.65 ^{***}	9.58 ^{***}	11.68 ^{***}
	Production	0.90	9.20	23.30	27.17 ^{***}	14.85 ^{**}	16.41 ^{***}
	Yield	247.99	630.98	691.93	5.40	4.80	4.24 ^{**}
Kerala	Area	1.79	2.13	0.85	3.08 ^{***}	-10.06 ^{***}	-4.00 ^{***}
	Production	56.40	36.50	30.39	-0.68	-2.72	-4.06 ^{***}
	Yield	314.93	176.73	357.01	-3.65	8.15 [*]	-0.07
Tamil Nadu	Area	0.03	0.04	0.04	4.84 ^{***}	3.17 ^{**}	0.72
	Production	0.70	3.07	1.26	11.99 ^{**}	-3.53	3.52
	Yield	218.01	724.09	313.90	6.82	-6.49	2.79
India	Area	1.86	2.34	1.30	3.79 ^{***}	-6.43 ^{***}	-2.15 ^{***}
	Production	58.10	49.03	58.75	1.39	1.93 [*]	-0.96
	Yield	311.76	211.50	453.74	-2.32	8.93 ^{***}	1.21

(Note: Area in lakh hectares, Production in Thousand Metric Tonnes, Yield in Kg/ha and CGR in per cent per annum and *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

4.1.3 Turmeric

The growth in area, production and productivity in major producing states of turmeric has been presented in the Table 4.1.3. Major producing states like Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka and Gujarat which covered more than 70 per cent of total production were selected for the study. Currently, turmeric occupied 1.87 lakh hectares of area in the country, contributed by Andhra Pradesh (0.62 lakh hectares), Tamil Nadu (0.32 lakh hectares), Karnataka (0.14 lakh hectares), Maharashtra (0.11 lakh hectares) and Gujarat (0.036 lakh hectares) during TE 2016-17. Positive growth rate in area was observed in all the major growing states of the country, which were in line with the findings of Krishnadas (2010). Gujarat recorded highest growth rate in area (12.85%), followed by Karnataka (6.82%) and Tamil Nadu (4.6%). Highest growth rate in area of Gujarat was mainly due to the increased yield on account of high potential yield level of that particular growing region in the state. Maharashtra showed negative growth rate in area (-0.89%) during pre-NHM period, which improved (5.77%) after National Horticulture Mission, making the overall period to be positive and significant (2.46%). Andhra Pradesh has shown decline in growth rate in area from 2.28 per cent to 0.04 per cent on comparing pre-NHM and post-NHM periods. This situation prevailed in Andhra Pradesh because of stagnated yields over the decades and also the state registered 5653.93 kg/ha which was less in comparison to Maharashtra (11082.13 kg/ha) and Gujarat (17255 kg/ha). But in the overall period, the growth rate in turmeric area was 0.89 per cent in Andhra Pradesh. Regarding production, largest share was contributed by Andhra Pradesh (3.51 lakh tonnes), Tamil Nadu (1.2 lakh tonnes) and Maharashtra (1.15 lakh tonnes) during TE 2016-17. Karnataka and Gujarat produced 0.72 lakh tonnes and 0.62 lakh tonnes respectively during the same period. Growth rate in production increased from pre-NHM period to post-NHM period in Maharashtra and Gujarat and rest of the states showed decline in growth rate. Moreover, Gujarat recorded highest growth rate in production (12.72%) during the overall period, followed by Maharashtra (9.39%) and Karnataka (7.48%). On looking at the productivity, Gujarat and Maharashtra recorded highest yield of 17254.63 kg/ha and 11082 kg/ha respectively during TE 2016-17, which was more than the national average of 5006 kg/ha. But still, the growth rate in yield was higher in Maharashtra (6.77%). The decline in growth rate in yield of Gujarat is due to the fact that it has nearly reached the potential yield and the gap between actual and potential yield is less. On comparing TE 1997-98 and TE 2007-08, Andhra Pradesh and Karnataka have shown increase in yield and Tamil Nadu has shown a decline in turmeric yield. At the all India level, the growth rate in yield has declined from 2.09 per cent to 1.28 per cent from pre-NHM period to post-NHM period.

Fig 5: Trends in area, production and yield of turmeric in India, 1995-96 to 2016-17

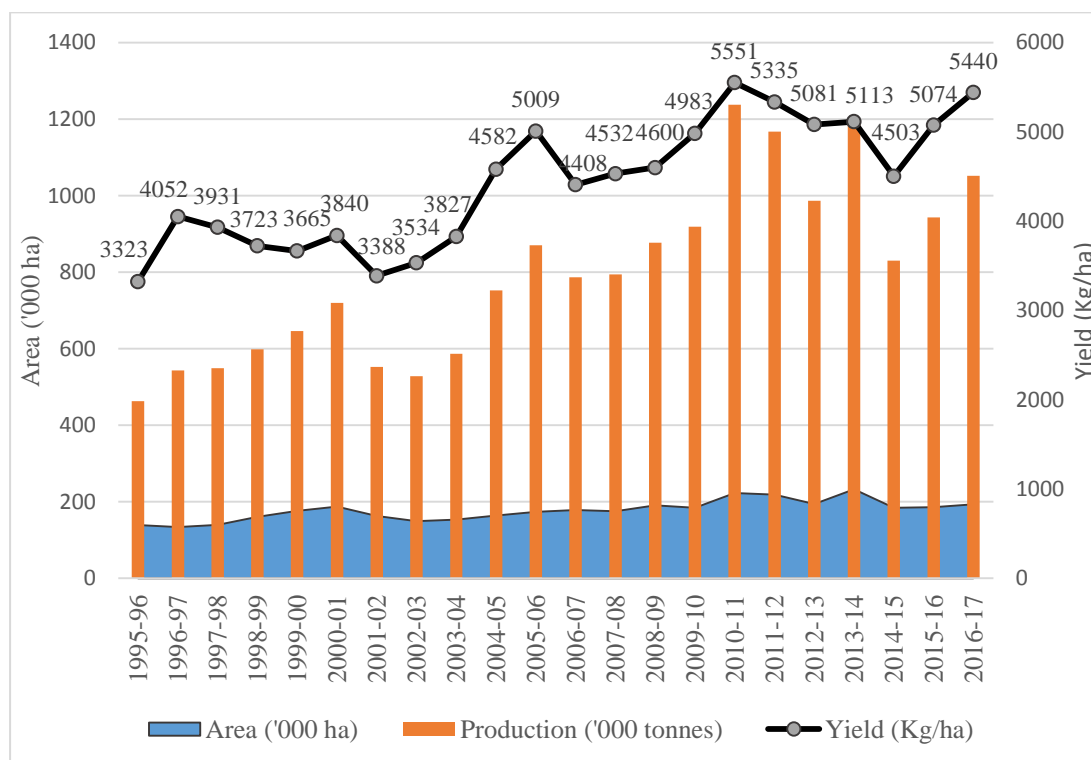


Fig 6: State wise trend in turmeric production in India ('000 MT)

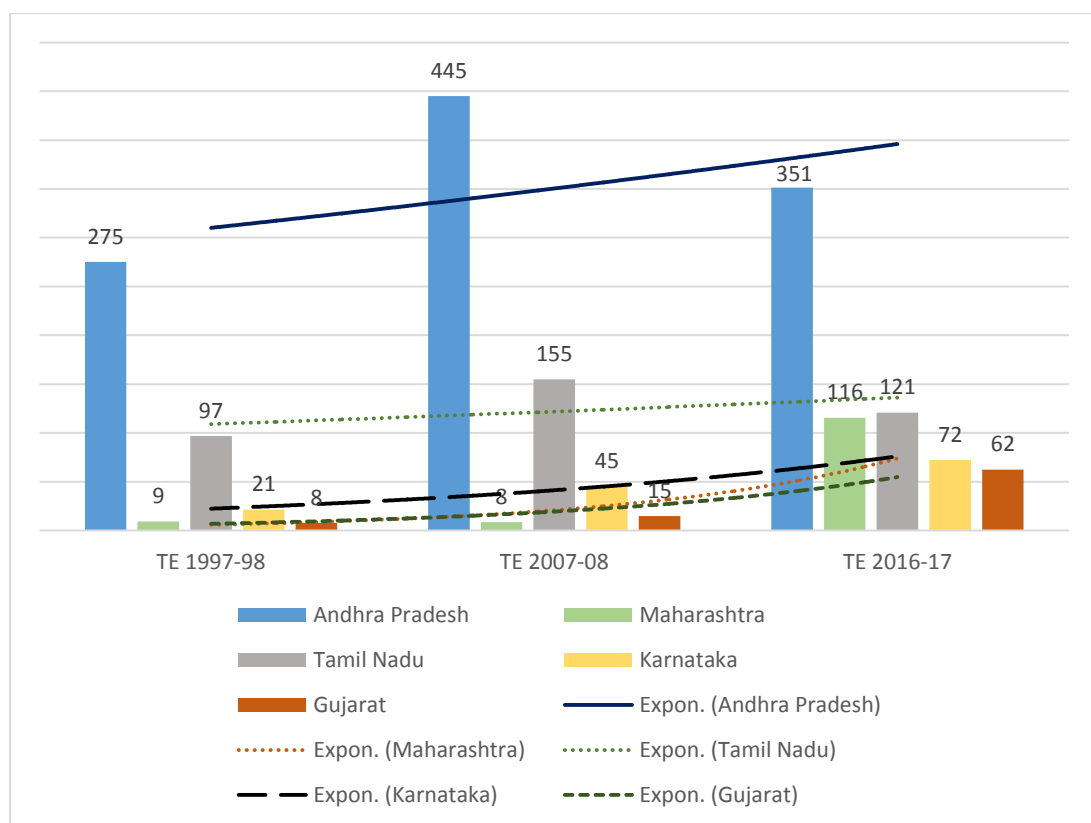


Table 4.1.3: Growth in area, production and yield of turmeric in major producing states of India, 1995-96 to 2016-17

States	Variables	Average (Triennium Ending)			Compound Growth Rate		
		1997-98	2007-08	2016-17	Pre-NHM	Post-NHM	Overall period
Andhra Pradesh	Area	0.51	0.66	0.62	2.28 [*]	0.04	0.89 ^{**}
	Production	275.10	445.20	351.34	4.72 ^{**}	-1.46	1.90 ^{**}
	Yield	5421.18	6726.99	5653.93	2.38	-1.50 ^{**}	1.00 [*]
Maharashtra	Area	0.07	0.07	0.11	-0.89 ^{***}	5.77 ^{**}	2.46 ^{***}
	Production	9.20	8.47	115.62	-1.14 ^{***}	30.11 ^{**}	9.39 ^{***}
	Yield	1266.11	1221.29	11082.13	-0.25 ^{***}	23.01 ^{**}	6.77 ^{**}
Tamil Nadu	Area	0.16	0.28	0.32	2.36	1.68	4.60 ^{***}
	Production	96.63	154.93	120.80	0.42	-1.92	3.61 ^{**}
	Yield	5912.54	5538.06	3774.67	-1.90	-3.54 ^{**}	-0.95 [*]
Karnataka	Area	0.04	0.07	0.14	7.32 ^{***}	3.81	6.82 ^{***}
	Production	21.30	45.47	72.29	9.13 ^{***}	2.89	7.48 ^{***}
	Yield	4890.19	5982.88	5278.45	1.69 [*]	-0.88	0.62
Gujarat	Area	0.005	0.01	0.04	12.43 ^{***}	15.13 ^{***}	12.85 ^{***}
	Production	7.80	14.90	62.28	9.74 ^{***}	18.25 ^{***}	12.72 ^{***}
	Yield	18111.11	13328.57	17254.63	-2.39	2.71 ^{**}	-0.11
India	Area	1.38	1.76	1.88	1.81 [*]	0.79	1.82 ^{***}
	Production	518.37	817.10	941.93	3.94 ^{**}	2.08	3.98 ^{***}
	Yield	3768.85	4649.57	5005.84	2.09 [*]	1.28 [*]	2.12 ^{***}

(Note: Area in lakh hectares, Production in Thousand Metric Tonnes, Yield in Kg/ha, CGR in per cent per annum and *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

4.1.4 Cumin

The growth in area, production and yield of cumin in major producing states of the country has been presented in the table 4.1.4. The major cultivators of cumin in India are Gujarat and Rajasthan, which accounts for more than 90 per cent of area and production. The perusal of the table showed that the total area under cumin cultivation is 8.19 lakh hectares during TE 2016-17, of which, Rajasthan contributed 4.75 lakh hectares (57.99% share) and Gujarat contributed 3.43 lakh hectares (41.88% share). The growth in area has tripled in two states as well as at the national level from TE 1997-98 to TE 2016-17. This magnificent increase was mainly due to the increased demand of cumin seeds in the national and international markets. Along with this, the suitability of the region i.e., agro-climatic conditions and increased yield led to increased area in both Gujarat and Rajasthan. The growth rate in area was more and significant in Gujarat (10.07%) compared to Rajasthan (5.39%) during pre-NHM period. But after NHM, the growth rate was more pronounced in Rajasthan (13.06%) compared to Gujarat (1.39%). Regarding production, India holds 4.91 lakh tonnes during TE 2016-17. Out of which, the largest share was occupied by Gujarat (3.16 lakh tonnes), followed by Rajasthan (1.73 lakh tonnes). Although the area of Rajasthan was higher than the Gujarat, the production was higher in Gujarat owing to its higher yield. As against this, the growth rate in production was highest in Rajasthan (20.55%), followed by Gujarat (6.29%) during post-NHM period. But during the overall period, the growth rate was highest in Gujarat (12.13%) compared to Rajasthan (6.28%). The yield of cumin at the national level was 602 kg/ha during TE 2016-17, which is nearly double that of the yield prevailed in TE 1997-98. The results revealed that, Gujarat holds highest yield (946 kg/ha) as against Rajasthan (363 kg/ha) during TE 2016-17. The common point regarding two states was that higher growth rate in yield was observed during post-NHM period over pre-NHM period. However, Gujarat has shown highest growth rate of 4.57 per cent in yield compared to Rajasthan (1.1%) during the overall period. The lesser growth rate in Rajasthan might be due to the incidence of pest attack (cumin wilt, blight and powdery mildew). The results were also supported by Farooqui *et al* (2005) and Soumya *et al* (2014).

Fig 7: Trends in area, production and yield of cumin in India, 1995-96 to 2016-17

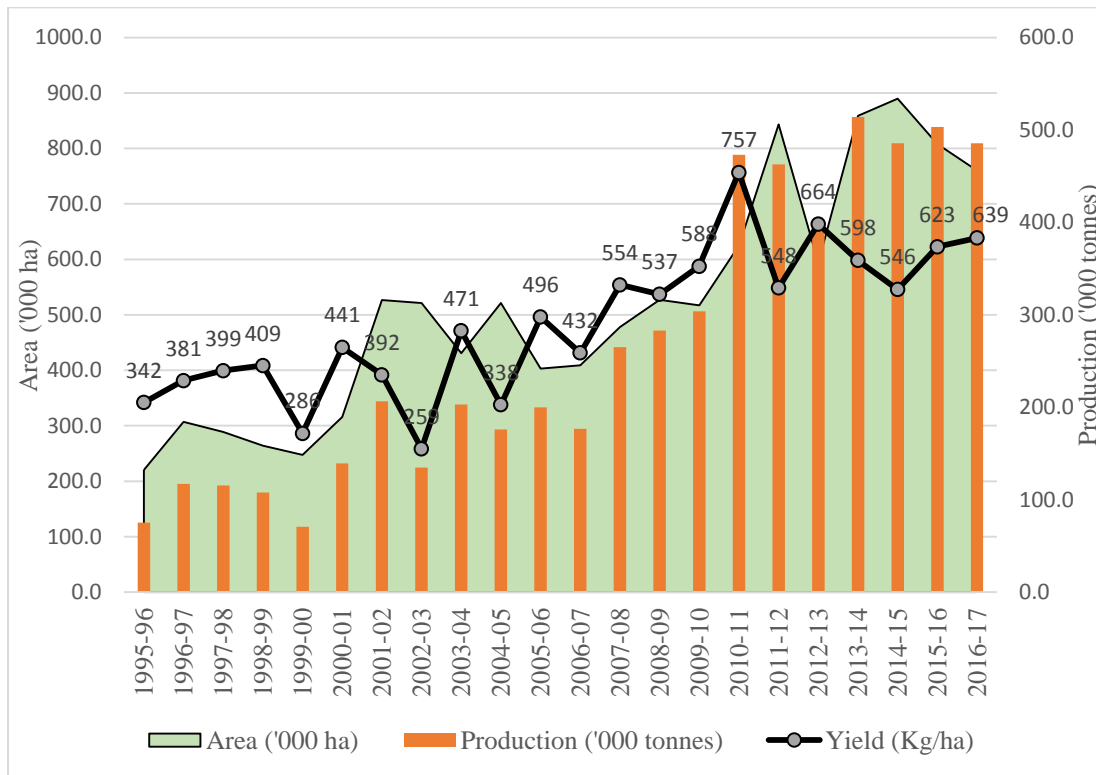


Fig 8: State wise trend in cumin production in India ('000 MT)

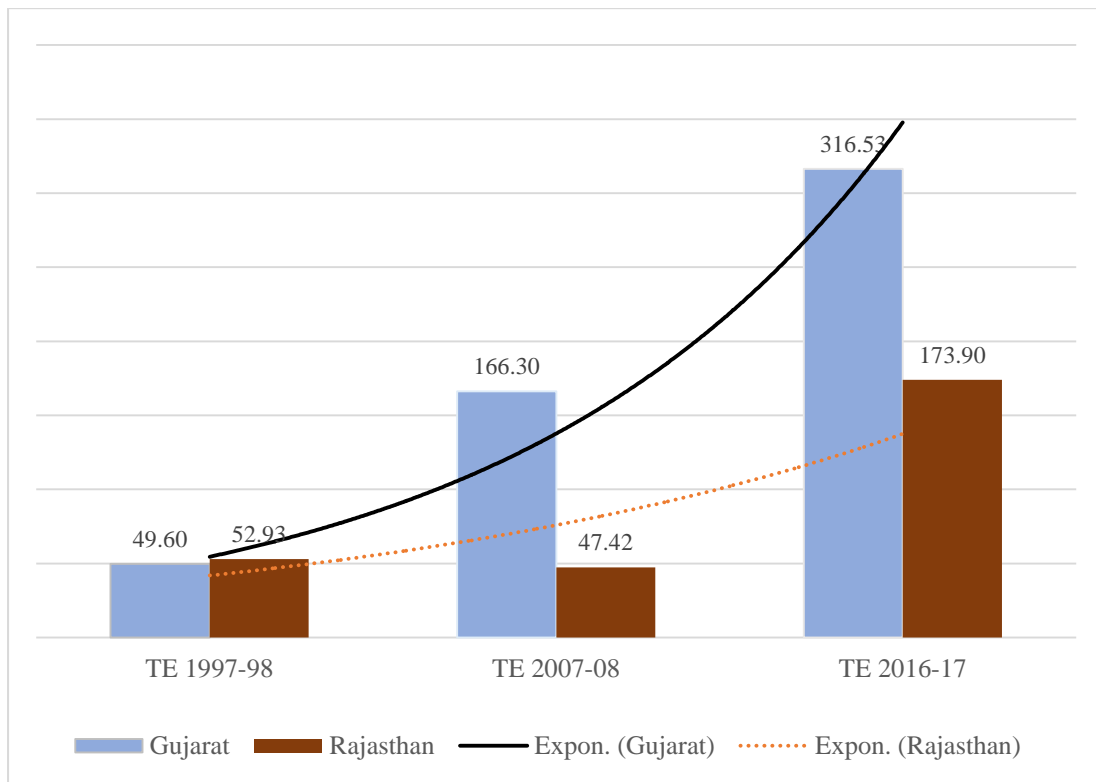


Table 4.1.4: Growth in area, production and yield of cumin in major producing states of India, 1995-96 to 2016-17

