EXPORT PERFORMANCE OF APPLE IN INDIA

THESIS

Submitted to
Dr.PanjabraoDeshmukhKrishiVidyapeeth, Akola
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DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"EXPORT PERFORMANCE OF APPLE IN INDIA"** or part thereof has neither been submitted for any other degree or diploma at any university, nor the data have been derived from any thesis / publication of any university or scientific organization. The source of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola
Date: / /2018

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CERTIFICATE

This is to certify that the thesis entitled **"EXPORT PERFORMANCE OF APPLE IN INDIA"** submitted in partial fulfilment of the requirements for the degree of **"Master of Science in Agricultural Economics& Statistics)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **SAYED BASHIR S/O SAYED MOHAMMAD AMIN** under my guidance and supervision.

The subject of the thesis has been approved by the student's Advisory Committee.

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(A) List of Tables

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(C) Abbreviations

Agril	-	Agricultural
CDI	-	Cuddy and Della Index
CGR	-	Compound Growth Rate
CV	-	Coefficient of Variation
Dr. PDKV	-	Dr.PanjabraoDeshmukhKrishiVidyapeeth, Akola
e.g.	-	Exampli gratia (For example)
et al.	-	Et alia (and others)
etc.	-	Et cetra
NPC	-	Nominal Protection Coefficient
Ha	-	Hectare
i.e.	-	That is
kg.	-	Kilogram
MT	-	Metric tones
No.	-	Number (s)
El	-	Theil’s entropy
pb	-	Border price
pd	-	Domestic price
Rs.	-	Rupees
Viz.,	-	Videlicet (namely)

(D) THESIS ABSTRACT

a)	**Title of the thesis**	**:**	**EXPORT PERFORMANCE OF APPLE IN INDIA**
b)	**Full name of student**	**:**	**SAYED BASHIR S/O SAYED MOHAMMAD AMIN**
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ABSTRACT

The present study explores the export performance of Apple in India from 1990-91 to 2016-17. The following specific objectives were considered to accomplish the study: To study the performance of area, production, and productivity of Apple in India, to study the export performance of Apple, to examine the market share and concentration of export of Apple, to study the export and competitiveness of Apple.

The calculation depicted that, the growth of the area of Applein India was continuously increasing at a rate of 0.95 per cent 1.93 per cent and

1.84 per cent in the first, the second and third period respectively. During the overall reference period for 27 years of the study, the coefficient of variation in the area under Apple was calculated at 16.84 per cent. On the other hand, the study was conducted on major Apple producing states under the area of cultivation in India viz., Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, and other minor producing states in India.

In the third period, Jammu & Kashmir growth rate was increased at a growth rate of 3.65 per cent followed by other minor states with a negative growth rate of 3.10 per cent, Arunachal Pradesh with 3.04 per cent, and Himachal Pradesh with 1.98 per cent at 1 per cent level of significance.

The state wise productivity growth a rate of Jammu & Kashmir was increased in the third period than the first and second period. Arunachal Pradesh growth rate was decreased in the third period but in the first period it was negatively increased at 1 per cent level of significance, and in the second period, it was significant at 5 per cent level of significance.

The CGR for Apple production in other minor states were negatively increased with 6.44per cent, Jammu & Kashmir was increased at a rate of 4.12 per cent followed by Himachal Pradesh with 3.79 per cent at 1 percent level of significance, and Arunachal Pradesh growth was non-significance, during the third period.

The total national export was increased with a growth rate of 17.44 per cent and agricultural export a with growth rate of 15.08 per cent and Apple export with a growth rate of 14.58 percent, the share of agricultural export has decreased to 12.30 per cent in 2016-17 from 18.49 per cent in 1990-91.

The studied conduct on export value of Apple in major countries, Bangladesh, Nepal, United Arabic Emirate, and other minor countries in the world. During the third study period, Nepal with a growth rate of 41.35 per cent, Bangladesh with 10.94 per cent were increased at 1 per cent level of significance. United Arabic Emirate and other minor countries were non-

significant growth rate. But during the third period, there was a positive growth rate with 12.73 per cent, at 1 per cent level of significance.

There was the most diversified market for Apple export quantity in 2016-17 at a rate of 0.49 per cent with value rate of 0.33 per cent and the market competition for India Apple export quantity increased in the same year at a rate of 0.33 per cent with the value of 0.48 per cent per annum.

The countries likeBangladesh and Nepal wouldbethestableimportersofIndianAppleinthefuture, and countries like UAE and other minor countries were least stable importers. The level of domestic price related to international price was much lower, which facilitated export advantages but except in 1999-00, 2016-17, during the twenty-seven years (1990-91 to 2016-17) of the study period.

CHAPTER I

INTRODUCTION

The agriculture sector is considered as the bedrock of Indian Economy and more than 50 per cent workforce is still dependent on agriculture for livelihood, despite structural changes taking place. Presently agriculture sector (including livestock) is contributing 17.32 per cent to the Gross Domestic Product (GDP) at the National level, and 20.59 per cent to GSDP (at current prices) but it is still the main source of livelihood for the majority of the rustic people. Therefore, the rapid growth of agriculture is indispensable for faster inclusive and sustainable growth, nearly 65 per cent countries population thereby making agriculture the lifeblood of our existence. Therefore agricultural growth needs to be pooled up in the interest of the stable & sustainable growth of the entire economy and provides employment to around two-thirds of nation's population. Agricultural commodity export accounts for nearly 20 per cent of the total export earnings of the country.

India is the second largest producer of fruits next to China and fifth largest producer of Apple in the world. But India's share in the global market is still nearly 1 per cent only, there is increasing acceptance of horticulture produce from the country. India having diverse agro-climatic conditions, produces many important fruits both for domestic consumption and export. The horticulture sector has emerged as an essential part of agriculture, offering a wide range of option to the farmers for crop diversification. It also provides plentiful opportunities for sustaining a large number of agro-industries which generate substantial employment opportunities. The horticulture sector contributes about 24.5 per cent the agriculture GDP from about 8 per cent of the area. Fruits play an important role in providing food and nutritional security as well as sustainable income to farmers. Presently, the area under fruit crops is at 6.7 million hectares with a production of 76.4 million tonnes, which contributes to about 30 per cent share in the total production of horticulture produce. Production of fruit is expected to reach about 115 million tonnes by 2017. The most fruit crops, being perennial in identity and character, call for utmost care in the

selection of varieties and quality planting crops material. Mistakes committed during the initial establishment of the orchard cannot be corrected and will cause serious loss of production and productivity.