States	Variables	Average (Triennium Ending)			Compound Growth Rate		
		1997-98	2007-08	2016-17	Pre-NHM	Post-NHM	Overall period
Gujarat	Area	1.081	2.632	3.430	10.07***	1.95	7.23***
	Production	49.600	166.300	316.533	11.10***	6.29***	12.13***
	Yield	456	632	946	0.92	4.26***	4.57***
Rajasthan	Area	1.639	1.668	4.752	5.39	13.06***	5.12***
	Production	52.933	47.420	173.900	5.78	20.55***	6.28***
	Yield	319	284	363	0.37	6.62**	1.1
India	Area	2.720	4.300	8.193	7.99***	7.28***	6.15***
	Production	102.567	213.753	491.423	9.24***	9.63***	9.84***
	Yield	374	494	602	1.16	2.19	3.47***

(Note: Area in lakh hectares, Production in Thousand Metric Tonnes, Yield in Kg/ha, CGR in per cent per annum and *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

4.1.5 Coriander

Unlike cumin and pepper, all major growing states of coriander showed negative growth rate in area during pre-NHM period (Table 4.1.5). At present, coriander occupied 5.98 lakh hectares of area in the country, wherein Rajasthan contributed 2.25 lakh hectares, followed by Madhya Pradesh (1.72 lakh ha) and Andhra Pradesh (0.33 lakh ha). Andhra Pradesh registered a sharp decline in area from 1.03 lakh hectares to 0.33 lakh hectares during TE 1997-98 to TE 2016-17. This abrupt fall in Andhra Pradesh is due to shift of coriander area to alternative crops like tobacco, chillies and groundnut. Other major reasons are vagaries of climate, non-availability of quality seed and terminal moisture stress during the period of harvest. Besides this, Andhra Pradesh recorded negative and significant growth rate in area (-7.02%) during the overall period. Same results were also obtained by Krishnadas (2010). However, Madhya Pradesh and Rajasthan showed positive and significant growth rate (1.78% and 2.1% respectively) during the overall period. Pertaining to production, India holds 5.52 lakh tonnes, mainly contributed by Rajasthan (2.12 lakh tonnes), Madhya Pradesh (1.02 lakh tonnes) and Andhra Pradesh (0.15 lakh tonnes). During the span of 22 years, the production of coriander doubled in Madhya Pradesh owing to a drastic increase in yield level from 369 kg/ha to 603 kg/ha. Nevertheless, growth rate in yield was more in Andhra Pradesh (5.7%) during the overall period. The growth rate in Madhya Pradesh and Rajasthan was 2.64 per cent and -0.01 per cent respectively during the overall period. The lesser growth rate in Rajasthan is due to the fact that it has nearly reached its potential yield level. In another way, Rajasthan recorded highest yield of 951 kg/ha during TE 2016-17 which is more than the national average (920 kg/ha).

Table 4.1.5: Growth in area, production and yield of coriander in major producing states of India, 1995-96 to 2016-17

States	Variables	Average (Triennium Ending)			Compound growth rate		
		1997-98	2007-08	2016-17	Pre-NHM	Post-NHM	Overall period
Andhra Pradesh	Area	1.029	0.258	0.340	-12.23 ^{***}	-0.15	-7.02 ^{***}
	Production	22.867	10.933	15.997	-6.34 ^{**}	1.52	-1.72
	Yield	236	422	463	6.71 ^{**}	1.67	5.70 ^{***}
Madhya Pradesh	Area	1.410	1.081	1.725	-2.91	4.82 ^{***}	1.78 [*]
	Production	52.200	40.467	102.550	-3.79	9.78 ^{***}	4.47 ^{**}
	Yield	369	371	603	-0.91	4.73 ^{***}	2.64 ^{***}
Rajasthan	Area	1.751	1.602	2.255	-0.66	2.02	2.10 ^{**}
	Production	161.600	180.967	212.633	1.94	-1.1	2.09 [*]
	Yield	920	1126	951	2.62 ^{***}	-3.05	-0.01
India	Area	4.922	3.680	5.989	-2.39	4.22 ^{***}	1.40 [*]
	Production	258.967	285.433	552.027	1.95	5.82 ^{**}	4.41 ^{***}
	Yield	528	775	920	4.44 ^{***}	1.53	2.97 ^{***}

(Note: Area in lakh hectares, Production in thousand Metric Tonnes, Yield in Kg/ha and CGR in per cent per annum and *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

Fig 9: Trend in area, production and yield of coriander in India, 1995-96 to 2016-17

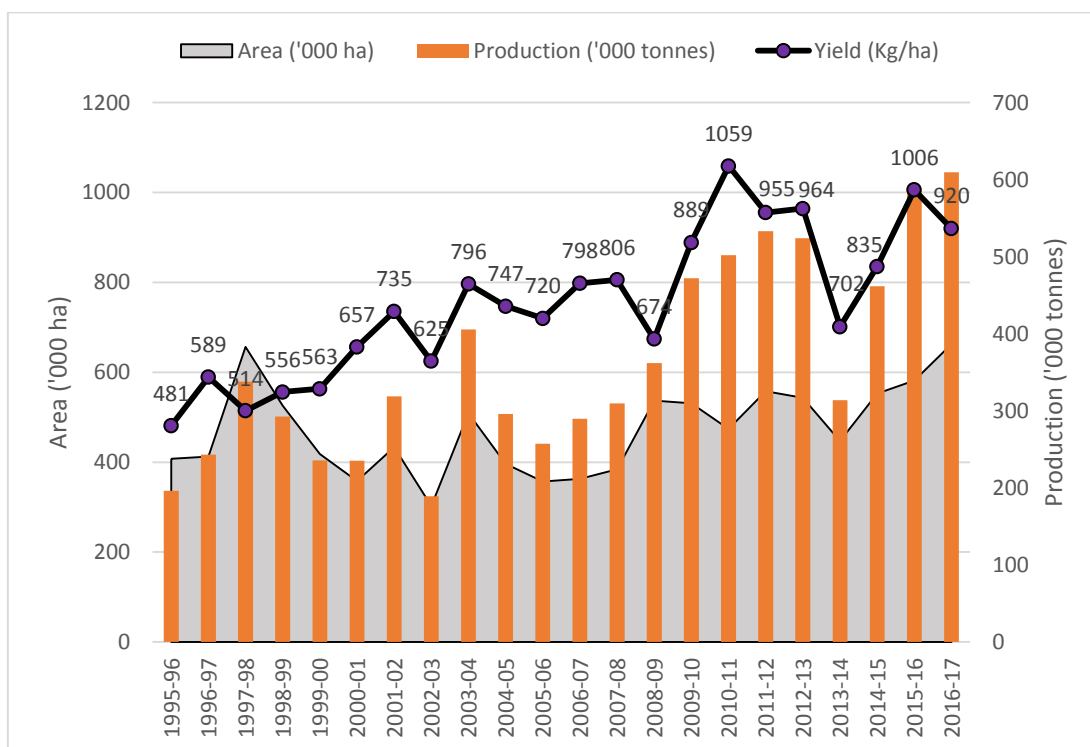
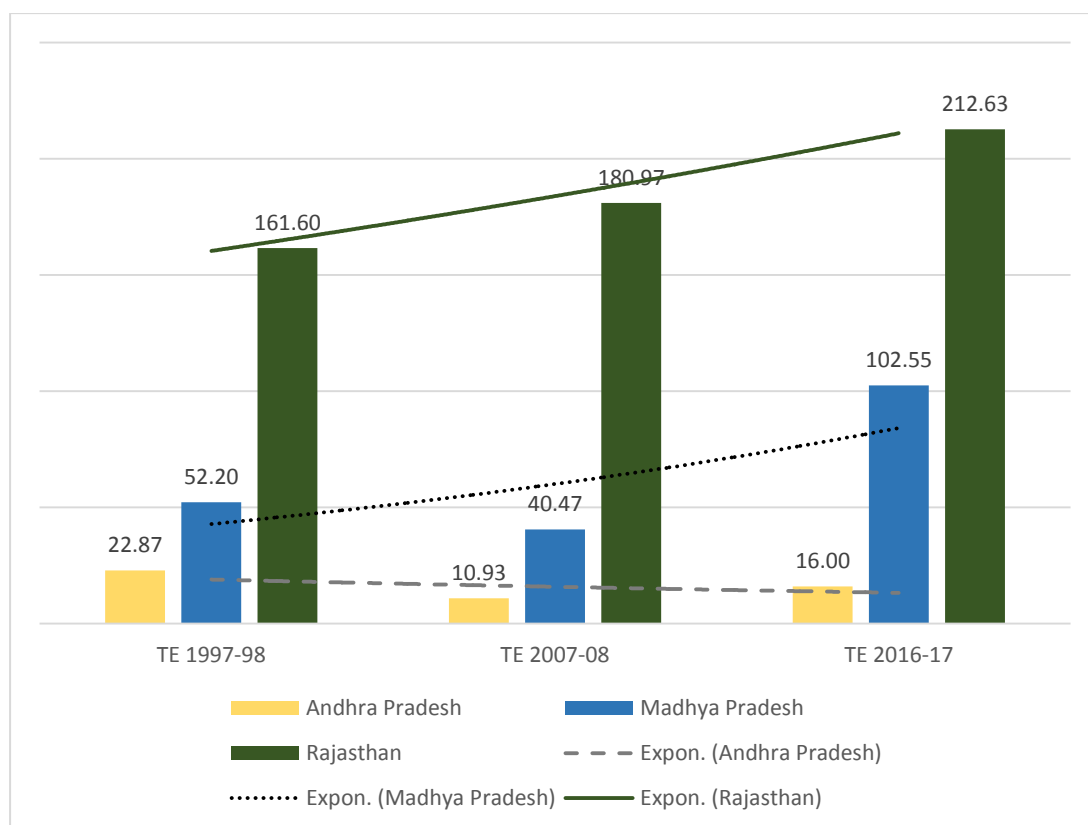


Fig 10: State wise trend in coriander production in India ('000 MT)



4.2 Instability in area, production and yield of major spices in India

4.2.1 Chilli

The instability indices for area, production and yield of major spices including chilli in major producing states of India have been presented in the Table 4.2. The instability in area under chilli cultivation was 7.78 per cent during the overall period. Karnataka registered highest instability in area (25.34%), followed by Andhra Pradesh (15.27%) and Madhya Pradesh (13.16%) during the overall period. West Bengal recorded highest stability in area during pre-NHM, post-NHM as well as in overall period. This stability might be due to the favourableness of chilli genotypes at different fertility levels under terai zone of West Bengal. All states registered decline in instability in area from pre-NHM to post-NHM period except in Andhra Pradesh. Highest instability in production was found in Andhra Pradesh owing to price fluctuations in domestic markets, pest attacks and raising cost of cultivation on account of commercial value of crop. Contrary to this, lowest instability in production was found in West Bengal during all the periods. West Bengal and Karnataka showed stability in yield during post-NHM period compared to pre-NHM period. For rest of the states, the stability in yield was vice versa.

4.2.2 Pepper

Kerala showed a shift from lowest instability in area in pre-NHM period to highest instability in post-NHM period. This might be due to price fluctuations in the domestic market and thus leads to frequent shift of pepper area to other crops. The results of the study were in line with the findings of Krishnadas (2010). However, highest instability in production was recorded in Tamil Nadu (118.13%), followed by Karnataka (46.33%) during the overall period. This highest instability was due to the larger production costs and highest instability indices of yield in these states. Furthermore, all the states registered higher instability values in post-NHM period compared to pre-NHM period as marked by cuddy-della valle indices. Pertaining to yield, Tamil Nadu registered highest instability of 137.41 per cent, followed by Karnataka (54.47%) and Kerala (34.39%). At all India level, the instability index increased from 14.04 per cent to 18.79 per cent on comparing pre-NHM and post-NHM periods. But in overall period, this instability reached to 25.82 per cent at the country level.

4.2.3 Turmeric

Instability in area under turmeric cultivation was 9.18 per cent during the overall period. Among states, Maharashtra registered highest stability in area during pre-NHM period, while in post-NHM period, Andhra Pradesh registered highest stability in area as marked by lower cuddy-della valle indices. During the overall period, Tamil Nadu registered highest instability in area (34.7%), followed by Karnataka (22.36%) and Gujarat (21.31%). Pertaining to production, Maharashtra showed an abrupt increase from lowest instability state in pre-NHM period to the highest instability state in post-NHM period. This drastic change

might be due to the larger changes in turmeric yield of the state after National Horticulture Mission. During the overall period, Andhra Pradesh registered lowest instability in production owing to the stability in turmeric area and yield. Tamil Nadu holds second highest instability in production (49.51%) as marked by higher Cuddy-Della Valle index. At all India level, instability in yield was 10.78 per cent during pre-NHM period and decreased to 6.9 per cent during post-NHM period, making it finally 8.59 per cent instability during the overall period. This underlies the importance of National Horticulture Mission due to which overall instability decreased at all India level.

4.2.4 Cumin

The estimates of instability showed that Rajasthan registered a highest instability (36.89%) in area during pre-NHM period (Table 4.2). But after NHM, the instability decreased to 22.77 per cent. Whereas in Gujarat, the situation was reverse i.e., more instability in area was observed in post-NHM period compared to pre-NHM period. This situation prevailed due to price fluctuations and shifting of area to other crops. With regards to production, both states i.e., Gujarat and Rajasthan showed higher instability during pre-NHM period compared to post-NHM period. This decline in instability was mainly due to stability of yield in both the states. Moreover, Rajasthan registered highest instability in production (47.33%) as well as in yield (26.87%) during the overall period. In Gujarat, the instability was 18.85 per cent in production and 16.16 per cent in yield during the overall period. The results are in par with the findings of Idris (2013), who observed increase in yield with decrease in instability in tomato, cashew nut, onion and eggplant. At the national level, the instability in production and yield became lower in post-NHM period compared to pre-NHM period on account of nearly stable prices of cumin seeds in the domestic and international markets.

4.2.5 Coriander

The extent of instability in area at the national level has declined from 20.93 per cent in pre-NHM period to 11.24 per cent in post-NHM period (Table 4.2). This decline in instability in area from period I to period II was followed by all the major growing states of the country. Besides this, Andhra Pradesh registered highest instability in area during all the periods. This was mainly the result of more changes in area from year to year. In addition to this, Andhra Pradesh registered highest instability in production (36.82%), followed by Madhya Pradesh (34.1%) and Rajasthan (28.05%) during the overall period. Madhya Pradesh showed highest instability (36.99 per cent) in pre-NHM period and reduced to 15.35 per cent during post-NHM period. This was marked by the lower cuddy-della valle index. At the national level, the instability in production was 21.52 per cent during the overall period. In case of yield, Rajasthan registered lowest instability during pre-NHM period, while Madhya Pradesh registered lowest instability during post-NHM period. However, stability in yield was

more pronounced in Rajasthan during the overall period as marked by lower instability index. At national level, the instability was found to be 11.56 per cent during the overall period.

Table 4.2: Instability in area, production and yield of major spices in India, 1995-96 to 2016-17

(Per cent)

States	Pre-NHM			Post-NHM			Overall period		
	A	P	Y	A	P	Y	A	P	Y
Chilli									
AP	14.28	19.89	14.81	14.73	31.18	24.29	15.27	28.86	24.77
MP	9.82	25.24	19.70	8.90	17.21	20.84	13.16	20.99	20.75
West Bengal	5.88	5.12	6.99	4.58	8.62	5.17	6.76	9.54	8.19
Karnataka	21.37	20.31	10.10	9.87	8.20	7.47	25.34	17.66	15.08
India	7.02	9.56	8.86	4.00	8.35	7.80	7.78	8.72	8.66
Pepper									
Karnataka	19.96	35.66	51.82	6.20	56.25	55.88	18.84	46.33	54.47
Kerala	4.41	19.61	18.11	16.75	23.31	38.19	21.04	23.45	34.39
Tamilnadu	10.91	74.12	60.99	11.27	125.05	137.67	16.18	118.13	137.41
India	5.08	15.38	14.04	12.85	9.95	18.79	18.14	16.45	25.82
Turmeric									
AP	10.46	18.27	16.12	7.48	11.42	5.47	9.33	16.87	12.75
MH	1.79	1.83	0.63	22.29	95.27	103.15	21.30	135.12	129.74
Tamilnadu	28.06	30.41	14.10	38.25	51.27	12.06	34.70	49.51	14.46
Karnataka	21.90	20.68	8.99	21.99	23.80	19.30	22.36	23.33	15.75
Gujarat	29.97	21.21	30.76	12.97	14.84	6.78	21.31	23.54	23.93
India	8.96	13.73	10.78	9.50	15.00	6.90	9.18	14.22	8.59
Cumin									
Gujarat	13.62	25.62	17.63	17.30	11.83	8.43	17.66	18.85	16.16
Rajasthan	36.89	42.76	27.28	22.77	29.28	22.65	35.14	47.73	26.87
India	19.38	22.20	18.84	13.17	14.81	12.33	16.46	18.60	16.59
Coriander									
AP	29.45	28.69	19.78	34.49	42.03	49.35	44.57	36.82	40.03
MP	29.16	36.99	15.69	11.67	15.35	12.72	23.59	34.10	17.94
Rajasthan	26.69	29.53	7.04	16.44	25.58	15.04	21.50	28.05	14.27
India	20.93	22.82	8.10	11.24	18.36	13.23	18.97	21.52	11.56

4.3 Growth and instability in export of major spices in India

Before stepping into the growth and instability in export of respective spices, the shares of selected spices export from total spices export during 2016-17 have been presented in the figure 11. Among the spices, chilli occupied the largest share (29%), followed by mint products (14%) and spice oils and oleoresins (13%) during 2016-17. The other spices from which India has got highest export earnings were cumin, pepper, turmeric and coriander during 2016-17. Apart from this, the status of spices sector in agricultural export earnings have to be examined critically in order to know the impact of spices in agricultural export earnings. At present, spices account for nearly 8 per cent of total agricultural export earnings during 2016-17 (Table 4.3.1). Positively, the share of spices in agriculture export earnings has become doubled i.e., from 4 per cent to 8 per cent during 1995-2016. The growth rate in spices exports was superior to agricultural exports in all the study periods. The country wise share of major spices exports in the world during 2016-17 has been presented in table 4.3.2. The study found that India was the largest exporter of chilli, turmeric, cumin and coriander in the world sharing 39 per cent, 71 per cent, 64 per cent and 22 per cent respectively during 2016-17. But in case of pepper, Vietnam has shown supremacy in the world showing 44 per cent of total exports, followed by Indonesia (13%) and Brazil (8%). India stands at fourth position in pepper exports in the world. Further, China and Spain in chilli, Indonesia and Netherlands in turmeric, Syria and Turkey in cumin and Russia and Syria in coriander were registered as the major exporting countries in the world excluding India.