The Indian Apple market also provides an example of the potential implications of import liberalization for domestic producers in emerging markets. Import liberalization for agricultural products, such as Apples, has been a cause for concern among Indian farm policy makers who is primarily focused on the welfare of domestic producers. An important finding of this study is that Indian Apple producers appear not to have been adversely affected by imports because the relatively high quality and price of imported Apples make them imperfect substitutes for domestic Apples. Instead, the presence of imported Apples indicates an opportunity for domestic growers to increase earnings by improving quality to compete with imported Apples.

History

Central Asia was one the earliest place which Apple cultivation recorded, maybe around the Caspian and Black seas (Hancock et al., 2008), where the main wild ancestor of all cultivated Apple, Malus sieversii (the Asian wild Apple), and other wild species (including M. sylvestris and M. pumila) still grow today. It is assumed that the place of origin and centre of varieties of the genus Malus is Central Asia around Turkestan, which today is Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan and Tajikistan (Hokanson et al., 1997; Harris et al., 2002; Velasco et al., 2010). Thus Apple trees most aerialist cultivated and over thousands of years than other fruit, selection has improved the fruit recent genetic studies suggest that the local variety of Apple (Malus x domestica), although largely originating from the Asian wild Apple received genetic material from several wild Apple species from both Asia and Europe (Cornille et al., 2012), which arrived over the trade routes and by way of human migration and settlement. Apple was introduced in India by the British in the Kullu Valley of the Himalayan State of H.P. as far back as 1865, while the coloured ‘Delicious’ cultivars of Apple were introduced to Shimla hills of the same State in the 1917 year.

India scenario

India's production is expected to improve, rising to 43.67 million tonnes on favourable growing conditions; export are projected to remain steady at 22,550.513 tonnes in 2016-17. Apple is the most important temperate fruit of the north-western Himalayan region in India. It is predominantly grown in Jammu & Kashmir, Himachal Pradesh, Uttara Khand, and some hilly areas of Uttar Pradesh accounting for about 90 per cent of the total production. In Himachal Pradesh, the Apple production starts from upper Shimla till the higher altitudes. The Apple growing areas in India do not take place in the temperate zone of the world but the predominant temperate climate of the region is primarily due to snow-covered Himalayan ranges and high altitude which helps meet the chilling requirement during winter season extending from mid-December to mid-March. The Apple average production in India is 5.5 tonnes per hectare whereas globally in countries like Australia, New Zealand, and the United States and European countries it ranges from 60 to 70 tonnes per hectare. Even in China, it is 2.5 times more than India. Though the climatic conditions and farming techniques in these countries are different, a lot can be done and productivity can be doubled from the present production if India adopts an approach which is integrated into nature. There are some fundamental problems in the Apple growing regions of Himachal Pradesh spanning from the scarcity of water, the absence of good agricultural practices, the absence of technological solutions, ineffective management of Apple orchards, the absence of quality training and capacity building etc. A holistic solution was needed which could address the larger issues of the region and would bring changes in the lives of the community.

Apple production

India is the fifth largest Apple producer in the world its area is estimated to be the second largest in the world, while its average yield, about 5.5 tonnes3 per hectare, is the lowest of the major world producers. Production is concentrated in a few regions of northern India where the climate suits production of temperate zone crops, such as Apples. Indian Apple-producing regions are exposed to the variable precipitation

associated with the subcontinent's monsoon climate, and producers also must contend with substantial annual fluctuations in producer prices.

Demand for Apple

Although production and consumption are small in per capita terms, India is one of the largest producer and consumer of Apples in the world. Growth in both production and consumption has been sluggish despite rising incomes. Apple demand is responsive to changes in both income and price, and demand for domestic and, particularly, imported Apples is likely slowed by their high price relative to other fruits.

Estimates of the income and price responsiveness of apple demand

To project and analyze trends in the Indian Apple market, it is important to understand the strength of the relationships between Apple demand, income growth, and Apple prices. Available estimates confirm that Apple demand is sensitive to changes in both incomes and prices. Sikka and Azad (1991) estimated income elasticity of demand for Indian fruit ranging between 0.11 and 1.31. Mango consumption was the most responsive to changes in income, followed by Apple consumption. Devadoss and Wahl (2004) reported an income elasticity of demand for domestic Apples in India of 1.05. Regression analysis based on 26 years of data on per capita Apple consumption and real per capita income results in an income elasticity of demand estimate of 1.06, consistent with these other findings.

Devadoss and Wahl (2004) also provided an estimate of the responsiveness of Apple consumption to changes in price, estimating an own-price elasticity of demand based on wholesale price data of -0.53. This is the only available estimate of the own-price elasticity of demand for Apples in India and indicates that, on average, a one per cent increase in Apple prices results in about a 0.53 per cent decline in the quantity consumed. Estimates of the relationship between the prices of other fruit and Apple consumption (cross-price elasticity's of demand) are not available but could be expected to show a significant response as budget-

constrained consumers adjust their fruit purchases based on changes in relative prices.

Consumption growth

India's per capita Apple consumption of about 1.35 kgs per year is low relative to other major producing countries because Apple is a relatively high-priced fruit in India, consumption is largely confined to the higher-income segments of the population. More than 60 per cent of India's total income is shared by only 40 per cent of the population (Gupta, 2001) Pingali and Khwaja (2004) note the concept of income-induced diet diversification, where economic prosperity enables consumers to afford a more varied and balanced diet and also to demand nutritionally superior food products. Increased workforce participation by women is also contributing to rising household incomes, particularly in urban areas. New dietary habits emerging in India reflect global patterns and could be quite unlike the habits that developed locally over many generations. Consumers are exhibiting a preference for diversifying their diets to include a broader variety of foods. Since the early 1990s, non-staple foods, including dairy products, meats, edible oils, and fruit and vegetables, have been the fastest-growing categories of food consumption. Although growth in Apple consumption has remained sluggish, overall consumption of fruit grew about 5 per cent annually during the 1990s.

Apple marketing

Almost all Apples produced in India are used for fresh consumption, with only small quantities used for processing into products such as Apple juice, jelly, or jam. Although there are a few government agencies and cooperatives, such as the Himachal Pradesh Horticulture Produce Marketing and Processing Corporation (HPMC), involved in Apple marketing, most Apples are sold through private marketing channels comprised of a large number of small-scale brokers and merchants. Information collected during field research suggests that India's Apple marketing system entails significant marketing costs and, particularly, significant marketing margins for both domestic and imported Apples.

Global export scenario

Global sales from Apple export by country amounted to US$7.2 billion in 2016. Overall, the value of Apple export was down by an average minus 0.40 per cent for all exporting countries since 2012 when Apple shipments were valued at $7.2 billion. Year over year, the value of global Apple export appreciated by 3.1 per cent from 2015 to 2016. Among continents, European countries accounted for the highest dollar worth of Apple export during 2016 with shipments valued at $2.8 billion or 38.7 per cent of the global total. In second place were Asian exporters at 25 per cent while 13.6 per cent of worldwide Apple shipments originated from North America. Latin America (excluding Mexico) and the Caribbean furnished 10.6 per cent worth of goods, 7 per cent came from Oceania countries.

Importance of the study

Apple is one of the most widely cultivated tree fruits and the third most internationally traded fruit behind only bananas and grapes. Apple is commonly consumed not only because of their flavour but also because of the important nutrients that it contain, including high levels of antioxidants, vitamins, and dietary fiber. Apple trees are deciduous and grow in temperate regions of the world. However, Apple' popularity is global: they are consumed worldwide in greater quantities than any other temperate region tree fruit, such as peaches and pears. Apple is a widely grown and consumed fresh and juice that has got the good international market. A large group of market participants is engaged in different activities in the entire value chain of Apple right from production to its consumption. Prices show considerable volatility that could pose profit risk to different stakeholders. Due to high marketing cost involved in the marketing of Apple, it reinforces the need for risk management tool. India got fifth rank produce of Apple of in the world, yet there are few studies throwing light on various facets of Apple. In the era of globalization, a reassessment of supply potential, domestic and international demand scenarios and export potential becomes most essential. Keeping in view the above points, the present study is an attempt to analyze production, export potential of Apple

in India since it is also one of the major producers of Apple in the world. The study will also help planners and policy makers to frame appropriate policies related to Apple production, marketing, and export.

1.2 **Objectives**

1. To study the performance of area, production, and productivity of Apple in India.
2. To study the export performance of Apple.
3. To examine the market share and concentration of export of Apple.
4. To study the export and competitiveness of Apple.

1.3 Hypothesis

1. The production of Apple is inconsistent.
2. There is positive growth in export performance of Apple from India.
3. There is scope to increase the export of Apple from India.

1.4 **Limitations of the study**

The present study has been done based on the secondary data collected from various published sources. Often data from various sources may not agree with each other and some efforts to choose the better among them are inevitable. Care has been taken to avoid personal bias in such decision. However, the limitations inherent in the secondary data were to be recognized.

CHAPTER II

REVIEW OF LITERATURE

With a view to evaluating the objectives of the study, it was considered desirable to have an idea of the findings of some earlier researchers and the methods adopted for arriving at the same. Such a review of literature connected with the main objectives of the study, it is hoped, would provide a basis either for confirming the earlier findings or for contradicting the same and thereby to suggest points of departure for further studies.

Consistent with the objectives of the study, the review of literature is presented in this chapter under the following heads:

2.1 Production and export performance of Apple.

2.2 Instability analysis of Apple.

2.3 Market share and concentration of export of Apple.

2.4 Competitiveness of Apple in India.

2.1. Production and export performance of Apple.

Lal and Lavanya (1984) evaluated the growth rates of major crops in Uttar Pradesh. Maize, wheat, potato, bajra and barley were selected for study from the period of 1959-60 to 1973-74. The growth rate was highest in maize production. Except for barley, all food grain crops showed significant growth of production.

Using the modified exponential growth function, log Yt = a + bt + e, Prakash (1986) studied the growth rates of production, consumption and export of Indian coffee. During the year 1962-63 to 1981-82, the production of coffee increased by 4.51 per cent per annum. The growth rate of consumption was calculated to be 1.69 per cent per annum during the same period. However, there was a significant increase in export during the study period recording 6.94 per cent compound growth rate per annum.

Sharma and Gandhi (1990) evaluated the growth rates of food grain production in India. They examined annual compound growth for the period 1950 to 1984. The study revealed a declined growth rate of production during the year 1975-76 to 1983-84. However, the 2.6 per cent of overall growth rate per annum indicated a sustained recovery. Area led growth rate depicted declining potential while yield based growth rate showed increasing potential during 1975-76 to 1983-84.

Chand and Tewari (1991) used an exponential trend equation and evaluated the growth of Indian export and imports of agricultural commodities. They concluded that the growth in agricultural export and imports was much lower than the growth of export and imports in total merchandise.

Veena (1992) examined the growth of Indian coffee export using exponential function analysis, $Y= ab^t$ from the period of 1965-1990. She concluded that export of Coffea Arabica exhibited the compound growth rate of 3.0 per cent per annum while the plantation type grew at 3.6 per cent. Also, the C. robusta exhibited 10 per cent compound growth.

Jalajaskshi (1994) studied export of shrimp from India from 1966 to 1991. Exponential model of the type $Y= ab^t$ was used to work out the growth rates. Foreign shrimp exoprt recorded a positive growth rate due to high demand in the importing countries. The negative growth rate observed for dried and canned shrimps were attributed to declining demand in the importing countries and increased cost of production in India.

Mamatha (1995) estimated the growth rates of production and export of selected spices for the period from 1970-71 to 1991-92. The spices considered were pepper, chillies, turmeric and ginger. She found that positive growth rate in respect of production and export of the selected spices was due to the increased domestic production and demand for these species in the international market. The increased domestic production and export were attributed to the several measures taken by the spice board such as improved methods of production, assistance for the

export of spices by setting up facilities for upgrading the quality and technical advice on scientific post-harvest operation and processing.