Table 4.3.1: Spices share in agricultural exports: 1995-96 to 2016-17

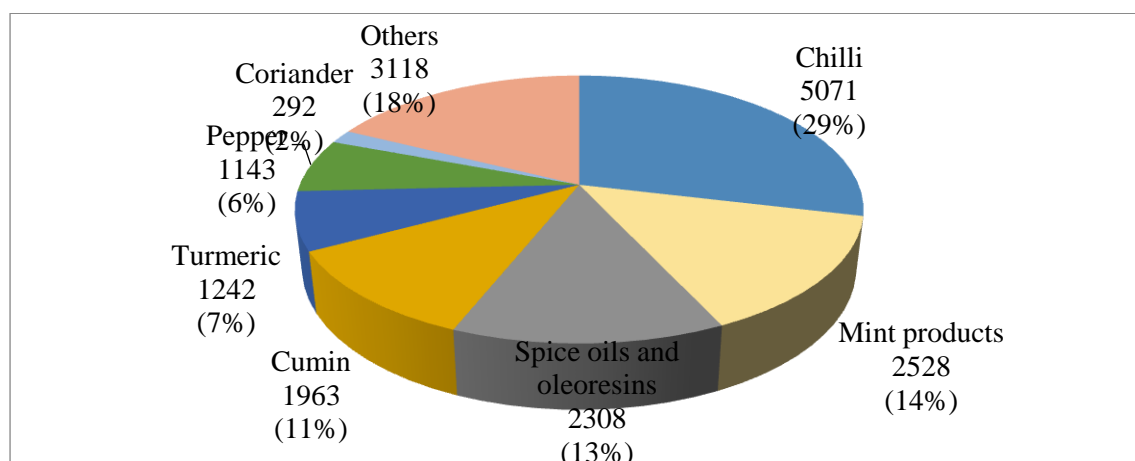
(Value in Rs. Crore)

Year	Spices exports	Agriculture exports	Spices share in total agricultural exports (%)
Pre-NHM period			
1995	804.43	20397.74	3.94%
2000	1833.529	28657.37	6.40%
2005	2627.62	49216.96	5.34%
Post-NHM period			
2006	3575.75	62411.42	5.73%
2011	9783.425	182801	5.35%
2016	17664.61	226651.9	7.79%
Trends in growth rate (% per annum)			
Pre-NHM	9.33 ^{***}	8.10 ^{**}	
Post-NHM	18.29 ^{***}	16.07 ^{***}	
Overall Period	15.17 ^{***}	14.48 ^{***}	

(Note: *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

Fig 11: Share of export value of major spices in India during 2016-17

(Value in Rs. Crore)



(Note: Figures in parentheses indicate percentage to the total)

Table 4.3.2: Country wise share of major spices exports in the world during 2016-17

Commodity	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6
Chilli	India (39)	China (26)	Spain (9)	Peru (5)	Mexico (3)	Germany (2)
Pepper	Vietnam (44)	Indonesia (13)	Brazil (8)	India (6)	Germany (5)	Malaysia (4)
Turmeric	India (71)	Indonesia (5)	Netherlands (3)	UK (2)	Ethiopia (2)	Germany (1)
Cumin	India (64)	Syria (12)	Turkey (5)	Ethiopia (1)	Iran (1)	Lithuania (1)
Coriander	India (22)	USSR (14)	Syria (12)	Italy (9)	Iran (8)	Bulgaria (5)

(Note: Figures in parentheses indicate percentage to the total)

The growth rate and instability in export quantity and export value of the major spices in India has been presented in the above table 4.3.3. The results revealed that all the major spices except pepper have registered positive growth rate in export quantity and export value during all the study periods. The negative growth rate in pepper export was mainly due to the decrease of pepper production in the major producing states of pepper. Besides this, another reason is increase of pepper export from competing countries in the world market. Highest growth rate in export quantity was found in cumin (16.37%), followed by mint products (12.77%) and chilli (11.4%) during the overall period. In case of export value, cumin registered highest growth rate of 22.9 per cent, followed by chilli (18.55%) and turmeric (15.43%) during the overall period. Apart from this, post-NHM period recorded superior growth rate over pre-NHM period in export quantity and export value of almost all the major

spices. Moreover, post-NHM period recorded as the most stable period in terms of export value in all the major spices and total spices compared to pre-NHM period. These figures highlighted the impact of National Horticultural Mission, due to which growth rate has increased in all the spices. However, instability was also found high in the spices as marked by the Cuddy-della Valle indices. The highest instability in export quantity and export value was found in cumin, pepper and mint products in the overall period. The highest instability in the aforementioned spices was mainly due to the larger changes in export quantity and export value during the study period. Positively, all the major spices recorded stability in export value during post-NHM period compared to pre-NHM period. Moreover, stability was also observed in export quantity in all the major spices except cumin and processed spices during post-NHM period over pre-NHM period. Further, total spices registered stability in both export quantity and export value after National Horticulture Mission.

Table 4.3.3: Growth and instability of major spices in India, 1995-96 to 2016-17

Particulars	(Per cent)					
	Pre-NHM		Post-NHM		Overall period	
	Export quantity	Export value	Export quantity	Export value	Export quantity	Export value
Compound Growth Rate						
Chilli	9.08***	9.70***	9.43***	19.68***	11.40***	18.55***
Cumin	7.81	14.15**	18.44***	25.38***	16.37***	22.90***
Pepper	-9.39***	-11.90**	-3.47	17.24***	-2.40**	6.48**
Turmeric	5.29***	10.05***	8.86***	21.42***	6.47***	15.43***
Coriander	6.50**	10.00***	4.43*	15.77***	5.90***	14.29***
Mint Products	25.59***	-21.89*	3.05*	11.36***	12.77***	4.83
Spice oils & Oleoresins	12.45***	13.24***	7.93***	17.93***	8.62***	13.51***
Total spices	4.49***	9.33***	9.95***	18.29***	8.08***	15.17***
Cuddy-Della Valle index						
Chilli	15.85	97.91	6.96	6.49	11.99	21.18
Cumin	16.48	52.45	27.87	21.44	39.21	37.53
Pepper	39.69	40.32	21.98	28.41	31.07	63.80
Turmeric	47.76	39.13	13.25	21.73	15.21	28.69
Coriander	24.18	53.62	21.83	28.70	22.92	29.04
Mint Products	23.41	142.67	13.79	25.47	25.47	126.14
Spice oils & Oleoresins	5.07	15.87	8.30	8.77	9.90	17.59
Total spices	9.43	12.89	6.21	11.27	12.07	19.06

(Note: *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

4.4 Direction of trade of spices export from India

The direction of trade of spices export to different countries was critically analysed with the estimation of transitional probability matrix using Markov chain analysis. Top six markets are selected for study in each spice and the remaining are pooled under others category. An overview of the top six import destinations for major spices in India have been presented in the table 4.4. The table also clearly states the percent share of the importing destinations for respective spice during 2016-17. Thailand, Vietnam and Sri Lanka were registered as the major importing destinations of Indian chilli, covering nearly 50 per cent of total export earnings. But in case of pepper, USA alone contributing 50 per cent of export earnings. Similarly, Iran and USA in turmeric, Vietnam and USA in cumin, Malaysia and UAE in coriander, China and USA in processed products like mint products and spice oils and oleoresins were registered as the major importing destinations during 2016-17.

In the transitional probability matrix, diagonal elements represent the probability of retention of trade. The row elements represent the probability of loss of trade to other competing countries and the column elements represent the probability of gain in trade from other competing destinations. Pre-NHM and post-NHM was done to see the contrasting pictures or situations of export before and after the National Horticulture Mission.

Table 1: Country wise share of major spices exports from India during 2016-17

Commodity	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6
Chilli	Thailand (19)	Vietnam (19)	Sri Lanka (10)	Malaysia (9)	U.S.A (8)	Bangladesh (6)
Pepper	USA (51)	UK (10)	Germany (7)	Netherlands (4)	Italy (2)	Canada (2)
Turmeric	Iran (11)	USA (9)	Bangladesh (8)	UAE (6)	Malaysia (5)	UK (4)
Cumin	Vietnam (33)	USA (11)	UAE (7)	UK (4)	Malaysia (4)	Egypt (2)
Coriander	Malaysia (36)	UAE (11)	UK (9)	South Africa (8)	Pakistan (7)	Saudi Arabia (6)
Mint products	China (38)	USA (16)	Netherlands (5)	Germany (3)	France (3)	Singapore (3)
Spice oils & oleoresins	USA (34)	China (8)	Germany (7)	South Korea (5)	UK (5)	Japan (3)

(Note: Figures in parentheses indicate percentage to the total)

4.4.1 Chilli

The perusal of the table 4.4.1 showed the changes in direction of trade of chilli export from India during pre-NHM and post-NHM periods. The major six destinations for Indian chilli were recognised as Malaysia, Bangladesh, Sri Lanka, USA, Vietnam and Thailand. The rest of the countries were kept under ‘others’ category.

The results of the study revealed that during pre-NHM period, the most stable market for Indian chilli was Malaysia with a retention probability of 43.43 per cent of its previous value, while it had lost 19.2 per cent share to USA market and 36.9 per cent share to other competing countries. At the same time, Malaysia gained 99.54 per cent share from Vietnam and 57.1 per cent share from Bangladesh. Export of chilli to Sri Lanka was retained to the tune of 18.8 per cent and the remaining share lost to USA (64.26%) and Bangladesh (16.58%). Similarly, USA had retained only 8 per cent of its original share and the leftover share had lost to Sri Lanka (75.18%) and Bangladesh (13.73%). In case of other countries, the retention was high i.e., 81.15 per cent of its previous export share, which was in line with the findings of Rajur and Patil (2013).

Due to NHM, the retention capacity of export destinations increased and they retained more percentage share of their previous share than pre-NHM period. Malaysia continued to be the most stable destination for Indian chilli even after NHM, retaining 85.87 per cent of its previous share. The results of the study are in line with the findings of Rajesh (2002) and Krishnadas and Mundinamani (2014). However, it had lost its share mostly to Bangladesh (12.64%). India retained 42.24 per cent of its share to Sri Lanka, while gained its export share of 18.38 per cent from other countries and 10.14 per cent share from Bangladesh. Vietnam had held 36.78 per cent of its previous share and lost the remaining share mostly to Thailand (56.55%). However, Vietnam gained 63.57 per cent export share from Thailand and 10.26 per cent of export share from Bangladesh. Similarly, USA had retained 33 per cent of its previous share, whereas other countries had maintained 60.2 per cent of its previous share. Nevertheless, USA had lost 58.67 per cent share to Bangladesh.

4.4.2 Pepper

The transitional probability matrices of Indian pepper during pre-NHM and post-NHM periods were represented in the table 4.4.2. The markets selected for study are USA, Germany, Netherlands, UK, Canada and Italy. The remaining countries were kept under others category.

The results of the study revealed that during pre-NHM period, USA was the most stable market for Indian pepper exports with a retention probability of 69.8 per cent of its previous share. It had gained 42.43 per cent share from other countries and had lost its major share to Netherlands (11.38%) and Canada (8%). Nevertheless, UK and Italy had recovered 46.71 per cent and 30.01 per cent of its original share. The most unstable importers of Indian pepper exports were Netherlands and Canada. In case of other countries, India had retained 57.57 per cent of its original share. However, it had gained shares from Germany (40.56%), Canada (55.2%) and Netherlands (31.06%)

In the post-NHM period, Italy emerged as the most stable market owing to its improvement in its retention share from 30.01 per cent to 40.51 per cent. However, USA had

retained 37.24 per cent of its previous share. This was clearly reflected in the findings of Rajesh (2002) and Krishnadas and Mundinamani (2014). This shows that Italy and USA were loyal customers to the Indian pepper market. A noteworthy point is that Netherlands, which was one of the most unstable market in the pre-NHM period was now retained 27.23 per cent of its previous share in post-NHM period. However, it had given up its remaining share to USA (72.77%). Likewise, UK had retained 29.73 per cent of its previous share and grabbed 21.55 per cent share from Germany and 13.75 per cent share from other countries. Canada seems to be the most unstable market for Indian pepper even after National Horticulture Mission and had lost its 100 per cent share to Italy (17.32%) and other countries (82.68%). In case of other countries, India had held 19.72 per cent of its previous share and the remaining shares lost to USA (62.77%) and UK (13.75%). These fluctuations in market share was mainly attributed to the export of pepper by Vietnam, Indonesia and Brazil. Another haunting thing is the decrease in pepper area of the country during recent times. Hence, Government has to take measures to enhance the pepper area in the country and should develop the quality standards in the domestic market and has to explore new markets in order to escape from the threat.

Table 4.4.1 Transitional probability matrix of chilli export from India, 1995-96 to 2016-17

Pre-NHM							
	Thailand	Vietnam	Sri Lanka	Malaysia	USA	Bangladesh	Others
Thailand	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Vietnam	0.0000	0.0046	0.0000	0.9954	0.0000	0.0000	0.0000
Sri Lanka	0.0000	0.0000	0.1888	0.0029	0.6426	0.1658	0.0000
Malaysia	0.0041	0.0000	0.0000	0.4343	0.1923	0.0000	0.3693
USA	0.0010	0.0000	0.7518	0.0299	0.0800	0.1373	0.0000
Bangladesh	0.0193	0.0007	0.0000	0.5710	0.0000	0.0000	0.4090
Others	0.0001	0.0000	0.0000	0.0000	0.1885	0.0000	0.8115
Post-NHM							
Thailand	0.2782	0.6357	0.0000	0.0000	0.0000	0.0000	0.0860
Vietnam	0.5655	0.3678	0.0000	0.0000	0.0000	0.0000	0.0667
Sri Lanka	0.0000	0.0000	0.4224	0.0783	0.1391	0.0909	0.2692
Malaysia	0.0000	0.0000	0.0000	0.8587	0.0149	0.1264	0.0000
USA	0.0000	0.0000	0.0000	0.0000	0.3304	0.5867	0.0829
Bangladesh	0.0000	0.1026	0.1014	0.0000	0.1608	0.0387	0.5964
Others	0.0945	0.0000	0.1838	0.0000	0.1197	0.0000	0.6020

Table 4.4.2 TPM of pepper export from India, 1995-96 to 2016-17

Pre-NHM							
	USA	UK	Germany	Netherlands	Italy	Canada	Others
USA	0.6982	0.0000	0.0000	0.1138	0.0081	0.0803	0.0996
UK	0.0000	0.4671	0.5329	0.0000	0.0000	0.0000	0.0000
Germany	0.0000	0.5630	0.0314	0.0000	0.0000	0.0000	0.4056
Netherlands	0.0000	0.0000	0.0000	0.0000	0.6894	0.0000	0.3106
Italy	0.0000	0.0000	0.2134	0.0000	0.3005	0.4861	0.0000
Canada	0.0000	0.1978	0.2502	0.0000	0.0000	0.0000	0.5520
Others	0.4243	0.0000	0.0000	0.0000	0.0000	0.0000	0.5757
Post-NHM							
USA	0.3724	0.0000	0.0067	0.0000	0.0324	0.0325	0.5561
UK	0.0000	0.2973	0.4446	0.1215	0.0000	0.0000	0.1366
Germany	0.4762	0.2155	0.1816	0.1267	0.0000	0.0000	0.0000
Netherlands	0.7277	0.0000	0.0000	0.2723	0.0000	0.0000	0.0000
Italy	0.0000	0.0000	0.0000	0.0000	0.4051	0.5949	0.0000
Canada	0.0000	0.0000	0.0000	0.0000	0.1732	0.0000	0.8268
Others	0.6277	0.1375	0.0377	0.0000	0.0000	0.0000	0.1972

4.4.3 Turmeric

Table 4.4.3 reveals the transitional probability matrices of Indian turmeric exports during pre-NHM and post-NHM periods. The important destinations for Indian turmeric are USA, Malaysia, Iran, Bangladesh, UAE and UK. The remaining countries are pooled and put under others category.

In pre-NHM period, Malaysia had retained 60 per cent of its previous share, followed by USA (51.4%) and Bangladesh (43.9%). USA had lost a major part of the export share to UAE (33.04%), while it had absorbed shares from UK (33.78%), Iran (16.98%), Bangladesh (15.02%) and UAE (3.14%). Iran had held 37.55 per cent of its previous share and grabbed 17.07 per cent share from UAE. Likewise, UK had retained 23.33 per cent share of its previous share and the remaining lost mostly to UAE (41.55%) and USA (33.78%). In case of other countries, India had retained 80.2 per cent of its previous share and gained major shares from Iran (43.29%), Malaysia (40%) and Bangladesh (11.98%). Similar results were also obtained by Sakamma (2009), Krishnadas (2010).

But in post-NHM period, the most reliable and loyal customers to Indian turmeric exports were UAE and UK, with a retention probability of 49.49 per cent and 37.88 per cent

of its previous share respectively. UAE had gained momentum from UK and Malaysia with an export share of 50.28 per cent and 15.32 per cent respectively. But UAE had given up its major share to other countries (48.81%). Bangladesh market was unstable i.e., lost its 100 per cent share to other countries (39.98%), USA (38.76%), Malaysia (14.19%) and Iran (4.57%). However, it had gained 32.86 per cent shares from Malaysia. Iran had retained 27.61 per cent of its previous share and gained major shares from USA (49.15%). Likewise, USA had recovered 20.98 per cent of its previous share and gained major shares from Bangladesh (38.76%), Malaysia (27.6%) and Iran (20.57%).

Table 4.4.3 TPM of turmeric export from India, 1995-96 to 2016-17

Pre-NHM							
	Iran	USA	Bangladesh	UAE	Malaysia	UK	Others
Iran	0.3755	0.1698	0.0000	0.0120	0.0000	0.0098	0.4329
USA	0.0000	0.5141	0.0000	0.3304	0.0000	0.0939	0.0616
Bangladesh	0.0000	0.1502	0.4390	0.0000	0.0000	0.0711	0.3398
UAE	0.1707	0.0314	0.4679	0.2102	0.0000	0.0000	0.1198
Malaysia	0.0000	0.0000	0.0000	0.0000	0.6000	0.0000	0.4000
UK	0.0134	0.3378	0.0000	0.4155	0.0000	0.2333	0.0000
Others	0.0000	0.0000	0.0000	0.0854	0.0447	0.0679	0.8020
Post-NHM							
Iran	0.2761	0.2057	0.0000	0.0000	0.0000	0.0000	0.5183
USA	0.4915	0.2098	0.0000	0.0000	0.0000	0.0000	0.2986
Bangladesh	0.0457	0.3876	0.0000	0.0000	0.1419	0.0250	0.3998
UAE	0.0000	0.0000	0.0000	0.4919	0.0000	0.0201	0.4881
Malaysia	0.0490	0.2760	0.3286	0.1532	0.1932	0.0000	0.0000
UK	0.0000	0.0000	0.0000	0.5028	0.0999	0.3788	0.0185
Others	0.0330	0.0073	0.0716	0.0000	0.0771	0.0488	0.7622

4.4.4 Cumin

The transitional probability matrices of Indian cumin exports during pre-NHM and post-NHM periods have been presented in the table 4.4.4. Top six markets for India cumin exports were USA, Vietnam, UAE, UK, Malaysia and Egypt. The remaining countries were kept under others category.