Ananthi (2000) analysed the growth of area production, productivity and export of Indian Non-basmati and basmati rice. The growth rates were calculated by sub-dividing the study period into 1949-50 to 1969-70 as first period and 1970-71 to 1997-98 as the second period. The area, production and productivity showed a positive trend. For the export, the study period considered was 1980-81 to 1998-99 for Basmati and non-basmati rice. The growth rate was also positive and significant.

Angles (2001) studied the production and export of turmeric in south India. He found that all the states registered significant growth in the area, production and productivity, except in the case of the area in Tamil Nadu and Kerala, production in Tamil Nadu and productivity in Karnataka. The analysis of price trend in important markets of south India revealed an increasing trend in all the markets.

Jayesh (2001) studied the production and export performance of pepper and cardamom in south India. He found that all the south Indian states except Karnataka 0.47 per cent and Tamil Nadu 1.62 per cent recorded significant negative growth in area and production of pepper and in case of cardamom, all the states recorded a negative growth in the area, while the productivity and production showed significant growth. A positive growth was found in the export quantity, value and unit value of pepper. But a negative growth was recorded in the export of cardamom.

Smita and Patil (2006) studied the trends in the export of grapes from India. The compound growth rate for the number of grapes exported was 12.05 per cent per annum. With respect to a value obtained from the export of grapes, the corresponding compound growth rate indicated an increase of 22 per cent per annum.

Sadesh et.al, (2007) analyzed the export performance of Indian spices during pre- and post-WTO era. He found that there was a higher growth in export of spices from India during the pre-WTO period compared to the magnitude of the post-WTO period. There was a significant reduction

in instability in exoprt of spices during the latter period, mainly in the quantum of exoprt.

Jose and Jayasekhar (2008) studied the growth trends in area, production and productivity of Arecanut in India during the period from 1971 to 2004. It revealed that the area and the production of Arecanut in India increased tremendously at the rate of 2.20 per cent and 3.20 per cent respectively. The rate of increase in both area and production is mainly due to favourable price prevailed during the period.

Sharad and Shekhar (2008) studied the status of silk production in India during the period from 1980-81 to 2004-05. It revealed that the pattern of growth in area under mulberry cultivation has increased with significant rate of 0.25 per cent. The production and productivity of raw silk showed high significant growth of 5.06 per cent and 4.80 per cent respectively. The production of raw silk has increased mainly due to high yielding mulberry varieties and silk worm breed. The above reviews revealed that most of the researchers had investigated various aspects of the growth of area, production, export and related aspects in various crops by computing the compound growth rate. Exponential growth function of the form $Y = ab^t$ was used and found different results based on the time series data which they had used for the specific crop and crop groups.

Dhakre and Sharma (2009) analysed the growth and instability analysis of ginger production in North-East region for the period of 1992-93 to 2004-05. The results of the study showed that during the period North-East has shown the significant growth rates in production was 26.72 per cent and productivity of ginger with 6.77 per cent. In case of area, the growth rate was positive 11.91 per cent but not significant. During the period the region recorded instability in the area, production and productivity of 204.20, 10.46, 29.43 per cent respectively and decomposition analysis showed that area instability was the dominant factor affecting production.

Mendhe and Degaonkar (2010) studied the detailed analyses of the export trade of chilli using Markov chain analysis. The study revealed that

there is huge scope to expand the export of chilli to Malaysia, Sri Lanka, Singapore, USA, UK and other countries.

Singh (2010) studied the trends in the area, production and yield of potato during 1950-51 to 2006-07 in India. The growth in value of output from potato and its comparison with fruits and vegetables and the total value of output from agriculture was estimated during 1999-2000 to 2005-06 in major potato growing states in India. The study observed that the annual compound growth in the area, production and yield was lowest in the post-WTO period (1997-2006) in comparison to any sub-period or entire period of the study. The analysis of the export composition of potato products revealed that the share of potatoes, fresh or chilled, and potatoes other than seed potatoes, fresh/chilled, declined while the share of flakes, granules and pellets of potatoes had increased substantially during 2003-07.

Angles et al. (2011) evaluated the production and export performance of turmeric in India using secondary data for the period from 1974-75 to 2007-08 and exponential form of growth function. The growth in production and export of turmeric reported significant, because of the high demand coupled with inflation. Instability index was worked for the production and export for pre-liberalization and post-liberalization periods. Instability was observed high for production, export and prices of domestic and international markets and domestic and international prices showed high integration.

Gyati Riku et al. (2011) estimated the growth rate in area, production and productivity of ginger in Meghalaya during 1998-99 to 2007-08, the results of the study revealed that the area under ginger with growth rate of 2.35 per cent and production with 1.58 per cent showed a positive growth rate while the productivity of ginger showed a declining negative trend over the year 0.78 per cent.

Veeranagouda et al. (2011) studied the growth rate scenario of chilli in northern Karnataka. The study revealed that northern Karnataka as a whole registered positive compound growth rate for the area with 13.76 per

cent, production at the rate of 13.88 per cent and productivity with 12.20 per cent. These registered values were non-significant at both ten and five per cent level of significance.

De et al. (2012) studied the cumulative growth rate of vegetable productivity in India. The cumulative growth was observed 31.8 per cent of onion production, 22.8 per cent growth of tomato and negative growth rate of 11.3 per cent in potato crop during the post-WTO regime. The impressive growth rate of vegetable export from India at 9.8 per cent per annum was recorded in last decade. The analysis of quantum share of export to total production was found to be very low, particularly in potato and tomato crops when compared to other vegetables.

Ashoka et al. (2013) examined the growth, instability and direction of chilli trade in India. They studied the growth, instability in the area, production and productivity and direction of trade of chilli from India compound growth rate analysis, Instability analysis and Markov chain analysis. The results indicated that the growth in area under chilli was negative, while production showed increasing growth due to increased productivity. The sources of instability in chilli production were found to be changed in area variance and change in yield variance. Malaysia, Sri Lanka, United Arab Emirates and Indonesia were found to be the loyal markets for Indian chillies. The influence of export price and production on the changes in the export of chilli was positive, but the influence of domestic price was negative.

Naik and Hosamani (2013) studied Growth and export dimensions of Indian turmeric for the period 1974-75 to 2009-10. The exponential form of growth function was used for the analysis of data. The study revealed that there were significant growth rates in production and export of turmeric. Instability index was evaluated for the production and export for pre-WTO and post-WTO periods and observed high for production, export quantity and export value. Also, the results of the Markov Chain analysis revealed that during the pre-WTO period ‘other countries’ and the UK were the stable importers of Indian turmeric as they had retained their share to the tune of 59.74 per cent and 39.91 per cent over the years respectively.

Whereas, during the post-WTO period, ‘other countries’, Iran, UAE and UK were the stable importers of Indian turmeric as they retained 83.18 per cent, 51.13 per cent, 32.93 per cent and 332.40 per cent of their share over the years, respectively.

Soumya et al. (2014) studied the growth and instability in production and export of selected spices of India. Three spices, pepper, cumin and coriander were selected and area under cumin showed only a meager growth rate while production, productivity and export showed significant positive growth rate. Area, production and export of coriander showed significant and positive growth rate while productivity showed non-significant positive growth rate at the national level. Area, production and productivity were found to be stable while export was found to be unstable in case of pepper. Similarly, at all India level, in case of cumin, area, production and productivity were found to be stable while export was found to be unstable. In case of coriander, area and productivity were found to be stable while production and export were found to be unstable.

Jacob and Job (2015) examined the growth and instability of pepper in accordance with production and export from India. The compound growth rate analysis revealed that there was a decrease in growth rate in the area, production and productivity of pepper in Kerela. The export value showed a growth rate of 19.68 per cent during 2005-06 to 2013-14 and export quantity showed a negative growth rate 2.87 during the same period.

Joshi et al. (2015) examined the trend in growth and instability in major spices in India empirically. They examined the trend in growth and instability of major spices in India for the last 39 years from 1974-75 to 2012-13, which were further divided into three sub-periods. The growth rates were worked out by fitting the exponential growth function and instability analysis was carried out by generating Cuddy Della instability index. The study has observed that almost all the spices have recorded a positive and significant growth rate in all the sub-periods. Sub-period II (1990-91 to 1999-00) is comparatively stable in terms of area, production and productivity in all the spices which also recorded higher growth rates.

Sub-period III (2000-01 to 2012-13) however witnessed fluctuations in growth rate in most of the spices. Variations in weather and price fluctuations were observed as the main factors affecting growth and instability in spices in India.

Ibrahim (2017) studied the disagreed analysis on the performance of spices exoprt during the WTO regime. He examined the export performance of Indian spices during the WTO regime taking the export of major spices from 1985 to 2013. The performance of the spices exoprt was analysed using the growth rate, trends and instability in growth rate. A serious attempt was made to examine the performance of spices exoprt before and after 1995. The trend-analysis method was used to derive the export potential of our country. The analysis revealed that the overall performance of Indian spices exoprt during the WTO regime is satisfactory and openness had led to the growth of India's spice export.

2.2 Instability analysis of Apple

Singh (1993) applied variance decomposition procedure to time series data on food grains to analyze the sources of instability over the period from 1950-51 to 1989-90. The increase in total food grain production and average production for two sub-periods had been accompanied by higher instability and risk in the production of certain crops. The coefficient of variation of food grains production increased by 6.97 per cent and 39.65 per cent respectively between the periods.

Singh and Mathur (1994) assessed instability in the production of potato in India using the coefficient of variation. It was found that area and production were unstable because of the response of potato production to prices of competing for crops and the adoption of modern technology respectively. The production of potato increased and decreased with the increase and decrease in the prices of competing for crops respectively.

Ananthi (2000) studied the instability in export value and export unit value of basmati and non-basmati rice for the period from 1990-91 to 1997 -98. The coefficient of variation was 90.76 per cent for export quantity, 55.77 per cent for export value and 24.35 per cent for export unit value.

She concluded that the instability was relatively high in the case of export quantity value of basmati rice.

Addisu (2000) analyzed the production instability and factors determining the area and yield of major oilseed crops. The factors influencing area and yield of oil seeds were studied by employing regression analysis, where area and yield were regressed on selected causal factors such as irrigation, relative prices, rainfall and labour wages. These factors showed significant impact on area and yield of oil seeds.

Mahadevaiah (2001) studied the export trade performance of Indian Cotton. He found that the stability in export earnings from total cotton export, exoprt to major importing countries and others indicated that change in price variance, change in mean price and change in the interaction term were the major sources which contributed to the variability in cotton export. He found that the change in price variance 19.72 per cent together with a change in mean price 13.72 per cent increased the instability in total cotton export earnings. About 66 per cent of the variance in export earnings was due to an interaction between change in mean quantity and mean price. The change in price variance contributed less than one per cent to the instability of export earnings from most of the major importing countries except in case of Japan, where it has stabilized the export earnings. The study also found that the increase in mean price has mainly contributed to the increase in total cotton export earnings.

Girma (2002) studied the instability and its sources in cotton production in Karnataka. The results showed that the instability increased from 14.8 per cent to 27.8 per cent. In the second period, the coefficient of variation was 40.66 per cent. All the study districts except Belgaum and Gulbarga showed maximum instability in cotton production.

Sharma and Kalita (2008) studied the variation and instability in the area, production and productivity of major fruit crops in Jammu and Kashmir for the period from 1974-75 to 1999-2000. They revealed that growing of pear, cherry and almond were riskier compared to other fruit crops in the state as revealed a higher coefficient of variation. The

coefficient of the area, production and productivity of these were more than 78 per cent. The raising of apple in the state was less risky, which had a coefficient of variation of less than 35 per cent.

Kumar (2010) studied the growth and instability of cereals production in Uttar Pradesh during 1970-2005. He concluded that the area, production and productivity of paddy and wheat showed positive and significant growth rate with the increase in area, production and productivity. But the area of jowar, bajra and barley declined. The production of jowar and barley declined but was increased in bajra. The variability was found highest under CV analysis in production. The area variability was found highest in barley, production variability in wheat and yield variability in bajra.