It is evident from the table 4.4.4 that during pre-NHM period, Malaysia is the most stable destination for Indian cumin exports, retaining 51.29 per cent of its previous share and gave up its remaining share to UK (45.48%) and USA (3.53%). Similarly, USA had retained 26.58 per cent of its original share and had lost its major share to UK (57.16%). India had not recovered anything from its previous share from countries like Vietnam, UAE, UK and

Egypt. It shows that Vietnam, UAE, UK and Egypt were the most unstable markets during pre-NHM period. But, other countries had retained 81.5 per cent of its previous share and it was also supported by Krishnadas (2010) and Sakamma (2009). However, other countries had grabbed 27.7 per cent share from UK, 12.51 per cent share from USA and 100 per cent share from UAE as well as from Egypt.

Vietnam emerged as the safest destination for Indian cumin and had improved its retention capacity from zero per cent share to 82.86 per cent of its original share after NHM. Of the remaining, 16.74 per cent share lost to USA and 1 per cent share lost to Egypt. However, Vietnam had absorbed 54.8 per cent share from Egypt. The results were in par with the findings of Ibrahim (2017). UAE and UK were considered to be the most unstable markets and had given up its 100 per cent share to other countries. India could not retain any share from Malaysia and had lost its share to UAE (61.67%) and USA (38.83%). Egypt came into picture after National Horticulture Mission and had retained 42.97 per cent of its previous share, while other countries had retained 58.7 per cent of its original share. Yet, Indian cumin had a threat from the countries like Syria, Turkey, China and Iran, which have a profound influence in the determination of cumin prices. So, India should explore new markets by developing a network of market intelligence.

Table 4.4.4 TPM of cumin export from India, 1995-96 to 2016-17

Pre-NHM							
	Vietnam	USA	UAE	UK	Malaysia	Egypt	Others
Vietnam	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
USA	0.0000	0.2658	0.0000	0.5716	0.0000	0.0375	0.1251
UAE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
UK	0.0000	0.0000	0.2312	0.0000	0.4918	0.0000	0.2770
Malaysia	0.0000	0.0353	0.0000	0.4518	0.5129	0.0000	0.0000
Egypt	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Others	0.0000	0.1568	0.0275	0.0000	0.0000	0.0000	0.8157
Post-NHM							
Vietnam	0.8226	0.1674	0.0000	0.0000	0.0000	0.0100	0.0000
USA	0.0000	0.1444	0.0000	0.0000	0.0000	0.0353	0.8203
UAE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
UK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Malaysia	0.0000	0.3883	0.6117	0.0000	0.0000	0.0000	0.0000
Egypt	0.5481	0.0000	0.0000	0.0000	0.0222	0.4297	0.0000
Others	0.0000	0.0842	0.1237	0.0894	0.0748	0.0406	0.5873

4.4.5 Coriander

Table 4.4.5 gives the transitional probability matrices of Indian coriander exports during pre-NHM and post-NHM periods. The major importers of Indian coriander are South Africa, Saudi Arabia, UAE, UK, Malaysia and Pakistan. The remaining countries are clubbed together and kept under others category.

During pre-NHM period, highest retention of coriander exports was observed in Malaysia (69.06%), followed by Pakistan (41.42%) and UK (37.77%). However, Malaysia gained 57.58 per cent share from Pakistan and 25.15 per cent share from other countries. Similarly, Pakistan gained 20.41 per cent share from Saudi Arabia. South Africa had lost 100 per cent of its previous share to other countries. Saudi Arabia had retained 20.98 per cent of its previous share and gained 43.3 per cent share from UK and 1.69 per cent share from Malaysia. Likewise, UAE had retained 17.32 per cent of its previous share and lost its remaining share to South Africa (38.78%) and other countries (43.9%).

The most reliable market for Indian coriander exports during post-NHM period was Malaysia, retaining 60 per cent of its previous share and had gained 100 per cent share from South Africa. UK had retained 27.36 per cent of its previous share, while it had lost 59.76 per cent share to UAE and 12.88 per cent share to Saudi Arabia. Similarly, USA had recovered 12.53 per cent of its original share, while it had given up 14.73 per cent share to Saudi Arabia and 72.74 per cent share to other countries. The market share of Saudi Arabia was not stable and lost its 100 per cent share to other countries. India retained only a meagre share of 8.95 per cent share to Pakistan. Nevertheless, India had retained 47.44 of its previous shares to other countries.

4.4.6 Mint products

The perusal of table 4.4.6 showed the transitional probability matrices of Indian mint products export in pre-NHM and post-NHM periods. The leading importing countries of Indian mint products are China, USA, Netherlands, Germany, Singapore and France.

The most loyal markets for Indian mint products during pre-NHM period were USA and China, reflecting highest probability retention of 77.54 per cent and 62.31 per cent of its previous share respectively. USA had gained 28.55 per cent share from Singapore and 12 per cent share from China. In the same way, China had absorbed major shares from Netherlands (100%) and Germany (55.97%). The most unstable destinations for Indian mint products were Netherlands and Germany. France retained only a meagre share of 3.43 per cent of its original share and the remaining shares lost to Singapore. India retained 75.17 per cent of its previous share to other countries, whereas it had grabbed shares from Singapore (26.15%), USA (16.48%) and China (2.6%).

But after NHM, China emerged as the most stable destination for Indian mint products, retaining 71.1 per cent of its previous share. The residual share was lost to USA

(24.9%) and France (3.99%). However, it had grabbed 100 per cent shares from Netherlands and 30.78 per cent shares from other countries. France had held 36.43 per cent of its previous share. Similarly, USA, Germany and others had retained 25.15 per cent and 16.36 per cent and 11.04 per cent of its original share respectively. France had given up 63.57 per cent of its share to other countries and Germany had lost its major shares to Singapore (18.04%) and others (65.6%). Likewise, other countries had given up its major shares to China (30.78%), USA (29.13) and Singapore (16.38%).

4.4.7 Spice oils and oleoresins

Table 4.4.7 showed the transitional probability matrices of Indian spice oils and oleoresins export during pre-NHM and post-NHM periods. The major terminals for Indian spice oils and oleoresins are China, USA, Japan, Germany, South Korea and UK.

China was the most reliable market for Indian spice oils and oleoresins during pre-NHM period, with a retention tune of 86.7 per cent of its previous share. The residual share was lost to South Korea (13.3%). It had gained 10.2 per cent of South Korea's share and 1 per cent of other countries' share. USA with a retention probability of 54.84 per cent was the second loyal customer of Indian spice oils and oleoresins. It had absorbed 95.69 per cent share from Germany and 14.11 per cent share from other countries. South Korea had held 35.57 per cent of its previous share. While it had lost its remaining share to Germany (54.23%) and China (10.2%). India had retained 48.5 per cent of its previous share to other importing countries. Of the remaining, it had lost its major share to Japan (15.28%), USA (14.11%) and Germany (11.72%). However, it had grabbed shares from Japan (95.32%), UK (75.79%) and USA (3.86%).

However, China had declined its market share from 86.7 per cent to 37.85 per cent owing to the increase of spices cultivation in China. Hence, India has to look for new and efficient markets in order to continue as a high foreign exchange earner of spice oils and oleoresins. Positively, USA and UK appeared to be the reliable and stable destinations for Indian spice oils and oleoresins, reflecting a retention probability of 47.36 per cent and 46.72 per cent of its original share respectively. USA had absorbed 49.2 per cent shares from China and 24.23 per cent shares from other countries, whereas it had given up its major share to other countries (47%). Similarly, UK had gained shares from Japan (13.78%), China (1.57%) and other countries (5.74%), while it had lost its major share to other countries (53.28%). China and Germany had recovered 37.85 per cent and 33.51 per cent of its previous share respectively. Japan had retained 17.97 per cent of its previous share and the remaining share lost mainly to Germany (55.65%). However, Japan had grabbed shares from Germany (32.54%) and other countries (2.02%). India had retained 46.89 per cent of its previous share to other importing countries and it had gained shares mainly from South Korea (100%), UK (53.28%), USA (47.05%) and Germany (33.5%).

Table 4.4.5 TPM of coriander export from India, 1995-96 to 2016-17

Pre-NHM							
	Malaysia	U.A.E	U.K.	South Africa	Pakistan	Saudi Arabia	Others
Malaysia	0.6906	0.0000	0.0000	0.0219	0.0000	0.0169	0.2705
U.A.E	0.0000	0.1732	0.0000	0.3878	0.0000	0.0000	0.4390
U.K.	0.0000	0.1893	0.3777	0.0000	0.0000	0.4330	0.0000
South Africa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Pakistan	0.5758	0.0000	0.0100	0.0000	0.4142	0.0000	0.0000
Saudi Arabia	0.0311	0.2813	0.2737	0.0000	0.2041	0.2098	0.0000
Others	0.2515	0.1490	0.1032	0.0440	0.0000	0.0000	0.4523
Post-NHM							
Malaysia	0.6008	0.0000	0.0853	0.2080	0.0000	0.0000	0.1059
U.A.E	0.0000	0.1253	0.0000	0.0000	0.0000	0.1473	0.7274
U.K.	0.0000	0.5976	0.2736	0.0000	0.0000	0.1288	0.0000
South Africa	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pakistan	0.0895	0.1902	0.1871	0.1445	0.0742	0.0676	0.2469
Saudi Arabia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Others	0.1019	0.1144	0.0473	0.0000	0.1731	0.0889	0.4744

Table 4.4.6: TPM of mint products export from India, 1995-96 to 2016-17

Pre-NHM							
	China	U.S.A	Netherlands	Germany	France	Singapore	Others
China	0.6231	0.1208	0.0402	0.1899	0.0000	0.0000	0.0260
U.S.A	0.0163	0.7754	0.0174	0.0000	0.0261	0.0000	0.1648
Netherlands	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Germany	0.5547	0.0000	0.0988	0.0000	0.0000	0.3464	0.0000
France	0.0000	0.0000	0.0000	0.0000	0.0343	0.9657	0.0000
Singapore	0.0000	0.2855	0.0024	0.3308	0.0000	0.1198	0.2615
Others	0.0000	0.0000	0.0000	0.1084	0.1333	0.0066	0.7517
Post-NHM							
China	0.7110	0.2490	0.0000	0.0000	0.0399	0.0000	0.0000
U.S.A	0.0000	0.2515	0.0976	0.1214	0.0151	0.1225	0.3919
Netherlands	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Germany	0.0000	0.0000	0.0000	0.1636	0.0000	0.1804	0.6560
France	0.0000	0.0000	0.0000	0.0000	0.3643	0.0000	0.6357
Singapore	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
Others	0.3078	0.2913	0.0461	0.0806	0.0000	0.1638	0.1104

Table 4.4.7: TPM of spice oils and oleoresins export from India, 1995-96 to 2016-17

Pre-NHM							
	U.S.A	China	Germany	South Korea	U.K	Japan	Others
U.S.A	0.5484	0.0000	0.0769	0.0000	0.1630	0.1730	0.0386
China	0.0000	0.8670	0.0000	0.1330	0.0000	0.0000	0.0000
Germany	0.9569	0.0000	0.0000	0.0000	0.0431	0.0000	0.0000
South Korea	0.0000	0.1020	0.5423	0.3557	0.0000	0.0000	0.0000
U.K	0.0000	0.0000	0.0000	0.0000	0.0000	0.2421	0.7579
Japan	0.0000	0.0000	0.0468	0.0000	0.0000	0.0000	0.9532
Others	0.1411	0.0010	0.1172	0.0579	0.0449	0.1528	0.4851
Post-NHM							
U.S.A	0.4736	0.0000	0.0000	0.0558	0.0000	0.0000	0.4705
China	0.4920	0.3785	0.0000	0.0536	0.0157	0.0000	0.0602
Germany	0.0000	0.0000	0.3351	0.0000	0.0045	0.3254	0.3350
South Korea	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
U.K	0.0000	0.0000	0.0000	0.0000	0.4672	0.0000	0.5328
Japan	0.0426	0.0000	0.5565	0.0835	0.1378	0.1797	0.0000
Others	0.2423	0.0857	0.0756	0.0499	0.0574	0.0202	0.4689

4.5 Factors influencing export of major spices

The major determinants of spices export taken for analysis were lagged production, world export quantity, domestic consumption, export price, domestic price and exchange rate. In order to find out the extent of influence of these factors on Indian spices exports, multiple regression analysis was carried out and the power production function was used to find out the regression coefficients.

Lagged production and world export quantity had shown positive and significant effect on Indian chilli exports during 2001-2016. The positive effect of world export quantity was mainly due to the raising demand of chilli in the international food industry. This was in line with the findings obtained by Kumar and Rai in tomato in 2007 and cucumber and gherkin products in 2008. Other factors like domestic consumption and export price had registered positive relation (0.07 and 0.81 respectively) with exports of chilli from India but did not play any major role in determining chilli exports from the country. However, domestic price and exchange rate had shown negative relation (-0.06 and -0.66 respectively) with Indian chilli exports but its influence was negligible. The coefficient of multiple determination (R^2) represents that 95 per cent of the variations in export of chilli are explained by the variables included in the model. But in case of pepper, only 86 per cent of

variations in export are explained by the variables included in the model. Domestic consumption and export price has negative impact on pepper exports from the country, with value of coefficient as -0.73 and -1.07; meaning thereby that export will decrease by 0.73 per cent and 1.07 per cent respectively with 1 per cent increase in domestic consumption and export price. The negative impact of export price was mainly due to the less comparative advantage of India in the world market compared to other top exporting countries. Similar results were obtained by Abolagba *et al* (2010) in cocoa and Adhikari *et al* (2016) in rice. But Kumar *et al* (2008) has found positive effect of export price on export of cucumber and gherkin from India, but the result was non-significant specifying that export price has not played any key role in determining export quantity of these crops. In this connection, India has been facing challenges from other pepper exporting countries like Vietnam, Indonesia and Brazil in the Asian market on account of the impact of domestic consumption in the country. Apart from this, domestic price has shown positive and significant effect on pepper exports from the country.

Indian turmeric exports were influenced largely by the lagged production and domestic consumption in the country. Lagged production has shown positive impact, whereas domestic consumption has shown negative impact on Indian turmeric exports. Same conclusions were also drawn by Adhikari *et al* (2016) in rice. Besides this, a minor effect of exchange rate on exports was also noticed in the study period. All these variables explain 98 per cent of the variations in turmeric export. In case of cumin, domestic consumption and exchange rate have shown negative impact and lagged production has positive impact on exports from the country. While, other factors like domestic price and exchange rate have negligible influence on the Indian cumin exports. All these factors accountable for 98 per cent of the changes in cumin exports, which was indicated by the coefficient of multiple determination. However, in case of coriander, all the factors that were taken for analysis have shown significant influence on the exports from the country and explain 97 per cent of variations in export. Domestic consumption and export price has recorded negative effect (-7.79 and -0.8 respectively) on Indian coriander exports. Similar findings were also drawn by Abolagba *et al* (2010) in cocoa and Adhikari *et al* (2016) in rice. But, world export quantity, domestic price and exchange rate have registered positive and significant influence on coriander exports from the country during the study period. All in all, domestic consumption and lagged production have major impact on spices exports from the country.

Table 4.5: Factors affecting major spices export from India during 2001 to 2016

Variable	b	t	R ²	F
Chilli				
Constant	-16.23 ^{**}	-2.31	0.95 ^{***}	26.60
World export quantity	0.68 [*]	2.08		
Lagged production	0.92 [*]	2.09		
Domestic consumption	0.07	0.15		
Export price	0.81	1.62		
Domestic price	-0.06	-0.16		
Exchange rate	-0.66	-1.36		
Pepper				
Constant	4.76	0.46	0.86 ^{***}	9.48
World export quantity	0.89	1.16		
Lagged production	0.4	1.37		
Domestic consumption	-0.73 ^{***}	-4.28		
Export price	-1.07 ^{**}	-2.61		
Domestic price	0.87 [*]	2.05		
Exchange rate	-0.04	-0.05		
Turmeric				
Constant	-5.45 ^{***}	-3.58	0.98 ^{***}	96.03
World export quantity	0.03	0.16		
Lagged production	13.27 ^{***}	6.58		
Domestic consumption	-12.20 ^{***}	-6.35		
Export price	-0.07	-0.56		
Domestic price	-0.06	-0.53		
Exchange rate	0.51 [*]	1.87		
Cumin				
Constant	-6.27 ^{**}	-2.31	0.98 ^{***}	92.74
World export quantity	0.05	0.36		
Lagged production	6.55 ^{***}	8.46		
Domestic consumption	-6.15 ^{***}	-7.35		
Export price	0.89	1.34		
Domestic price	0.29	0.62		
Exchange rate	-0.90 [*]	-1.91		
Coriander				
Constant	-6.62 ^{***}	-5.28	0.97 ^{***}	50.13
World export quantity	0.35 ^{***}	3.70		
Lagged production	8.69 ^{***}	11.51		
Domestic consumption	-7.79 ^{***}	-10.94		
Export price	-0.80 [*]	-2.02		
Domestic price	0.68 [*]	1.98		
Exchange rate	0.51 ^{**}	2.29		

(Note: *, ** and *** indicate significance at 10 per cent, 5 per cent and 1 per cent level respectively)

4.6 Measures to promote spices export from India

The production and export of a commodity of any nation is determined largely by the principle of comparative advantage. The comparative advantage tells about the capability of a nation to export a particular commodity in the international markets. The revealed comparative advantage (RCA) and comparative export performance (CEP) indices were computed for major spices in determining the comparative advantage of the top six exporting countries.

4.6.1 Revealed comparative advantage (RCA) of major spices

Several developments that have taken place after trade liberalization (i.e., after 1995) and after National Horticulture Mission (i.e., after 2005) seemed to have a notable effect on the Indian spices exports either directly or indirectly. A brief perusal of the table reveals the comparative advantage of India and other major chilli exporting countries in Asia. The analysis showed that India has high comparative advantage in the Asian market against other competing countries like Germany, Mexico, Peru, Spain and China. This might be due to the quest of Indian chilli in the Asian market on account of its taste and flavor and also India's relations with other countries. Besides this, higher RCA indices of all the major countries in the recent years compared to initial years is a positive sign i.e., India's competing power has raised in the recent years in exporting chilli to the Asian market. In case of pepper, Vietnam, Indonesia and Malaysia have shown domination in the Asian market against India. However, India has shown comparative advantage over Brazil and Germany in pepper exports. But in 2016, Brazil also showed supremacy over India in the Asian market in pepper exports which indicates the lose of control of power in pepper exports in the Asian market for India.

The estimates of RCA of Indian turmeric over other competing countries in the Asian market have been presented in the table. The results revealed that India has enjoyed comparative advantage in turmeric exports against other major exporting countries like Germany, Netherlands, Indonesia and UK. However, Ethiopia has shown comparative advantage over India in turmeric exports in the Asian market. In case of cumin, India has faced a stiff competition from Ethiopia and Syria in the Asian market in the entire study period. Another serious concern was that Iran was improving its position at a much rapid pace posing a serious threat to Indian cumin in the Asian market in the recent years. However, Lithuanian cumin did not enjoy any comparative advantage throughout the study period and its position rather worsened gradually over the years. In contrast, Turkey improved its competitive power in the recent years which was reflected in the lower RCA indices (i.e., from 2.1 in 2001 to 1.77 in 2016). Regarding coriander, India has revealed comparative advantage against Italy and Russian federation in the initial years (showing 8.36 and 4.26 respectively in 2001) has now emerged as the stiff competitors in Asian market showing RCA

indices of 0.07 and -0.03 respectively in 2016. Besides this, Bulgaria and Syria have enjoyed comparative advantage in the Asian market during the period of investigation.