Sakamma and Ananth (2011) evaluated the growth and instability of major spices. Five major spices of India namely chilli, pepper, cumin, turmeric and coriander were chosen purposively because these five spices account for 77.9 per cent of the area and 64 per cent of the production of total spices. The data on the selected spices were collected for the period 1985-86 to 2006-2007 and this period was divided into two sub-periods. The first period is from 1985-86 to 1996-97 (Pre-WTO) and the second period is from 1997-98 to 2006-07 (Post-WTO). Export of Indian spices during Pre-WTO (1985-86 to 1996-97) and Post-WTO (1997-98 to 2006-07) periods indicated positive compound growth rates in both export quantity and value during both the periods, except for pepper which showed decreased and negative growth rate both in export quantity and value terms. Instability was high in terms of export value than the export quantity and these instability values were high in Pre-WTO period compared to Post-WTO period for the spices such as chilli, turmeric, and coriander. However, in case of pepper and cumin are verse trend was found.

Boyal et al. (2015) studied the growth and instability in the area, production and productivity of fenugreek in Rajasthan. Growth rates of area and production in fenugreek was observed positive and significant in Kota and Jhunjhunu districts of the period I and overall period. Growth rates of

production in fenugreek was found negative in Sikar district during the period I and in Kota and Sikar districts during period II due to negative growth in the area of fenugreek seed spice. The growth rate of productivity in fenugreek was recorded positive and significant only in Kota district during all three periods. The magnitude of instability in the production of fenugreek crop was higher compared to area and productivity in the selected districts as well as in the state as a whole except Jhunjhunu district during period I and in Kota district during period II and overall period (in all the three measures) where the variation in area was more.

Maity and Dey (2014) analyzed the growth and instability of rice using Cuddy–Della Valle index of instability for measuring the instability in rice export determining the trends, growth rate and concentration was determined to study the entire period since 1997-98 to 2008-09 as regime 1 and 2008-09 to 1012-13 as regime 2 and concluded that there is consistent import from traditional importers with greater stability. They also reported that Bangladesh declined its rice import with high inconsistency and instability.

2.3 Market share and concentration of export of Apple.

Ames (1983) examined the changes in US groundnut export for the period between 1971-77 using constant market share models. The registered gain in shelled groundnut export was attributed to the size of market effected and the competitiveness of US groundnuts in the world market. The competitiveness was attributed to the improved gravity of the US groundnut and reduced world supply resulting in better price relationship for US groundnut.

Achoth (1985) while studying the structure of tea export using Hirschman's index and Entropy index indicated that the market, concentration has decreased progressively as the distribution of the export trade became more and more equitable. Further, the study indicated that after sixties structural changes in the export trade had resulted. The share of four largest exporters had fallen to 71 per cent, which further declined to

66 per cent in the later part of the seventies. During these two periods, the market had moved towards moderately concentrated oligopoly.

Arshad and Ghaffar (1990) examined the competitiveness of Malaysia's primary export commodities such as palm oil, Rubber, Coca and pepper in the world market share using the constant market share technique. The CMS method categorized changes in export positions into three separated effects namely, size of market distribution and competitiveness.

Bhatia and Tiwari (1990) studied the diversification, growth and stability of the agricultural economy in Uttar Pradesh for period 1970-71, 1976-77 and 1980-81 respectively. The Herfindahl index and Entropy index were used to measure diversification in favour of secondary and tertiary sectors which is a healthy sign of economic development. The contribution of forestry and logging subsectors seems to be almost falling. Availability of irrigation water all-round the year in a district is expected to promote diversification. Higher nitrogen distribution/ consumption in a district promote specialization. Agricultural business risk showed the negative and significant effect on crop diversification.

Nagaraja (1997) examined the market share and concentration for horticultural commodities exported from India during the year 1947-1971 to 1990-1993. The Indian horticultural commodities trade more or less approximate a monopoly in a few commodities and the Hirschman's index had increased from 0.50 per cent in 1981-1984 to 1990-1993, suggesting thereby that there was concentration towards export of few products. The Theil's entropy index indicated that the distribution of the export trade among few commodities and it index M(X) from 0.78 per cent in 1981-1984 to 0.61 per cent in 1992-1993. In the early concentrated oligopoly as the largest six commodities viz., Mango, Grapes, Onion, Garlic, Mango juice, Mango pickles and Mango chutney accounted for over 67 per cent of total horticultural trade.

Singhal, H. and A. K. Gauraba (1998) studied, crop diversification in Chhattisgarh region of Madhya Pradesh. An economic analysis stated the

Herfindahl and Entropy indices, the extent of crop diversity shift in different eco-system over different periods and registered a steeper decline in crop diversification or shifting towards specialization.

Islam (1998) decomposed the export performance of horticultural exoprt of developing countries and each region each region on the basis of market share analysis into three different components, namely the import growth effect, the market effect and the competitive effect of Africa negative growth of 252.20 per cent which was not only negative but it was so large that is has offset the positive growth effect with 175-90 per cent. Latin America gained in overall competitiveness and increased its share in almost all markets except Japan. Regarding, Near East, although the market with 33.50 per cent and the competitive effects 160 per cent were both positive, it was the positive import growth effect that contributed to the increased earnings during the study period. The competitive effect in far-east was 42.30 per cent followed by positive import growth 37.30 per cent and the market effect was 20.10 per cent.

Rangi and Sidhua (2001) studied WTO VIS-A-SIS export to basmati rice from India had reported that the global rice export has varied from 18.79 million tonnes in 1997 to 27.43 to 23.33 million tonnes. The average annual export from 1996 has been just six per cent of the total production. During the year 1999, the largest rice exporter in the world was Thailand had a share with 24.43 per cent followed by Vietnam 1.15 per cent, USA 11.79 per cent, India 11.79 per cent, China 8.58 per cent, Argentina, Burma, Guyana and Uruguay and European union were other rice exporting countries but their share was small.

2.4 Competitiveness of Apple in India

Gulati et al. (1990) worked out the protection coefficients for groundnut in India by selecting three different groundnut growing States under both import and export competition hypotheses. Domestic price of groundnut was about 50 per cent more than import price, which implied that groundnut received a significant degree of protection from the existing policies under import competition hypothesis. The NPCs of Gujarat, Andhra

Pradesh and Tamil Nadu were 1.47, 1.50, 1.53 under importable hypothesis and 1.87, 1.96 and 1.95 under exportable hypothesis respectively, indicating the level of incentives was significantly higher under export competition hypothesis than under import competition hypothesis. Indian export of groundnuts to hard currency areas had been a limited one in the 1980s.