4.6.2 Comparative export performance (CEP) of major spices

Another index used to study the comparative advantage is the comparative export performance index, which assess the export specialization of a country for a particular product. The country with higher CEP index has higher comparative advantage against other competing countries and vice versa. The CEP indices of chilli of top exporting countries have been presented in the table. The results revealed that India has shown superiority in chilli exports over other competing countries except Peru during the overall period. However, India was at the back edge in comparative advantage when compared to Peru in chilli exports to the world up to 2013. But in the year 2016, India has shown revealed comparative advantage in chilli exports over Peru. Among all the major competitors. Germany has registered negative CEP indices indicating the less competitive ability of the country in the world market in exporting chilli. In case of pepper, Vietnam and Indonesia has shown supremacy in pepper exports over other competing countries which was reflected in the higher CEP indices of these countries in the entire study period. While India has shown export competitiveness of pepper against Brazil, Germany and Malaysia in the world market. Apart from this, all the top six exporting countries registered positive CEP indices in the study period, which indicates the importance of pepper exports in these countries.

A brief perusal of the table showed the export specialization of turmeric in the top exporting countries during 2001-2016. The results revealed that the CEP index of India has decreased from 4 to 3.68 during 2001 to 2016. But still, India is the leading exporter and competitor in turmeric exports over other exporting countries. Next to India, Ethiopia has shown dominance in the marketing of turmeric exports in the entire study period. In the remaining countries like Indonesia, Netherlands, UK and Germany, negative CEP indices were observed representing the comparative disadvantage of turmeric exports in these countries.

Among all the competitors, Syria had recorded highest comparative advantage in cumin exports in all the periods. Next to Syria, India has exhibited a higher competitive advantage in cumin exports in the study period except in 2001 in Ethiopia and Iran and in 2007 in Iran. Positively, the CEP index of India has improved from 2.17 to 3.58 during 2001 to 2016. In contrast, the index value decreased in other competing countries like Syria, Turkey, Ethiopia and Iran. However, Lithuania has registered negative indices in the initial periods, but improved in the recent year (0.68).

Table 4.6.1: Revealed Comparative Advantage of major spices in India against top exporting countries in the Asian market from 2001 to 2016

Country	2001	2004	2007	2010	2013	2016
Chilli						
China	1.23	1.52	2.86	2.67	2.48	3.11
Spain	1.00	1.77	2.37	1.98	1.89	2.84
Peru	4.70	2.71	5.79	4.06	2.57	5.16
Mexico	5.43	3.72	5.26	5.08	3.82	5.43
Germany	5.19	5.17	6.69	5.69	5.39	6.47
Pepper						
Vietnam	-2.92	-4.04	-3.05	-3.73	-2.99	-3.36
Indonesia	-1.41	-1.94	-0.98	-2.18	-1.78	-2.47
Brazil	0.26	0.31	0.27	-0.25	0.39	-0.14
Germany	4.51	3.49	4.16	3.24	3.67	3.05
Malaysia	-0.59	-1.21	-0.51	-1.31	-0.75	-1.28
Turmeric						
Indonesia	5.04	4.52	3.54	2.48	3.33	1.89
Netherlands	6.59	8.78	6.20	5.84	5.43	5.78
UK	–	6.07	5.55	7.42	9.08	11.05
Ethiopia	-1.00	-1.69	-0.96	-1.12	-1.54	-1.51
Germany	7.15	8.21	8.90	9.33	7.53	7.62
Cumin						
Syria	-3.23	-2.69	-3.2	-1.64	–	–
Turkey	2.10	0.47	1.68	0.56	1.75	1.77
Ethiopia	-1.28	-1.31	-1.68	-1.78	-0.57	-0.81
Iran	0.34	-1.04	-0.46	-0.79	1.73	3.11
Lithuania	–	4.86	6.27	4.16	4.58	7.87
Coriander						
Russia	4.26	5.80	4.83	3.18	2.81	-0.03
Syria	-0.13	0.09	-1.48	-1.90	–	–
Italy	8.36	4.73	2.03	0.68	0.65	0.07
Iran	0.50	2.23	0.03	-1.88	-0.75	-0.46
Bulgaria	-2.84	-2.93	-2.30	-2.95	-2.31	-2.07

Regarding coriander, India has recorded comparative advantage over Russian federation and Italy and comparative disadvantage over Syria, Iran and Bulgaria. In the initial periods, Bulgaria has shown dominance in coriander exports but in the recent years, Syria emerged as the largest competitor in exporting coriander to the world market. Italy has shown negative indices in the years 2001, 2004 and 2007 and later on registered positive indices indicating the competitiveness of the country in coriander exports.

Table 4.6.2: Comparative Export Performance of major spices in top exporting countries in the world from 2001 to 2016

Country	2001	2004	2007	2010	2013	2016
Chilli						
India	2.35	2.73	2.86	3.05	2.40	3.09
China	1.66	2.16	1.77	1.69	1.76	1.73
Spain	1.37	0.99	0.88	1.07	1.18	0.97
Peru	3.43	3.87	3.92	3.56	3.34	2.66
Mexico	1.26	0.37	0.13	0.44	0.89	0.34
Germany	-0.47	-0.68	-0.93	-0.73	-0.53	-0.96
Pepper						
India	4.12	3.22	3.54	2.97	2.74	2.80
Viet Nam	5.63	5.67	5.38	5.20	5.62	5.39
Indonesia	4.96	3.63	3.56	3.59	3.46	3.30
Brazil	3.13	2.72	2.52	2.04	2.03	1.95
Germany	1.38	1.45	1.24	1.31	1.43	1.41
Malaysia	4.04	2.93	2.66	2.48	2.41	2.45
Turmeric						
India	4.00	4.12	3.61	3.74	3.22	3.68
Indonesia	-0.94	-0.97	-0.37	0.27	-0.67	0.63
Netherlands	-0.46	-0.96	-0.90	-1.13	-0.88	-0.82
UK	-0.79	-0.82	0.03	-0.87	-0.11	0.10
Ethiopia	3.15	2.85	1.79	1.76	1.78	2.28
Germany	-1.16	-1.66	-1.63	-1.84	-1.65	-1.38
Cumin						
India	2.17	2.20	2.47	3.23	3.20	3.58
Syria	6.21	6.21	5.57	3.89	5.33	6.02
Turkey	1.49	1.65	1.29	2.06	1.54	1.42
Ethiopia	2.27	1.55	1.80	1.91	1.23	1.78
Iran	2.27	3.53	2.87	2.93	1.34	1.51
Lithuania	-3.69	-1.00	-1.13	-0.55	-0.31	0.68

Coriander						
India	2.96	3.28	2.67	2.55	2.47	2.53
Russia	1.78	0.67	0.28	0.81	1.06	2.54
Syria	3.72	4.08	4.01	3.95	4.47	6.01
Italy	-3.41	-2.47	-0.21	0.50	0.86	1.09
Iran	3.28	1.54	2.95	3.79	3.29	4.15
Bulgaria	4.87	4.99	4.47	3.58	3.31	2.74

Based on the above findings, the following suggestions can be drawn to promote spices exports from the country.

- ❖ India has recorded comparative advantage in chilli exports in the Asian market against other competing countries. But in the world market, Peru has comparative advantage over India. Hence, India should focus on the export destinations in the Asian market like Malaysia, Sri Lanka and Vietnam where higher retention probability was attained in these countries after National Horticulture Mission.
- ❖ However, India has attained the back edge in pepper exports against Vietnam, Indonesia and Malaysia in the entire period and also Brazil in the recent years in the Asian market. So, India should shift its focus towards the countries where India got the upper hand in RCA.
- ❖ India enjoyed comparative advantage in turmeric exports in the world market against other competing countries during the entire study period but in the Asian market, India has faced challenges from Ethiopia. Therefore, India should maintain the turmeric exports in those countries where the demand for this commodity persists.
- ❖ Compound growth rate of almost all the Indian major spices registered positive growth rate in both export quantity and export value, but instability was also found high in these commodities. So, India should take necessary measures to stabilize spices exports from India.
- ❖ Even though India has been the largest exporter of cumin, coriander and processed products in the world, the country is now facing stiff competition from the other exporting countries. Besides this, the major importing countries also started the cultivation of these spices which leads to a serious setback to the country like India. Hence, India should explore new markets and should develop a network of market intelligence.
- ❖ Nowadays, the developed countries are more focused towards quality rather than quantity of products. Hence, concerted efforts are required in the direction of producing quality specific products which should be in line with the legal standards of the top importing countries.

CHAPTER V

SUMMARY

Across the world, the fast growing food industries rely mainly on spices owing to its taste and flavor. In other words, spices are considered as the basic building blocks of flavor in world food industry. Apart from flavor and taste, spices contain anti-oxidant, anti-microbial, anti-cancer and anti-biological properties. Health conscious consumers in advanced economies prefer more of natural ones to artificial flavours, medicines and drugs. Another noteworthy feature was that more than 90 per cent of spices produced in India were consumed in the country and remaining are exported as raw and value added products. But still, India is pioneer in export of spices and has not withheld its strong toe-hold in the world. Though India has monopoly in Spices cultivation over the years, but recently spices cultivation has spread to a number of other countries as well and the competition in spice trade has become fierce. In this context of new opportunities and challenges of Indian spice sector, a detailed study on growth and instability in major spices, direction of export trade and the determinants of spices export is necessary to continue as a monopoly of spices in the world. Hence, the present study was carried out in this perspective with the following specific objectives:

1. To estimate growth and instability in area, production and yield of major spices in India
2. To analyse the direction of trade of spices export in India.
3. To examine the factors influencing change in export of major spices in India.
4. To suggest suitable measures to promote the export of major spices in India.

Taking into consideration the objectives of the study in mind, time series data regarding area, production, yield, export, domestic prices, export prices and domestic consumption of major spices in major producing states of India and exchange rates were collected from various secondary sources such as Spice Board of India, uncomtrade.com, fao.org.in. The major spices were considered based on the coverage of 80 per cent of export value and the major states were decided on the basis of 70 per cent of production of the selected spices. Further, the area, production and yield of Chhattisgarh and Telangana were merged with the parent states i.e., Madhya Pradesh and Andhra Pradesh respectively in order to obtain the clear picture. The time frame considered for the study include 1995-96 to 2016-17. In order to assess the impact of National Horticulture Mission (NHM), the data was divided into two periods viz., pre-NHM period (1995-96 to 2005-06) and post-NHM period (2006-07 to 2016-17). Exponential growth function, Cuddy-Della Valle Index and Markov chain analysis were used to compute the compound growth rates, instability indices and direction of trade of Indian spices export respectively. Multiple regression analysis was employed in order to identify the major determinants of spices export from India. RCA and

CEP indices were calculated for all the major spices to know the comparative advantage of India against other competing countries.

At present, the total area under chilli cultivation in the country is 8.93 lakh hectares and Andhra Pradesh accounted for maximum contribution i.e., 2.57 lakh hectares during TE-2016-17. During the span of 22 years, Madhya Pradesh registered highest positive and significant growth rate in area and production, while Karnataka registered negative and significant growth rate in area and production owing to lower productivity and climatic conditions. Positively, average yield of chilli in the country has become more than doubled i.e., from 980 kg/ha to 2079 kg/ha during TE 1997-2017. Moreover, all the major states and the country as whole showed positive and significant growth rate in yield of chilli during the overall period. In case of pepper, Kerala accounts for maximum area and production, followed by Karnataka and Tamil Nadu during all the periods. But, Karnataka registered highest growth rate in area, production and yield on account of high yielding varieties and suitability of soil for pepper in this region of the country. However, Kerala registered negative and significant growth rate in area, production and yield during the overall period on account of stagnating yield over the decades. With reference to turmeric, positive growth rate was registered in all the three variables i.e., area, production and yield of almost all the major producing states of the country (except in yield of Gujarat and Tamil Nadu) during the overall period. Growth rate in area and production increased from pre-NHM period to post-NHM period in Maharashtra and Gujarat whereas rest of the states showed decline in growth rate. Furthermore, Gujarat and Maharashtra recorded highest yield of 17255 kg/ha and 11082 kg/ha respectively during TE 2016-17, which was more than the national average of 5006 kg/ha. In cumin, two states namely Gujarat and Rajasthan have equipped more than 90 per cent of area and production. During the span of 22 years, growth in area and production has increased dramatically in both the states i.e., Gujarat and Rajasthan as well as at the national level. Comparatively, Gujarat has shown highest growth rate in yield during the overall period, which made the state as the top producer of cumin in the country. Unlike cumin and pepper, all the major producing states of coriander registered negative growth rate in area during pre-NHM period, which improved after National Horticulture Mission. Andhra Pradesh recorded a sharp decline in area from 1.03 lakh ha to 0.33 lakh ha during TE 1997-2017 owing to the shift of coriander area to other alternative crops like tobacco, chilli etc., Rajasthan showed maximum contribution in area, production and yield during the study period.

In chilli, highest area instability was observed in Karnataka, followed by Andhra Pradesh and Madhya Pradesh. Positively, West Bengal recorded highest stability in area, production and yield of chilli during all the periods. However, Andhra Pradesh was the largest producer of chilli in the country and highest instability was recorded in this state on account

of pest attacks, larger production costs and price fluctuations in the domestic and international markets. In pepper, all the states showed highest instability in area, production and yield in post-NHM period over pre-NHM period on account of erratic climatic conditions, price fluctuations in domestic and international markets, which results in shift of pepper area to other crops. In case of turmeric, Maharashtra recorded as the highest instable state and Andhra Pradesh recorded as the most stable state in area, production and yield of turmeric in the country after NHM. At all India level, the instability in yield has declined after NHM. With special reference to cumin, the instability in area, production and yield was found to be highest in Rajasthan during the study period. However, both the states i.e., Rajasthan and Gujarat and at the national level has found lower instability in production and yield during post-NHM period over pre-NHM period owing to the stable prices of cumin seeds in the national and international markets. The same trend of declining instability after NHM was also registered in area of coriander at all India level and in all the major coriander producing states of the country except Andhra Pradesh. Besides this, Madhya Pradesh showed lower instability in production and yield during post-NHM period over pre-NHM period. These figures highlighted the importance of National Horticulture Mission due to which overall instability decreased in most of the states of the country. At present, spices account for nearly 8 per cent of total agricultural export earnings during 2016-17. Among the spices, chilli occupied the largest share followed by mint products and spice oils and oleoresins during 2016-17. Besides this, all the major spices except pepper have registered positive growth rate in both export quantity and export value during the study period. Moreover, stability was also observed in both export quantity and export value in all the major spices and total spices except cumin and processed spices in export quantity during post-NHM period over pre-NHM period.

Malaysia recorded as the most stable destination for Indian chilli during pre-NHM period with a retention probability of 43.43 per cent of its previous value. However, it had lost its major share to USA (19.2 per cent) and other competing countries (36.9 per cent). At the same time, Malaysia gained 99.54 per cent share from Vietnam and 57.1 per cent share from Bangladesh. During the same period, Thailand registered as the most unstable importer of Indian chilli with a zero retention probability. But the retention capacity of export destinations of Indian chilli increased during post-NHM period, which accentuate the impact of National Horticulture Mission. In case of pepper, USA was the loyal customer (retention probability of 69.8 per cent of its previous share) during pre-NHM period and Italy emerged as the most stable destination after NHM with 40.51 per cent probability and the remaining share lost to Canada (59.49 per cent). However, Canada recorded as the most unstable importer of Indian pepper even after NHM and had lost its 100 per cent share to other competing countries (82.68 per cent) and Italy (17.32 per cent). Regarding turmeric, Malaysia and USA were the

most stable markets in pre-NHM period and UAE and UK emerged as the loyal customers after NHM. Malaysia recorded as the most stable destination for both Indian cumin and coriander exports during pre-NHM period. But after National Horticulture Mission, the retention probability of Malaysia has declined in both the commodities i.e., Indian cumin (from 51.29 per cent to zero per cent) and coriander (from 69.06 per cent to 60.08 per cent). Vietnam, UAE, UK and Egypt were the most unstable importers of Indian cumin exports. Positively, Vietnam emerged as the safest destination for Indian cumin after National Horticulture Mission, retaining 82.86 per cent of its original share. South Africa and Saudi Arabia appeared to be the most unstable importer of Indian coriander exports even after National Horticulture Mission. In case of processed products like mint products and spice oils and oleoresins, the retention probabilities of China and USA (loyal customers) declined after NHM (except in mint products of China) owing to the increase of spices cultivation in China and USA had opt some of the newer markets in the world. Besides this, Netherlands and Singapore in mint products and South Korea in spice oils and oleoresins have registered as the most unstable importers even after NHM. Hence, India has to look for new and efficient markets in order to continue as a high foreign exchange earner of spices in the world.

The major determinants of Indian spices exports found in the study were lagged production and domestic consumption during the period of 2001 to 2016. Lagged production has shown positive and significant impact on Indian spices exports except pepper. However, domestic consumption has recorded negative impact on spices exports from India except chilli. Similarly, export price has registered negative and significant effect on pepper and coriander exports from the country. Besides this, domestic price has shown positive impact on Indian pepper and coriander exports, which led to the decrease of competitive ability in pepper and coriander exports to the world. While world export quantity has shown positive and significant influence on Indian chilli and coriander exports. On the other hand, exchange rate has minor influence on turmeric, cumin and coriander exports from the country.

Revealed comparative advantage (RCA) indices were calculated between India and other exporting countries for respective spices in the Asian market and Comparative export performance (CEP) of the major spices were calculated for top six exporting countries in the whole world from 2001 to 2016. The study found that India is the leading exporter of chilli in the world and has shown highest comparative advantage in the Asian market. But in the world market, Peru has comparative advantage over India. In case of pepper, Vietnam and Indonesia dominated the other exporting countries in the world market. Even, Brazil also emerged as the competitor to India in the Asian market in the recent years that was reflected in the RCA indices. Nevertheless, India has been the largest competitor and showing its toe-hold in the world market. Regarding turmeric, India has faced stiff competition from Peru in the Asian market. But in the whole world, India showed supremacy over other exporting countries. In

case of cumin and coriander, Syria has highest comparative advantage over other exporting countries including India. Besides this, Bulgaria and Ethiopia have shown comparative advantage over Indian coriander and Indian cumin in the Asian market respectively which were reflected in the RCA indices.