Rao (1995) analyzed the export competitiveness of Indian onions in major markets using constant market share model over a period from, 1979-82 to 1989-92. The importing countries considered for analysis were Malaysia, Singapore, Sri Lanka, UAE and the rest of the importing countries grouped as others. Onion exoprt to Malaysia were fairly competitive wherein 26 per cent of total change in exoprt was due to the competitiveness of our exoprt in that market. The UAE was the only country where India's onions were not competitive. Only one per cent of the total change in India's onion exoprt was found to be due to competitiveness.

Datta (1996) calculated NPC, EPC and DRC for Indian basmati and non-basmati rice. The results revealed that India had very slender competitive strength in the export of basmati rice. However, the DRC analysis revealed that Indian exporters had some amount of buffer because India requires spending of only Rs 0.89 on non-tradable inputs in order to earn one rupee of foreign exchange in case of non-basmati rice also these three ratios were below one indicating that the Indian rice is competitive in International markets.

Maji (1998) estimated Nominal protection coefficient, Effective protection coefficient and Domestic resource cost of Indian rice. The results showed that NPC was less than unity i.e. the country can potentially benefit from export and obtain higher International price. The EPC was also less than one indicating that rice producers were not protected through policy incentives. DRC ratios were also less than one, which means that a domestic resource cost can earn a much higher value on the foreign exchange through exoprt.

Ravi and Reddy (1998) used Nominal Protection Coefficient technique to work out the export competitiveness of jowar, maize, groundnut, sunflower, cotton and coffee from Karnataka under the importable and exportable hypothesis for a period of ten years from 1984-85 to 1994-95. The results revealed that among the six commodities Karnataka lacked comparative advantage in most of the crops except cotton. The export poteAntial of jowar, maize, groundnut and sunflower were found to be significantly low.

Reddy et al. (1998) studied the export competitiveness of sunflower production using the nominal protection coefficient (NPC). Data on the domestic prices for sunflowers sold in Karnataka were collected for the period 1984-85 to 1993-94 and compared to the FAO's world prices for 1984-93. Results indicated that sunflower production is an efficient import substitute but that sunflower exoprt are less competitive on the world market.

Srinivas et. al. (1999) studied the competitiveness of potato export from India. Potato exoprt were moderately competitive 1986-87 to 1992-93 at shadow exchange rates except in 1988-89 and 1991-92. The study was based on average price for the period (January to June) in respect of three major markets viz; Delhi, Kanpur and Calcutta, India, and revealed that the exoprt were not competitive during the first two years (1991-92 and 1992-93) and the last year (1997-98).

Tamanna et al. (1999) examined the export potential of fruits from India by using the NPC. The values were less than one for almost all years (1989-90 to 1996-97) except 1990-91 and 1991-92 in case of mango. For 1994-95, on an average, the NPC values for mango 0.87 per cent, grapes 0.59 per cent and banana 0.49 per cent were lower than one indicating their export competitiveness in the International market. It was also found that export of Indian mango to Australia was most profitable NPC 0.23 per cent followed by Sweden, France, Switzerland, Belgium, Singapore etc. Similarly, grapes possessed the high export potential for France, Mauritius. The banana fruit was highly competitive for export to USA, Russia, Jordan

and UAE. The study emphasized the minimum use of inorganic chemicals in the cultivation of these crops.

Sudha (2000) worked out the DRC for rose cultivated in 38 Hi-Tech rose units located in Bangalore urban and Bangalore rural districts of Karnataka and adjoining Dharmapuri district of Tamil Nadu during 1997-98. The results revealed that the DRC for the industry as a whole was 0.52, which revealed a high export competitiveness of Hi-Tech rose in the study area. The DRC ratio suggested the efficient use of resources by the rose cultivating Hi-Tech units. It was inferred that as long as the price of output and the proportion of the traded components of inputs remained at the present level study period, it was highly competitive to produce rose for export purposes.

Mahesh (2001) studied the export competitiveness of Indian tea export using NPC and DRC methodology. The results indicated that under the importable hypothesis, the NPC and DRC were 0.71 per cent and 0.66 per cent respectively and under the exportable hypothesis, the NPC and DRC were competitive and also good import substitute.

Phuke et al. (2004) analyzed the export potential of banana in India for the period of 1991-92 to 2001-02. Nominal Protection Coefficient (NPC), NPC = DP/BP used to measure the export competitiveness of banana. India did not enjoy a comparative advantage in the total banana export in 1991-92 as NPC is more than unity. India enjoyed the comparative advantage in export of banana in the new world trade order (after LPG) to all the countries except Nepal.

Raghavendra (2004) analyzed global competitiveness of exoprt of important crops from Karnataka State (India) for 1992-93 to 2000-01 (post-liberalization period), using the. Policy Analysis Matrix, which was decomposed into Effective Protection Coefficient (EPC), NPC and ORC. Crops considered for analysis included rice, maize, groundnut, red gram and cotton. DRC for rice was 0.68 per cent during the study period, this implied that the value of domestic resources used up in producing a unit of rice was less than what it would cost to import, therefore India has a

comparative advantage in producing rice. EPC for rice was less than unity 0.80 per cent, an indication that rice production was protected by Government. NPC for rice was 0.47 per cent, implying that Karnataka had price Competitiveness in rice.

Reddy et al. (2005) assessed the export competitiveness of medium-quality Indian rice (produced in Karnataka), and the concomitant welfare effects of rice trade liberalization. Results of a policy analysis matrix show that liberalization will benefit the rice sector in terms of giving farmers a better deal. Consumers may have to pay a higher price because of the limited domestic supply. The positive impact on the farming community may lead to more efficient rice production and in the process increase the export prospects of rice.

Shivaraya and Hugar (2005) evaluated the export competitiveness of tomato from Hubli market in Karnataka through the estimation of the nominal protection coefficient (NPC). Time series data on export before (from 1979-80 to 1990-91) and after from 1991-92 to 1998-99 the liberalization of the Indian economy with regard to the promotion of the trading and export of agricultural commodities were used for analysis. The results indicated that the quantity and value of export of tomato increased significantly during the pre- and post-liberalization periods, as well as during the overall period. In general for the overall period, the increases in the quantity 3.83 per cent and value 3.42 per cent of export were similar. However, the increase in the number of tomato export 77.85 per cent was higher than the increase in the value of export 74.19 per cent during the pre-liberalization period. A similar trend was observed during the post-liberalization period 29.87 and 24.48 per cent, respectively. The values of NPC were less than unity 0.60 per cent over a period of 11 years, indicating the high competitiveness of tomato from Hubli for export in the international market.