Conclusion

Based on the above discussion, it can be inferred that almost all the major spices except turmeric have recorded an increase in growth rate in production during post-NHM period compared to pre-NHM period. This increased growth rate in production is mainly attributed by increase in area in some spices (chilli and coriander) and increase in yield in another spices (cumin and pepper). Most of the spices registered instability in area on account of unfavourable weather conditions and price volatility in domestic and international markets. Positively, the share of Indian spices exports in total agricultural exports has nearly reached to 8 per cent. Besides this, compound growth rate of almost all the major spices in India registered positive growth rate in both export quantity and export value coupled with higher instability indices in these commodities. All the major spices except chilli have registered lesser retention probability in most of the major destinations after National Horticulture Mission. In case of processed products like mint products and spice oils and oleoresins, the retention probabilities of China and USA (loyal customers) declined after NHM (except in mint products of China) on account of the increase of spices cultivation in China and USA had opt some of the newer markets in the world. Lagged production has shown positive and significant impact on export, while domestic consumption has shown negative and significant impact on export of almost all the major spices. Other factors have played a minor role on Indian spices exports. India has enjoyed comparative advantage in turmeric exports in the world market and in chilli exports in the Asian market during the study period. India has been facing stiff competition in pepper exports against Vietnam, Indonesia and Malaysia and in coriander exports against Russia, Syria, Iran and Bulgaria and in cumin exports against Syria in the world market.

Policy implications

Keeping in mind the domestic and international demands, Government has changed the trade policies from time to time in order to boost the spices exports from India. In order to sustain and maintain the highest share as before, the following suggestions can help to a large extent.

1. In most of the spices, productivity has increased at a remarkable level on account of National Horticultural Mission. But still, efforts are required to exploit the full potential in productivity of all the spices as better yield may work out to be competitive in the world market.

2. Government has to fix competitive price in advance to encourage the farmers and priority should be given for promotional programmes to augment and stabilize the area under spices cultivation.
3. Even though India has been the largest exporter of cumin, coriander and processed products in the world, the country is now facing stiff competition from the other exporting countries. Hence, India should explore new markets and should develop a network of market intelligence.
4. Processing sector has to be given prior importance as processed products have more demand in the advanced countries.

REFERENCES

- Abolagba E O, Onyekwere N C, Abonkpolor B N and Umar H Y (2010) Determinants of agricultural exports. *J Hum Ecol* **29**: 181-84.
- Adhikari A, Sekhon M K and Kaur M (2016) Export of rice from India: Performance and determinants. *Agric Econ Res Rev* **29**: 135-50.
- Anonymous (2011) *Analysis of export of spices from India to Middle East*. Gulf cooperation council.
- Anonymous (2016a) *Percentage share of horticulture output in agriculture is more than 33 per cent*. Economic Survey 2015-16, Government of India, Ministry of Agriculture and Farmers Welfare.
- Anonymous (2016b) *Impact of National Horticulture Mission*. Economic Survey 2015-16, Government of India, Ministry of Agriculture and Farmers Welfare.
- Babu P H (2017) Export performance of spices in India: an empirical study. *Parikalpana KIIT J Management* **13**: 66-73.
- Boansi D (2014) Comparative performance of agricultural export trade: During and post-agricultural
- Cuddy J D A & Della Valle P A (1978) Measuring the instability of time series data. *Oxford Bulletin Economics and Statistics* **40**: 79-85.
- Devi G and Jadav K S (2018) Growth performance in area, production, productivity and export of spices in India. *ACTA Scientific Agric* **2**: 87-90.
- Devi I B, Srikala M, Ananda T and Subramanyam V (2016) Direction of trade and export competitiveness of chilli in India. *Agric Econ Res Rev* **29**: 267-72.
- Diversification project in Ghana. *British J Econ Management and Trade* **4**:1501-11.
- Ganesan R (2015) Growth and instability in area, production and productivity of turmeric in selected states in India. *J Management Sci* **5**: 13-23.
- Ibrahim Y.C. (2017). Impact of WTO and related policies on composition and direction of Indian spice export. *Int. J. Res. Econ. Social Sci.*, **7**: 20-29.
- Joshi D and Singh H P (2015) An empirical analysis of growth and instability in major spices in India. *Int J of Agric Sci* **7**: 440-44.
- Kannan E and Sundaram S (2011) Analysis of trends in India's agricultural growth. Institute for Social and Economic Change, Bangalore. *Working paper* **276**:1-21.
- Kannan M (2013) The determinants of production and export of natural rubber in india. *IOSR J Econ and Finance* **1**: 41-45.
- Krishnadas M (2010) *Production and export performance of major Indian spices- an economic analysis*. M.Sc.thesis, University of Agricultural Sciences, Dharwad, India.
- Krishnadas M and Mundinamani S M (2014) Changing direction of major spices exports from India. *Ind J Arecanut Spices and Medicinal plants* **13**: 20-24.

- Kumar A (2004) Export performance of Indian fisheries: strengths and challenges ahead. *Econ Pol wkly* **39**:4264-70.
- Kumar N R and Rai M (2007) Performance, competitiveness and determinants of tomato export from India. *Agri Econ Res Rev* **20**: 551-62.
- Kumar N R, Rai A B and Rai M (2008) Export of Cucumber and Gherkin from India: Performance, destinations, competitiveness and determinants. *Agri Econ Res Rev* **21**: 130-38.
- Lamba S, Midha K and Agrawal S (2015) Export of spices. *Int J Recent Research in Commerce Econ and Management* **2**: 256-66.
- Madisa M E, Obopile M and Assefa Y (2012) Analysis of horticulture trends in Botswana. *J Plant Studies* **1**: 25-32.
- Mandanna P K, Urs D S D and Achoth L (1998) Structural change in India's tobacco exports: A Markov chain approach. *Tropical Agric Res* **10**: 134-42.
- Mokashi P and Hosamani S B (2014) Direction of trade analysis of Indian grapes. *Int J Commerce and Business Management* **7**: 105-09.
- Okoruwa V O, Ogundare G O and Yusuf S A (2003) Determinants of traditional agricultural exports in Nigeria: an application of cointegration and correction model. *Quart J Int Agri* **4**: 427-38.
- Priscilla L, Balakrishnan A, Lalrinsangpuii and Chauhan A K (2017) A study on the performance of agriculture sector in India. *Ind J Agric Res* **51**: 282-86.
- Raju S R (2002). *Export performance of major spices in India*. Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.
- Rajur B C and Patil B L (2013) Export performance of chilli- An analysis. *J Agric Sci* **26**: 233-37.
- Rajur B C, Patil B L and Basavaraj H (2008) Growth performance of chilli in Karnataka. *Karnataka J Agric Sci* **21**:312-13.
- Ramachandra VA, Pavitra B S and Wader D G (2012) Production and export of chillies from India. *Agric Update* **7**: 136-41.
- Rao E P and Ankalam B (2018) Comparative export performance (CEP) and Revealed comparative advantage (RCA) of Paddy: with reference to India. *J Emerging Tech and Innovative Res* **5**:306-13.
- Renjini, V R (2012) *Growth and stability of foodgrain production in India with special reference to Punjab*. M.Sc. thesis, Punjab Agricultural University, Ludhiana.
- Shende, N V and Bhole B D (1999) Export potential for India's food grains. *Econ Affairs* **44**: 59-64.
- Sakamma S (2009) *Export trade of major spices of India- An economic analysis*. M.Sc. thesis, University of Agricultural Sciences, Bangalore, India.

- Shinoj P and Mathur V C (2008) Comparative advantage of India in agricultural exports vis-à-vis Asia: A post-reforms analysis. *Agric Econ Res Rev* **21**:60-66.
- Soumya C, Burark S S, Sharma L and Jain H K (2014) Growth and instability in production and export of selected spices of India. *Int J seed spices* **4**: 1-10.
- Spice Board of India (2017) *Monthly export statistics*. Ministry of Commerce and Industry, New Delhi, India.
- Suvagiya D, Shilpa V C, Parth S and Ardesna N J (2017) Growth performance of major vegetable crops in Gujarat state. *Agric Econ Res Rev* **30**: 139-49.
- Tewari H, Singh H P and Tripathi U (2017) Growth and instability in wheat production: A region wise analysis of Uttar Pradesh, India. *Int J Curr Microbiol App Sci* **6**: 2537-44.
- Thakur B (2012) Declining share of agriculture sector in GDP: A serious concern. *Int J Eng Res Tech* **1**: 1-9.
- Yanita M, Yazid M, Alamsyah Z and Mulyana A (2016) Determinant analysis of rubber export in Indonesia. *Int J Res Sci and Publications* **6**: 478-81.
- Yogesh M S and Mokshapathy S (2014a) Growth of Indian export and import of spices. *Int J Hum Arts Med Sci* **2**: 41-46.
- Yogesh M S and Mokshapathy S (2014b) An analysis of spices production in India. *Asian J Res in Business Econ and Management* **4**: 36-40.

Appendix I

Area, Production and yield of Chilli in major producing states of India from 1995-96 to 2016-17

YEAR	Andhra Pradesh			Madhya Pradesh			West Bengal			Karnataka			India		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1995-96	203.70	363.50	1784	42.1	16.4	389.5	58.60	49.80	850	188.50	108.10	573	883.70	809.70	916
1996-97	264.00	464.60	1760	42.2	15	355.5	58.90	49.70	844	190.70	121.90	639	956.50	945.50	988
1997-98	172.90	338.30	1957	48.9	23.7	484.7	64.00	55.60	869	163.60	130.80	800	840.60	870.10	1035
1998-99	222.50	525.00	2360	50	19.3	386.0	64.40	51.30	797	170.30	146.50	860	891.20	1043.20	1171
1999-00	267.80	496.10	1853	53.4	27.5	515.0	63.10	52.30	829	176.70	157.20	890	977.50	1056.00	1080
2000-01	238.00	526.20	2211	43.2	13.2	305.6	61.50	55.00	894	172.90	151.00	873	884.00	1046.20	1183
2001-02	224.80	591.40	2631	39.7	22.2	559.2	61.00	54.50	893	197.20	167.00	847	881.30	1113.10	1263
2002-03	223.80	408.80	1827	50.4	33.1	656.7	61.70	62.20	1008	161.9	153.44	948	831.60	907.00	1091
2003-04	250.00	797.00	3188	55.6	42.6	766.2	60.50	66.30	1096	69.90	94.50	1352	774.30	1235.70	1596
2004-05	237.00	749.00	3160	51.3	42.9	836.3	52.20	61.44	1177	69.90	94.50	1352	737.50	1185.50	1607
2005-06	172.00	538.00	3128	48.4	37.1	766.5	52.00	60.70	1167	69.90	94.50	1352	654.00	1014.60	1551
2006-07	214.00	766.00	3579	52.6	42.5	808.0	52.20	63.60	1218	132.20	148.0	1120	763.20	1242.10	1627
2007-08	223.00	772.00	3462	48.6	47.4	975.3	62.40	93.70	1502	136.00	155.00	1140	805.80	1297.90	1611
2008-09	210.80	781.70	3708	47.3	58.5	1236.8	63.20	96.00	1519	126.00	143.50	1139	802.90	1381.50	1721
2009-10	206.50	831.00	4024	54.4	90.6	1665.4	63.50	95.80	1509	138.70	144.00	1038	809.70	1470.40	1816
2010-11	195.50	638.30	3265	54.4	127.4	2341.9	63.60	96.20	1513	113.80	128.80	1132	716.40	1299.20	1814
2011-12	185.40	568.70	3067	60	96.4	1606.7	63.60	100.00	1572	133.40	153.10	1148	804.80	1276.30	1586
2012-13	212.40	688.90	3243	59.9	101.9	1701.2	63.60	100.00	1572	100.00	107.00	1070	794.10	1304.40	1643
2013-14	210.2	279.8	1331	59.4	95.3	1604.4	63.60	100.00	1572	89.60	111.60	1246	774.90	1492.10	1926
2014-15	208.3	992.9	4767	77	136.8	1776.6	63.60	100.00	1572	89.00	114.20	1283	761.00	1605.00	2109
2015-16	237.66	846.03	3560	77.05	136.84	1776.0	65.12	100.34	1541	95.45	118.49	1241	811.14	1520.39	1874
2016-17	326.2	1220	3740	90	140	1555.6	70.00	110.00	1571	102.30	103.20	1009	830.80	1872.00	2253

Note: Area in thousand hectares, Production in thousand tonnes and Yield in kg/ha and data compiled from various issues of Spice Board of India

Appendix II

Area, Production and yield of Pepper in major producing states of India from 1995-96 to 2016-17

YEAR	Karnataka			Kerala			Tamilnadu			India		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1995-96	3.6	0.9	250.0	190.8	59.9	313.9	3.2	0.7	218.8	198.0	61.6	311.1
1996-97	3.5	0.9	257.1	172.6	53.8	311.7	3.0	0.6	200.0	179.6	55.4	308.5
1997-98	3.8	0.9	236.8	173.9	55.5	319.1	3.4	0.8	235.3	181.5	57.3	315.7
1998-99	4.4	1.0	227.3	182.4	68.5	375.5	2.6	0.5	192.3	189.8	70.2	369.9
1999-00	6.9	1.7	246.4	198.4	47.5	239.4	4.0	0.9	225.0	209.7	50.1	238.9
2000-01	7.3	1.8	246.6	202.1	60.9	301.3	4.1	0.9	219.5	213.9	63.7	297.8
2001-02	9.7	2.2	226.8	204.0	58.2	285.3	4.1	0.9	219.5	218.2	61.5	281.9
2002-03	9.9	2.3	232.3	208.6	67.4	323.1	4.0	0.9	225.0	223.1	70.6	316.5
2003-04	13.8	3.9	282.6	216.4	69.0	318.9	4.2	0.9	214.3	235.4	74.3	315.6
2004-05	24.3	5.4	222.2	237.7	75.0	315.5	4.1	0.9	219.5	267.1	81.9	306.6
2005-06	14.8	12.0	810.8	238.0	33.5	140.8	5.2	4.5	865.4	260.2	50.0	192.2
2006-07	14.0	12.0	857.1	226.1	34.0	150.4	3.7	4.0	1081.1	246.0	50.0	203.3
2007-08	16.0	3.6	225.0	175.7	42.0	239.0	3.1	0.7	225.8	197.0	47.1	239.1
2008-09	18.8	6.2	329.8	153.7	34.0	221.2	3.1	0.7	225.8	181.3	50.0	275.8
2009-10	19.7	4.0	203.0	171.5	46.0	268.2	2.8	1.0	357.1	199.0	51.0	256.3
2010-11	21.1	18.0	853.1	172.2	21.0	122.0	3.0	9.0	3000.0	201.4	48.0	238.3
2011-12	20.0	5.5	275.0	170.3	31.7	186.1	3.8	0.8	210.5	200.3	40.6	202.7
2012-13	27.0	6.2	229.6	86.8	42.5	489.6	4.3	1.0	232.6	124.6	52.6	422.2
2013-14	28.3	8.0	282.7	84.9	38.7	455.8	4.3	1.0	232.6	123.8	50.9	411.1
2014-15	32.7	19.7	602.4	85.4	40.7	476.6	3.9	0.9	230.8	128.7	64.6	501.9
2015-16	32.7	19.2	587.4	84.8	30.5	359.1	4.0	0.9	221.9	128.6	54.6	424.9
2016-17	35.0	31.0	886.0	85.0	20.0	235.3	4.1	2.0	489.0	131.2	57.0	434.4

Note: Area in thousand hectares, Production in thousand tonnes and Yield in kg/ha and data compiled from various issues of Spice Board of India

Appendix III

Area, Production and yield of Turmeric in major producing states of India from 1995-96 to 2016-17

YEAR	Andhra Pradesh			Maharashtra			Tamilnadu			Karnataka			Gujarat			India		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1995-96	52.5	244.1	4649.5	7.3	9.3	1274.0	15.6	79.6	5102.6	4.7	20.6	4383.0	0.6	5.0	8333.3	139.3	462.9	3323.0
1996-97	51.9	308.2	5938.3	7.2	9.2	1277.8	15.2	99.6	6552.6	4.1	19.2	4682.9	0.4	11.0	27500.0	134.0	543.0	4052.2
1997-98	48.1	273.0	5675.7	7.3	9.1	1246.6	18.2	110.7	6082.4	4.3	24.1	5604.7	0.4	7.4	18500.0	139.7	549.2	3931.3
1998-99	60.0	309.2	5153.3	7.2	9.1	1263.9	24.8	126.0	5080.6	5.	25.4	5080.0	0.4	7.4	18500.0	160.7	598.3	3723.1
1999-00	64.2	312.6	4869.2	6.9	8.7	1260.9	32.5	167.4	5150.8	6.8	29.6	4352.9	0.3	6.4	21333.3	176.3	646.2	3665.3
2000-01	73.9	375.8	5085.3	6.9	8.7	1260.9	33.0	158.6	4806.1	9.3	41.0	4408.6	0.5	8.7	17400.0	187.4	719.6	3839.9
2001-02	61.7	249.5	4043.8	6.8	8.5	1250.0	23.6	118.3	5012.7	6.7	35.6	5313.4	0.7	12.2	17428.6	163.0	552.3	3388.3
2002-03	56.8	283.5	4991.2	6.6	8.2	1242.4	17.3	64.5	3728.3	6.2	30.2	4871.0	0.8	14.7	18375.0	149.4	528.0	3534.1
2003-04	58.4	320.7	5491.4	6.8	8.5	1250.0	16.2	67.3	4154.3	8.1	47.4	5851.9	1.0	11.2	11200.0	153.4	587.1	3827.2
2004-05	60.4	417.8	6917.2	6.8	8.5	1250.0	21.6	118.5	5486.1	10.9	60.0	5504.6	1.0	14.1	14100.0	164.1	751.9	4582.0
2005-06	70.0	518.6	7408.6	6.8	8.4	1235.3	26.0	143.4	5515.4	6.4	33.9	5296.9	1.4	16.5	11785.7	173.7	870.1	5009.2
2006-07	65.0	401.0	6169.2	7.0	9.0	1285.7	30.5	175.4	5750.8	7.5	37.8	5040.0	1.0	14.1	14100.0	178.5	786.8	4407.8
2007-08	63.0	416.0	6603.2	7.0	8.0	1142.9	27.3	146.0	5348.0	8.5	64.7	7611.8	1.0	14.1	14100.0	175.3	794.4	4531.7
2008-09	61.6	403.2	6545.5	6.8	8.5	1250.0	34.6	172.3	4979.8	15.3	93.8	6130.7	1.7	23.3	13705.9	190.7	877.2	4599.9
2009-10	59.5	364.0	6117.6	6.8	8.6	1264.7	33.4	169.3	5068.9	17.9	65.8	3676.0	1.8	25.0	13888.9	184.4	918.9	4983.2
2010-11	69.2	466.9	6747.1	13.9	66.8	4805.8	51.4	278.0	5408.6	18.0	90.4	5022.2	1.9	28.5	15000.0	222.9	1237.4	5551.4
2011-12	75.0	485.0	6466.7	6.8	8.4	1235.3	60.2	326.1	5416.9	15.9	100.0	6289.3	3.0	50.5	16833.3	218.7	1166.8	5335.2
2012-13	67.8	423.2	6241.9	11.0	11.0	1000.0	35.8	190.1	5310.1	16.1	100.0	6211.2	3.0	50.5	16833.3	194.2	986.8	5081.4
2013-14	67.4	404.0	5994.1	11.0	11.0	1000.0	77.0	462.0	6000.0	14.0	65.4	4671.4	3.0	50.5	16833.3	232.7	1189.9	5113.5
2014-15	60.0	359.5	5991.7	13.5	32.1	2377.8	32.0	117.4	3668.8	13.4	63.6	4746.3	3.2	52.1	16281.3	184.4	830.4	4503.3
2015-16	59.6	305.4	5127.8	9.6	136.9	14242.5	34.7	132.4	3812.3	12.8	76.8	5989.1	3.6	69.3	19507.0	185.9	943.3	5074.2
2016-17	66.6	389.1	5842.3	10.7	177.9	16626.2	29.3	112.6	3843.0	15.0	76.5	5100.0	4.1	65.5	15975.6	193.4	1052.1	5440.0

Note: Area in thousand hectares, Production in thousand tonnes and Yield in kg/ha and data compiled from various issues of Spice Board of India

Appendix IV

Area, Production and yield of Cumin in major producing states of India from 1995-96 to 2016-17

YEAR	Gujarat			Rajasthan			India		
	A	P	Y	A	P	Y	A	P	Y
1995-96	94.5	39.2	414.8	125.8	36.0	286.2	220.3	75.3	341.8
1996-97	108.9	51.4	472.0	198.1	65.7	331.7	307.0	117.1	381.4
1997-98	120.9	58.2	481.4	167.9	57.1	340.1	288.8	115.3	399.2
1998-99	116.3	51.7	444.5	147.7	56.1	379.8	264.0	107.9	408.5
1999-00	108.7	35.4	325.7	138.7	35.4	255.2	247.4	70.8	286.2
2000-01	115.9	62.6	539.9	199.8	76.8	384.1	315.8	139.4	441.3
2001-02	145.1	61.3	422.5	381.5	145.1	380.3	526.6	206.4	391.9
2002-03	200.1	64.3	321.3	321.2	70.5	219.4	521.3	134.8	258.5
2003-04	203.0	82.0	403.9	227.8	121.0	531.0	430.8	203.0	471.1
2004-05	200.0	107.0	535.0	321.2	69.1	215.1	521.3	176.1	337.8
2005-06	267.9	147.6	551.0	135.1	52.2	386.4	403.0	199.9	496.0
2006-07	259.2	152.8	589.5	149.8	23.7	158.2	409.0	176.5	431.5
2007-08	262.5	198.5	756.3	215.5	66.4	308.0	477.9	264.9	554.2
2008-09	359.9	242.2	673.0	165.7	39.4	237.8	527.1	283.0	536.9
2009-10	311.8	221.9	711.7	203.9	80.5	394.8	517.1	303.9	587.7
2010-11	292.8	219.2	748.6	330.6	114.9	347.5	625.1	473.0	756.7
2011-12	373.9	283.3	757.7	468.0	177.8	379.9	843.4	462.6	548.5
2012-13	373.9	283.3	757.7	220.0	111.0	504.5	594.0	394.3	663.8
2013-14	370.0	280.0	756.8	488.0	233.8	479.1	858.9	513.9	598.3
2014-15	454.9	364.7	801.7	434.8	120.8	277.8	889.8	485.5	545.6
2015-16	295.4	300.9	1018.6	511.1	200.9	393.1	808.0	503.3	622.8
2016-17	278.7	284.0	1019.0	479.7	200.0	416.9	760.2	485.5	638.6

Note: Area in thousand hectares, Production in thousand tonnes and Yield in kg/ha and data compiled from various issues of Spice Board of India

Appendix V

Area, Production and yield of Coriander in major producing states of India from 1995-96 to 2016-17

YEAR	Andhra Pradesh			Madhya Pradesh			Rajasthan			India		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1995-96	77.0	15.2	197.4	113.4	40.0	352.7	137.7	116.4	845.3	407.6	196.1	481.1
1996-97	76.8	25.1	326.8	113.2	43.1	380.7	154.9	153.5	991.0	412.5	243.1	589.3
1997-98	154.8	28.3	182.8	196.5	73.5	374.0	232.6	214.9	923.9	656.5	337.7	514.4
1998-99	81.0	26.0	321.0	174.4	65.1	373.3	198.2	179.6	906.2	525.8	292.4	556.1
1999-00	58.9	11.8	200.3	157.6	61.9	392.8	124.2	127.8	1029.0	418.2	235.6	563.5
2000-01	58.4	20.0	342.5	94.7	27.5	290.4	145.1	166.3	1146.1	358.1	235.2	656.7
2001-02	57.9	22.7	392.1	103.8	38.0	366.1	204.7	234.0	1143.1	433.4	318.7	735.3
2002-03	45.1	13.7	303.8	62.0	12.7	204.8	112.3	122.7	1092.6	302.5	189.0	624.8
2003-04	48.7	16.0	328.5	129.1	48.2	373.4	241.4	286.4	1186.4	509.0	405.4	796.5
2004-05	24.0	9.3	387.5	140.5	53.6	381.5	148.4	169.8	1144.2	396.3	296.1	747.2
2005-06	28.1	12.7	452.0	105.4	39.2	371.9	136.8	142.4	1040.9	357.0	257.1	720.2
2006-07	25.4	10.1	397.6	120.6	51.0	422.9	131.1	155.1	1182.7	362.9	289.6	798.0
2007-08	24.0	10.0	416.7	98.3	31.2	317.4	212.8	245.4	1153.2	384.2	309.6	805.8
2008-09	33.4	15.6	467.1	141.4	59.1	417.8	250.5	280.3	1118.9	537.0	362.0	674.1
2009-10	37.5	20.6	549.8	150.5	70.9	471.0	232.1	281.1	1210.8	531.0	472.0	888.9
2010-11	20.3	13.8	677.0	150.5	70.9	471.0	197.9	218.9	1106.1	474.0	502.0	1059.1
2011-12	20.8	26.0	1250.0	178.2	82.9	465.2	260.0	311.0	1196.2	557.9	533.0	955.4
2012-13	20.8	26.0	1250.0	177.9	82.8	465.4	250.0	300.0	1200.0	543.2	523.9	964.5
2013-14	9.9	5.9	596.0	163.0	75.8	465.0	182.7	117.1	640.9	447.1	313.7	701.6
2014-15	41.8	21.2	507.2	146.7	94.9	647.0	249.3	198.8	797.4	552.7	461.7	835.4
2015-16	26.4	10.8	409.5	167.8	109.2	650.9	212.7	227.2	1068.0	581.6	585.0	1005.8
2016-17	33.8	16.0	473.4	203.0	103.5	509.9	214.4	211.9	988.3	662.5	609.4	919.8

Note: Area in thousand hectares, Production in thousand tonnes and Yield in kg/ha and data compiled from various issues of Spice Board of India

Appendix VI

Country-wise export of Chilli from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	Malaysia	Bangladesh	Sri Lanka	U.S.A	Vietnam	Thailand	Others	Total
1995-96	805.3	3348.7	3096.8	3359.1	0.0	86.1	8850.1	19546.2
1996-97	2443.4	68.2	1843.2	4206.5	0.2	314.9	11268.7	20145.2
1997-98	426.5	0.0	716.2	4801.1	0.1	11.1	7892.5	13847.4
1998-99	605.3	4454.4	7302.7	4408.2	0.0	13.7	8503.0	25287.3
1999-00	2128.2	1828.5	5986.8	6488.8	0.0	14.8	9024.6	25471.6
2000-01	738.6	334.2	6182.2	6822.2	0.0	45.9	8850.2	22973.3
2001-02	1066.7	856.9	6996.9	7573.3	0.0	37.4	8712.8	25244.0
2002-03	1496.3	4600.0	7854.2	8676.6	0.0	36.2	8851.5	31514.7
2003-04	3891.5	4986.3	9086.6	7418.1	5.3	93.4	11206.6	36687.8
2004-05	9443.5	7184.9	8130.4	10286.6	14.4	106.4	14736.7	49902.9
2005-06	8955.9	166.0	7482.2	8592.0	2.5	171.2	14930.7	40300.5
2006-07	25133.2	15507.7	11228.6	8328.2	493.8	387.1	19696.4	80775.0
2007-08	30520.7	16120.3	13501.1	12956.9	2738.6	1544.3	32368.1	109750.0
2008-09	26072.1	1023.3	19628.0	12881.6	231.6	5434.6	42823.8	108094.9
2009-10	32303.7	15157.9	19441.6	15137.3	3142.7	5110.1	38879.5	129172.8
2010-11	35642.0	18207.9	19728.6	13801.2	2399.9	1850.8	61923.5	153554.0
2011-12	37544.9	14176.9	31955.7	17626.3	3132.5	10782.0	99189.7	214408.0
2012-13	31579.2	13212.9	22479.9	27728.6	36201.1	26234.7	80624.4	238060.9
2013-14	36416.9	32647.9	28679.8	29080.7	35856.7	30141.2	79404.0	272227.2
2014-15	38144.9	32977.1	38783.8	31652.5	63537.4	45184.4	101429.9	351710.0
2015-16	40031.3	5614.2	50120.2	37846.5	78560.0	70671.4	110326.4	393170.0
2016-17	44187.5	32720.0	52053.0	39172.2	95929.4	96101.2	146911.7	507075.0

Source: Data compiled from various issues of Spice Board of India

Appendix VII

Country-wise export of Pepper from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	USA	Germany	Netherlands	UK	Canada	Italy	Others	Total
1995-96	5408.7	947.7	573.9	811.9	1159.1	1745.0	8983.5	19629.8
1996-97	21938.6	1279.0	2558.1	1246.3	1906.9	1628.5	10674.3	41231.8
1997-98	21970.7	1717.1	1575.7	1982.4	2396.2	2871.1	16228.2	48741.3
1998-99	30925.4	2093.9	2625.2	2635.3	4148.5	2767.7	18283.8	63479.9
1999-00	51097.2	2354.1	4922.1	2823.0	5113.6	3084.1	19133.9	88528.0
2000-01	18840.8	1359.8	3211.2	2288.2	2188.9	1971.7	8221.1	38081.6
2001-02	9950.6	830.7	719.5	883.6	1732.7	1603.8	4647.9	20368.8
2002-03	7298.1	1157.3	994.2	915.6	1733.7	1235.9	4553.2	17888.0
2003-04	4833.6	975.4	620.7	1160.5	726.3	851.5	5109.0	14277.0
2004-05	3647.1	1218.8	363.1	1268.8	748.5	727.2	4197.5	12171.0
2005-06	5368.5	1649.3	175.5	1769.1	801.7	617.5	4713.4	15095.0
2006-07	14408.1	1633.1	747.0	2048.2	1261.8	1314.7	9207.1	30620.0
2007-08	21149.9	2741.2	816.2	2583.5	2119.3	2289.5	20250.4	51950.0
2008-09	16325.3	2031.8	705.3	2869.1	1944.5	1928.0	15570.0	41374.0
2009-10	13149.9	1945.6	594.4	2908.0	1379.4	1249.1	10166.2	31392.5
2010-11	13883.4	1333.4	804.2	3273.6	2111.3	1807.1	15105.7	38318.5
2011-12	30979.2	3842.3	1802.7	4972.9	2785.9	3544.0	39886.4	87813.4
2012-13	29589.6	3358.9	1905.1	5658.2	2062.0	1574.4	19662.2	63810.3
2013-14	42069.3	5987.7	4555.6	8049.3	2802.0	3381.7	27156.8	94002.3
2014-15	54465.3	9468.1	5952.5	11765.8	2454.7	1354.8	35381.0	120842.2
2015-16	65961.2	14456.8	10027.1	14904.3	3677.5	3373.2	60641.4	173041.5
2016-17	58200.0	7905.8	4203.3	11495.1	2487.4	2488.4	27532.5	114312.5

Source: Data compiled from various issues of Spice Board of India

Appendix VIII

Country-wise export of Turmeric from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	USA	Malaysi a	Iran	Banglades h	UAE	UK	Others	Total
1995-96	684.8	115.4	490.3	147.6	647.6	348.6	2186.0	4620.3
1996-97	767.5	236.7	438.2	219.2	885.6	537.9	2759.4	5844.6
1997-98	975.5	226.9	1086.0	567.3	1157.2	552.0	3450.3	8015.0
1998-99	1268.5	290.6	326.3	1309.8	2508.0	814.7	6396.6	12914.5
1999-00	1276.7	418.0	661.0	1343.0	2421.1	683.5	5548.6	12351.8
2000-01	1195.0	413.7	627.6	2067.5	1269.0	626.2	5358.7	11557.6
2001-02	1007.5	382.9	469.1	1178.9	980.6	608.9	4445.8	9073.7
2002-03	1329.1	696.8	212.6	289.9	1295.3	713.9	5800.4	10338.0
2003-04	1310.3	897.1	149.3	815.6	2244.9	898.6	6795.9	13111.7
2004-05	1417.9	1003.0	250.2	1678.3	1594.2	1134.9	8546.5	15625.0
2005-06	1425.1	1028.5	373.6	1491.3	1963.5	1076.3	7927.7	15286.0
2006-07	1378.8	761.4	1456.8	1037.8	2042.4	1069.2	8733.6	16480.0
2007-08	1206.2	910.5	939.6	695.0	1442.7	856.2	9649.8	15700.0
2008-09	1643.0	1747.6	1974.2	1615.2	3040.6	1518.3	13319.1	24858.0
2009-10	1880.8	2678.0	3008.7	2535.3	4638.6	2180.4	21201.1	38123.0
2010-11	3916.3	6700.4	3724.1	3281.6	11184.5	3060.8	38417.4	70285.1
2011-12	5216.7	3807.3	3117.3	7540.9	12781.7	2537.4	38433.1	73434.4
2012-13	5410.2	3786.4	3946.5	3021.3	5281.1	2480.2	31562.0	55487.7
2013-14	5279.3	6800.6	8281.8	1206.2	4460.3	2737.5	37910.2	66675.9
2014-15	6064.9	5222.3	7281.0	5045.1	5148.1	3358.0	42315.7	74435.0
2015-16	9388.5	6593.1	11975.4	2478.4	5298.5	4410.7	52020.4	92165.0
2016-17	11410.4	6408.7	13575.5	10464.8	7646.3	5473.0	69210.3	124189.0

Source: Data compiled from various issues of Spice Board of India

Appendix IX

Country-wise export of Cumin from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	USA	Vietnam	UAE	UK	Malaysia	Egypt	Others	Total
1995-96	163.4	0.0	19.0	189.3	17.2	0.0	1350.4	1739.3
1996-97	516.4	0.0	200.3	200.1	151.4	10.9	2358.7	3437.8
1997-98	1467.1	0.5	654.8	443.7	308.8	227.8	4825.8	7928.4
1998-99	873.4	0.0	177.9	537.4	183.6	71.8	4136.7	5980.9
1999-00	380.6	0.0	78.7	498.8	335.0	81.5	3344.5	4719.0
2000-01	1852.6	0.0	1291.8	1324.7	1058.5	95.9	12211.8	17835.3
2001-02	1729.3	0.3	425.2	933.7	1387.9	57.7	10283.8	14818.0
2002-03	1545.5	0.0	126.2	1193.8	864.1	3.7	5593.0	9326.3
2003-04	554.6	0.0	271.2	1093.8	670.9	13.5	3279.8	5883.8
2004-05	1342.6	0.0	694.0	1214.7	1727.8	0.0	6549.9	11529.0
2005-06	1582.4	111.5	347.5	1324.2	1007.2	42.5	5403.8	9819.1
2006-07	3182.5	3041.5	1186.4	1568.8	1017.7	47.6	10105.5	20150.0
2007-08	3202.8	748.0	2708.8	2115.1	1250.2	831.4	18293.7	29150.0
2008-09	4012.1	374.7	4466.8	3052.9	2337.6	1793.9	38361.9	54400.0
2009-10	4821.5	1.3	6224.9	3990.8	3425.1	2756.4	33604.6	54824.5
2010-11	2979.9	8.3	2150.7	3242.8	2061.5	349.3	28805.3	39597.7
2011-12	7108.3	9460.1	8277.3	3432.7	3257.4	2318.2	30588.1	64442.0
2012-13	14185.7	15169.6	10832.5	4430.2	4162.9	7077.4	59448.3	115306.6
2013-14	12601.5	51013.8	13053.5	5428.8	4895.2	8485.1	64528.2	160006.0
2014-15	14971.9	53541.6	22400.1	5485.3	4966.8	9950.7	72503.8	183820.0
2015-16	17964.2	37492.0	8551.3	7323.9	6537.4	6063.2	72766.9	156699.0
2016-17	21961.6	65333.1	13399.1	7853.0	6981.9	3819.6	76971.8	196320.0

Source: Data compiled from various issues of Spice Board of India

Appendix X

Country-wise export of Coriander from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	South Africa	Saudi Arabia	UAE	UK	Malaysia	Pakistan	Others	Total
1995-96	222.4	88.4	297.9	136.8	585.8	15.4	896.6	2243.3
1996-97	225.0	50.2	329.9	210.3	882.7	34.0	1404.5	3136.6
1997-98	459.4	227.8	848.0	450.2	1307.5	36.7	2596.4	5926.1
1998-99	362.0	173.1	555.1	322.4	1215.6	26.9	1892.1	4547.1
1999-00	263.2	45.4	358.9	268.3	1246.7	0.0	1163.7	3346.1
2000-01	314.3	134.9	306.4	261.3	1608.5	1.7	1109.4	3736.4
2001-02	262.4	92.0	252.7	307.4	1804.9	1.1	2113.4	4833.9
2002-03	265.3	253.8	412.6	538.8	2083.6	2.2	2008.3	5564.6
2003-04	281.9	568.7	793.0	674.0	2337.0	63.7	2482.7	7201.0
2004-05	278.1	857.7	906.4	617.0	1563.2	1648.5	2338.2	8209.1
2005-06	308.5	390.5	712.3	598.5	2366.5	707.6	1686.8	6770.7
2006-07	141.8	450.8	1091.1	781.7	2188.0	352.9	2455.7	7462.0
2007-08	778.1	847.4	1849.1	1003.4	2111.5	405.0	4030.5	11025.0
2008-09	919.6	1454.4	2532.1	1332.2	3243.0	2438.6	8459.2	20379.0
2009-10	1061.1	2061.4	3215.0	1661.0	4374.5	4472.1	5740.4	22585.5
2010-11	1148.3	1105.3	2142.0	1427.3	3450.0	977.8	6412.7	16663.3
2011-12	910.4	1653.1	2197.5	1249.5	5376.5	765.5	4249.5	16401.8
2012-13	1381.5	1771.9	2891.8	1264.2	5180.5	713.7	6979.1	20182.6
2013-14	2174.2	2318.3	2911.6	2221.1	10857.9	1821.9	14880.7	37185.7
2014-15	2845.5	2409.0	3903.0	3220.8	13440.8	4271.7	19721.7	49812.5
2015-16	1990.7	2161.9	4699.7	3223.6	13534.2	3196.4	13874.0	42680.5
2016-17	2250.5	1748.8	3067.4	2680.6	10635.8	2121.1	6703.3	29207.5

Source: Data compiled from various issues of Spice Board of India

Appendix XI

Country-wise export of Mint products from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	China	U.S.A	Netherlands	Germany	Singapore	France	Others	Total
1995-96	0.0	1777.5	135.2	172.6	510.4	640.0	1514.4	4750.1
1996-97	0.0	4598.9	99.2	684.0	716.9	765.3	6585.2	13449.5
1997-98	394.9	2431.4	106.9	677.9	788.2	989.2	4205.0	9593.6
1998-99	205.1	2726.8	55.6	543.4	3336.6	1012.1	4498.0	12377.6
1999-00	100.1	3145.5	126.0	1723.1	1623.1	1083.6	4788.8	12590.1
2000-01	3031.7	2938.7	286.8	964.6	2557.5	932.4	4786.7	15498.2
2001-02	9796.0	8699.7	859.9	7052.0	5179.3	1430.1	15457.4	48474.3
2002-03	11547.6	10979.6	753.7	6251.3	6729.7	2161.3	18134.8	56557.9
2003-04	6269.7	10932.1	1479.2	4266.1	2618.4	1667.1	12202.9	39435.5
2004-05	11151.2	14025.2	1688.4	5777.3	3200.5	2162.1	12214.0	50218.7
2005-06	20893.6	21270.4	2059.1	7287.1	7373.2	3415.6	19021.6	81320.6
2006-07	30365.7	28005.6	4472.6	12519.6	8954.5	2214.8	23562.2	110095.0
2007-08	31284.8	28115.6	3922.6	10569.8	14959.1	1812.4	37385.7	128050.0
2008-09	34344.7	26876.1	4075.3	9046.1	12732.2	2439.7	52511.0	142025.0
2009-10	37404.7	25636.6	4228.0	7522.3	10505.3	3067.0	30608.2	118972.0
2010-11	54559.3	31444.0	5265.6	12078.2	13695.1	2218.1	50418.7	169679.0
2011-12	70176.8	52416.2	16091.2	14210.7	19498.3	2321.9	47657.0	222372.0
2012-13	170298.2	78918.7	19934.1	15209.1	29235.3	9707.8	70746.4	394049.5
2013-14	160273.9	62727.8	16697.0	13233.3	14233.0	8525.3	67351.9	343042.2
2014-15	118684.8	74740.6	6460.9	8745.6	10247.8	8190.2	41855.1	268925.0
2015-16	90342.8	63288.4	8828.5	13303.8	18224.7	10956.7	52814.2	257759.0
2016-17	94955.5	41629.2	12490.5	8810.5	7505.0	8398.2	78961.1	252750.0

Source: Data compiled from various issues of Spice Board of India

Appendix XII

Country-wise export of Spice oils and oleoresins from India during 1995-96 to 2016-17

(Rs. in lakhs)

Year	China	USA	Japan	Germany	South Korea	UK	Others	Total
1995-96	0.0	4978.4	704.6	1197.2	169.6	1053.2	8103.1	11501.8
1996-97	8.0	7203.3	1665.8	989.9	411.0	1403.8	11681.8	15901.2
1997-98	55.5	7713.0	3131.8	2123.7	549.6	1762.0	15335.6	22321.5
1998-99	77.0	9951.5	2728.5	2915.1	817.2	2804.9	10792.3	30086.6
1999-00	178.0	11610.1	3272.2	2570.2	827.5	3549.3	10742.8	32750.1
2000-01	181.9	11281.0	5422.8	3312.9	977.6	2859.1	15336.2	39371.3
2001-02	217.3	11523.5	6085.8	2675.1	963.2	2859.3	12986.9	37311.1
2002-03	326.9	11198.3	5158.2	2621.2	1017.3	2629.1	16143.2	39094.2
2003-04	706.7	10551.5	3925.1	3793.5	1741.6	2533.8	14739.6	37991.8
2004-05	993.9	10937.3	6204.9	4530.9	2290.2	3144.1	18829.5	46930.8
2005-06	1237.9	13993.9	5768.2	5665.5	2194.2	2883.0	18814.6	50557.3
2006-07	1283.0	16120.4	4526.3	5881.2	2015.3	3203.3	18049.5	51079.0
2007-08	2238.9	15003.0	3405.0	6454.0	2475.3	3442.9	23280.9	56300.0
2008-09	2727.0	17475.6	4069.5	7335.3	3076.4	4437.0	32929.3	72050.0
2009-10	3215.1	19948.1	4733.9	8216.7	3677.5	5431.0	25652.7	70875.0
2010-11	3703.2	22420.7	5398.4	9098.0	4278.7	6425.1	39738.5	91062.5
2011-12	4191.3	31941.1	6121.6	14410.4	4879.8	8784.2	60109.8	130438.1
2012-13	21036.3	36816.4	4851.0	15602.0	4874.9	8086.9	64620.6	155888.2
2013-14	23467.3	48531.9	5449.1	11784.6	7570.6	9523.7	66997.6	173324.9
2014-15	14808.1	55858.4	6114.1	10646.8	8564.3	10431.0	84667.3	191090.0
2015-16	24936.9	61125.7	5675.7	11307.3	7438.5	8966.8	94804.0	214255.0
2016-17	18920.4	78693.0	7169.3	15201.5	12378.7	11711.5	86700.7	230775.0

Source: Data compiled from various issues of Spice Board of India

Appendix XIII

Domestic prices of major spices in India from 1995-96 to 2016-17

(Rs/kg)

Year	Chilli	Pepper	Turmeric	Coriander	Cumin
	Guntur market	Cochin market	Cochin market	Mumbai market	Mumbai market
1995-96	31.78	77.08	24.32	16.89	47.17
1996-97	29.24	83.75	31.11	30.41	62.01
1997-98	19.01	173.43	42.58	26.67	51.80
1998-99	35.43	206.03	60.36	16.41	57.65
1999-00	27.91	215.02	42.74	16.74	67.46
2000-01	21.53	174.24	30.57	24.40	108.65
2001-02	22.17	80.39	26.90	26.36	114.43
2002-03	31.98	88.32	41.91	25.94	81.44
2003-04	38.74	74.11	48.22	27.88	66.30
2004-05	31.24	69.08	52.78	24.26	68.31
2005-06	24.70	66.44	49.45	25.97	64.47
2006-07	44.58	100.50	41.82	33.37	77.00
2007-08	40.60	140.16	26.76	40.77	98.57
2008-09	48.11	129.30	43.39	66.98	101.05
2009-10	50.74	136.42	71.76	42.00	107.06
2010-11	54.54	197.05	130.31	35.19	122.81
2011-12	69.83	318.77	103.02	50.02	138.92
2012-13	51.74	398.18	66.02	53.91	150.66
2013-14	67.06	448.29	99.08	79.29	139.01
2014-15	68.66	686.64	104.17	113.88	127.95
2015-16	98.35	655.22	122.92	108.19	167.04
2016-17	97.68	694.77	152.92	85.03	190.76

Source: Data compiled from various issues of Spice Board of India

Appendix XIV

Domestic consumption of major spices in India from 2000-01 to 2016-17

(Quantity in Tonnes)

Year	Chilli	Cumin	Pepper	Turmeric	Coriander
2001-02	1044216	190123	44951	514642	303182
2002-03	827616	127831	64383	496911	171572
2003-04	1150550	196373	71964	552106	385262
2004-05	1048107	161466	85485	710418	263738
2005-06	902359	187927	49507	827717	235182
2006-07	1095195	151691	36951	742303	271370
2007-08	1089375	238860	25600	749800	284600
2008-09	1194320	230640	35500	827225	334830
2009-10	1267700	255750	49350	872600	426200
2010-11	1059650	441015	45250	1192050	462415
2011-12	1037040	417765	31465	1089625	508675
2012-13	1004625	308818	52837	900782	492468
2013-14	1180180	392970	45330	1119750	272590
2014-15	1258275	330200	64450	753700	425450
2015-16	1173315	407480	45905	870130	570185
2016-17	1472805	369300	59665	949750	623585

Source: Data compiled from various issues of Spice Board of India

Appendix XV

Country wise agricultural exports to the world from 2001 to 2016

(Billion US dollars)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brazil	16.0	16.7	20.9	27.2	30.7	34.6	42.5	57.1	52.4	63.3	80.8	79.5	83.2	80.1	72.5	69.5
Bulgaria	0.6	0.7	0.8	1.0	1.2	1.5	1.6	2.8	2.7	3.4	4.3	4.1	5.2	4.7	4.0	4.2
China	15.1	16.4	18.4	18.4	21.3	23.5	28.6	32.2	32.4	39.3	46.7	48.5	51.5	55.3	55.9	59.4
Ethiopia	0.2	0.3	0.4	0.5	0.8	0.9	1.0	1.3	1.3	1.7	2.0	2.2	3.1	3.6	3.3	2.2
Germany	23.6	25.3	31.6	37.7	40.9	45.7	55.7	68.9	61.6	64.7	77.4	76.4	81.2	81.9	70.1	71.7
India	4.9	5.2	6.1	6.6	8.4	10.5	15.9	16.3	14.6	18.3	27.8	35.5	38.1	31.3	24.5	22.7
Indonesia	4.3	6.2	6.9	9.3	10.8	14.0	17.1	27.4	21.1	30.5	41.4	37.9	34.5	35.9	32.3	31.4
Iran	1.0	1.1	1.6	1.4	1.9	2.6	3.2	3.1	1.5	5.2	4.7	4.1	4.5	2.1	1.8	1.6
Italy	15.4	17.1	20.4	24.1	24.9	27.4	31.1	36.6	32.9	35.5	40.4	39.4	42.6	43.6	39.1	40.7
Lithuania	0.5	0.5	0.7	1.0	1.3	1.6	2.4	3.3	2.7	3.1	4.0	4.8	5.4	5.2	4.2	4.0
Malaysia	5.4	7.2	9.4	10.6	10.4	12.5	17.2	23.0	16.8	23.5	32.5	28.3	24.7	24.6	20.5	20.3
Mexico	7.0	7.4	8.1	9.2	10.0	12.5	13.7	15.1	14.7	16.3	20.0	20.6	22.5	23.4	24.4	27.0
Netherlands	27.1	31.7	40.9	46.4	49.2	53.0	65.4	75.9	71.3	74.4	86.1	82.7	87.0	81.9	70.8	76.1
Peru	0.6	0.7	0.8	1.1	1.3	1.7	1.9	2.5	2.4	3.1	4.4	4.0	4.0	4.6	4.5	4.9
USSR	1.1	1.8	2.3	2.1	3.3	4.2	7.6	7.8	7.5	5.8	9.1	14.0	13.1	15.8	13.1	13.7
Spain	14.1	16.0	20.9	23.6	24.3	26.0	30.2	35.6	31.7	34.3	39.7	41.2	44.3	46.2	41.5	44.0
Syria	0.6	0.7	0.7	0.7	0.6	1.4	1.7	2.2	2.3	2.3	0.8	0.5	0.6	0.5	0.3	0.4
Turkey	4.0	3.4	4.7	5.9	7.6	6.2	6.4	10.2	10.2	11.5	13.6	14.3	16.1	17.2	16.0	15.4
UK	12.7	14.0	16.4	20.4	20.7	18.7	21.9	24.1	21.3	23.7	28.1	28.0	28.6	29.2	26.3	25.2
Vietnam	2.0	2.1	2.5	3.3	3.6	4.3	5.6	7.7	7.3	10.5	13.8	14.6	10.2	12.8	12.8	12.9
World	413.0	441.5	524.1	602.7	649.2	716.2	869.7	1061.7	949.7	1085.1	1319.5	1334.1	1391.6	1407.2	1267.5	1277.8

Source: Data compiled from faostat.org

Appendix XVI

Country wise total merchandise exports to the world from 2001 to 2016

(Billion US dollars)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
China	266.1	325.6	438.2	593.3	762.0	968.9	1220.1	1430.7	1201.6	1577.8	1898.4	2048.8	2209.0	2342.3	2273.5	2097.6
USA	729.1	693.1	724.7	814.8	901.0	1037.0	1162.5	1299.9	1056.7	1278.1	1481.7	1544.9	1577.6	1619.7	1501.8	1451.0
Germany	571.4	616.0	748.5	911.7	977.1	1122.0	1328.8	1466.1	1127.8	1271.1	1482.2	1410.1	1451.0	1498.2	1328.5	1340.8
Netherlands	216.2	219.8	264.8	318.0	349.8	400.7	477.6	545.9	431.5	492.6	530.6	552.5	571.2	672.8	570.7	570.9
Italy	244.3	254.2	299.5	353.5	373.0	417.2	500.2	541.8	406.5	446.8	523.3	501.5	518.1	530.0	457.5	461.7
UK	279.4	286.0	312.1	355.0	392.7	458.6	454.0	482.0	359.6	422.0	517.3	481.2	548.0	511.1	466.3	411.5
Mexico	158.4	160.8	164.9	188.0	214.2	250.0	271.8	291.3	229.7	298.3	349.3	370.7	379.9	396.9	380.5	373.9
USSR	99.9	106.7	133.7	181.6	241.5	301.6	352.3	468.0	301.8	397.1	517.0	524.8	527.3	497.8	343.9	285.5
Spain	116.1	125.9	156.0	182.7	192.8	214.1	253.8	279.2	223.1	246.3	298.2	285.9	311.0	324.6	282.5	290.0
India	43.9	50.1	59.4	75.9	100.4	121.2	145.9	181.9	176.8	220.4	301.5	289.6	336.6	317.5	264.4	260.3
Viet Nam	15.0	16.7	20.1	26.5	32.4	39.8	48.6	62.7	57.1	72.2	96.9	114.5	132.0	150.2	162.0	176.6
Malaysia	88.0	93.3	105.0	126.6	141.6	160.7	176.0	198.7	157.2	198.8	227.0	227.4	228.3	234.1	200.2	189.4
Brazil	58.3	60.4	73.2	96.7	118.5	137.8	160.6	197.9	153.0	201.9	256.0	242.6	242.0	225.1	191.1	185.2
Indonesia	56.3	57.2	61.1	71.6	85.7	100.8	114.1	137.0	116.5	157.8	203.5	190.0	182.6	176.0	150.4	144.5
UAE	–	–	–	–	115.5	–	156.6	210.0	–	–	–	350.1	379.5	380.3	333.4	298.7
Turkey	31.3	35.8	47.3	63.1	73.5	85.5	107.3	132.0	102.1	113.9	134.9	152.5	151.8	157.6	143.9	142.5
Iran	23.9	28.2	33.8	44.6	60.0	63.2	83.5	107.2	77.6	108.6	137.4	132.7	92.1	90.3	60.0	83.1
Peru	6.8	7.7	9.0	12.7	17.1	23.8	28.1	31.3	26.7	35.8	46.4	46.4	42.6	38.6	33.7	36.3
Lithuania	4.6	5.5	7.2	9.3	12.1	14.1	17.2	23.8	16.5	20.8	28.1	29.7	32.6	32.4	25.4	25.0
Bulgaria	5.1	5.7	7.5	9.9	11.7	15.1	18.6	22.5	16.5	20.6	28.2	26.7	29.5	29.3	25.4	26.6
Myanmar	–	–	–	–	–	–	–	–	–	7.6	8.1	9.1	11.4	11.5	12.2	11.7
Ethiopia	0.4	0.4	0.5	0.6	0.9	1.0	1.3	1.6	1.6	2.3	2.6	2.7	2.6	3.0	2.7	2.6
Syria	20.8	26.9	23.6	22.2	6.4	10.9	11.5	14.4	9.7	11.4	8.0	2.3	1.5	1.1	0.9	0.8
World	6127.5	6424.4	7486.2	9100.0	10340.9	11956.3	13832.3	15978.3	12348.7	15094.3	18083.4	18388.1	18871.4	18998.3	16559.7	16036.0

Appendix XVII

Item wise world spices exports from 2001 to 2016

(Thousand US dollars)

Year	Chilli	Pepper	Turmeric	Cumin	Coriander
2001	341712	66920	24630	293129	35793
2002	376717	68433	31217	460969	43878
2003	448864	80501	39729	247698	53403
2004	577891	95114	47161	167844	59927
2005	601631	104948	53588	109354	50606
2006	633905	111698	53948	244648	60506
2007	864884	192497	56072	347054	100435
2008	954691	228101	82474	280772	154224
2009	930492	205507	105872	231189	145487
2010	979114	240683	204760	213105	160215
2011	1314424	360352	259843	317368	141169
2012	1299241	408946	162567	326958	131828
2013	1157060	438713	166481	382624	167680
2014	1386923	530418	157947	424678	227687
2015	1439920	607514	189498	394990	240409
2016	1674736	646207	254076	459034	210558

Source: Data compiled from uncomtade.com

Appendix XVIII

Maximum Residual Limits (MRL's) for export of spices and spice products set by USA and European Union

Country/Region	Spices & spice products	Parameter	Maximum limit
European Union	Chilli Whole Turmeric Whole Ginger Whole & Ginger Products Nutmeg Whole & Nutmeg products Mace Whole & Mace Products Chilli Powder & Chilli Products Turmeric Powder & Products Curry Powder & Curry Masalas Curry Pastes & Pickles	Aflatoxin Sudan I –IV	Aflatoxin B1 - 5 ppb Aflatoxin Total - 10 ppb Not Detected
	Curry Leaves	Profenofos Triazophos Endosulfan	<0.05 mg/kg (ppm) <0.01 mg/kg (ppm) <0.05 mg/kg (ppm)
	Cumin Seeds	Extraneous matter Other Seeds	3.00 % Max. 0.25 % Max
USA	Chilli Whole	Aflatoxin Salmonella	Aflatoxin Total – 20 ppb Absent in 25g
	Chilli Powder & Chilli Products Curry Powder & Curry Masalas Curry Pastes & Pickles Turmeric Powder	Aflatoxin Sudan I –IV Salmonella Sudan I –IV	Aflatoxin Total- 20 ppb Not Detected Absent in 25g Not Detected
	Cumin Seeds	Extraneous matter Other Seeds Salmonella	3% max 0.25% max Absent in 25g

Source: Data collected from Spice Board of India

Appendix XIX

1. Maximum Residual Limits (MRL's) of pesticides in spices and spices products as per the standards set by Japan

(Values in ppm)

Pesticide	Chilli Whole	Chilli Powder & Curry Powder	Cumin seeds & ground	Turmeric whole & powder	Cardamom whole & ground	Black pepper whole & ground	Fenugreek whole & ground
Iprobenfos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Profenofos	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Triazophos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethion	<5.00	<5.00	<3.00	<0.30	<5.00	<5.00	<3.00
phorate	<0.10	<0.10	<0.50	<0.10	<0.10	<0.10	<0.50
Parathion	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
Chlorpyrifos	<1.00	<1.00	<5.00	<1.00	<1.00	<1.00	<5.00
Methyl Parathion	<5.00	<5.00	<5.00	<3.00	<5.00	<5.00	<5.00

Source: Data collected from Spice Board of India

2. Number of US FDA import detentions of spices exports from India from 2013 to 2018

Product	No. of refusals	Reason	Manufacturer States
Chilli	23	Salmonella, Pesticide	Karnataka, Maharashtra, Gujarat, Haryana
Cumin	1	Salmonella	West Bengal
Pepper	2	Pesticide	Tamil Nadu
Turmeric	3	Salmonella	Maharashtra, Haryana, Kerala
Coriander	10	Salmonella	Kerala, Delhi, Maharashtra
Herbals and Botanicals	25	Pesticide, Misbranding	Himachal Pradesh, Rajasthan, Tamil Nadu, Karnataka
Mixed spices & seasoning	58	Salmonella, Adulteration	Rajasthan, Kerala, Andhra Pradesh, Gujarat, Maharashtra
Others	31	Salmonella, Pesticide, labelling, misbranding	Gujarat, Haryana, Kerala, Tamil Nadu, Maharashtra, New Delhi

Source: Data compiled from US FDA database, <http://www.accessdata.fda.gov/scripts/importrefusals>

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