Rakotoarisoa and Gulati (2006) studied that India has become the world's largest milk producer but its dairy industry lacks market access. This paper determines how world dairy policy reforms would affect dairy production and trade in India and the competitiveness of its dairy industry.

We measure nominal protection coefficient for India's dairy products to determine level and change in competitiveness between 1975 and 2001. Estimate parameters of domestic demand for and supply of raw milk and whole milk powder to determine how a world price increase would affect domestic milk production and whole milk powder export. Results show that India's dairy products lack export competitiveness. But with less distorted world dairy markets, India could be competitive and would emerge as a net exporter of whole milk powder, benefiting dairy industries and milk producers

Arulanandhu et al (2007) studied the growth, instability and export performance of chillies during pre and post-liberalization periods. They observed that in recent years, there had been ups and downs in the export of important spices but a steady growth in some spices like chillies. The present study had been carried out to (i) study the area, production, productivity and export of chilies, (ii) assess the share of export of chilies in production (iii) measure the growth and instability in the export of chilies during pre and post-liberalization period and (iv) project the export of chilies. Chillies export had shown a higher growth rate during the post-liberalization period in terms of both quantity and value. The estimated instability index for chillies had revealed the trade to be highly unstable during the pre-liberalization period but had been moderately stable during the post-liberalization period.

Kumar and Muraleedharan (2007) investigated India's export performance of spices (whole pepper and capsicum) in the markets of the Organization for Economic Cooperation and Development and South and Southeast Asia, which constitute a substantial market for Indian spices. A Constant Market Share model was used to decompose the growth in export of spices into the size of the market effect, market composition effect and competitiveness effect. The analysis was performed for the export during the nineties, the period India had to resort to increased challenges of food safety. The study confirms that there has not been substantial trade effect for Indian spices due to quality issues, such as sanitary and phytosanitary regulations. They argued that increase in export to neighbouring regions is

explained more by the increased demand and supply and not by the stringent quality requirements of traditional importing countries.

Savadatti (2007) analyzed export competitiveness of Basmati rice with the help of Nominal Protection Coefficient for the period 1980-81 to 1989-99. Although Basmati rice trend is positive, it is not smooth and steady. Around 60 to 70 per cent of the entire basmati rice export were going to Saudi Arabia, Kuwait and UAE. The estimated NPC of the basmati rice with respect to the USA with an average of 0.82 revealed that basmati rice export is competitive and enjoys advantages in export. There was ample scope to export basmati rice to the USA. But there was stiff competition from Pakistan.

Yeledhalli and Kulkarni (2009) examined the growth pattern, competitiveness and trade directions of onion in India. Markov chain analysis was employed to ascertain the direction of trade through transitional probability matrix and the values of nominal protection coefficient and domestic resource cost revealed that Malaysia showed the increasing trend while UAE showed a declining trend. UAE and Sri Lanka have been very loyal markets for Indian onion market. The NPC for onion was 0.95 per cent during 2000-2001 under exportable hypothesis while under the importable hypothesis it was 0.31 per cent. This implied domestic prices received by farmers were below the international prices in India. The DRC ratio worked out to be less than unity 0.23 per cent indicating high export competitiveness of onion.

Tavisikonda and Thomas (2012) this study examined the export competitiveness of Indian turmeric along with the product's price instability. It is shown that the domestic prices of turmeric were far below the international prices, indicating that India enjoys more export competitiveness for turmeric in the international market.

Patil et al. (2012) studied on a macro framework based on secondary data on various aspects of international trade among Middle East countries. The yearly data on export quantity and value was compiled for the period of 18 years (1993-94 to 2009-10). The results of the

instability indices revealed that for export of onion in terms of quantity UAE., Bahrain and Saudi Arabia were stable importers, for potato Qatar was a stable importer, for peas Qatar, Oman and Bahrain were stable importers and for green chilli, Bahrain was a stable importer. It was observed that India was in a competitive position in onion, potato, peas and green chilli with the NPCs values of 0.97, 0.95, 0.97 and 0.89 per cent respectively for the period 2009-10.

Rajur and Patil analysed the export performance and competitiveness of chilli and revealed that the growth in value of chilli export 27.57 per cent was higher than that in quantity of export 19.37 per cent. The growth rate of the unit value of chilli export 10.38 per cent was higher in period I than period II 2.88 per cent. The nominal protection coefficients (NPCs) indicated that the chilli crop was competitive for export to other countries. Sri Lanka was found to be the highly loyal market for export of Indian chilli as indicated by the retention of their previous shares of chilli export from India by 25 per cent. The USA retained about 19 per cent of its previous share of chilli export from India. Indian chilli is export competitive; there is a higher instability in its export in the international market (Singh, 2004).

Bhavani Devi et al. (2016) studied the direction of trade and export competitiveness of chillies in India. The direction of trade of chillies was analysed using Markov chain analysis and concluded that USA was the most stable market of chilli, followed by UAE and Sri Lanka, while Malaysia, Bangladesh and Pakistan are the unstable importers. The estimated NPCs indicated that the Indian chilli was price competitive during the study period 2006-07 to 2010-11. A comparison of competitiveness of Indian chilli against Chinese red chilli revealed that Indian red chilli is globally priced competitively for three years in the study period of five years, 2006-07 to 2010-11.

CHAPTER III

METHODOLOGY

The data were collected and analyzed into meaningful information to draw conclusions in order to review the situation of Apple in India. The object of any investigation is to draw the useful conclusion in the light of objectives of the study in order to derive the meaningful conclusion, it is essential to the investigator to adopt appropriate method and procedure. Keeping this in view, this chapter has been devoted to explain the methodology adopted during the course of study. The present investigation was undertaken to study the “Export Performance of Apple in India." This chapter deals with the sources of data, period of study and analytical procedure used to draw the inferences.

3.1 Nature and scope of data

The study based on the secondary data collected for the period 1990-91 to 2016-17 years. Data on different aspects required for the present study was collected from various government sources, like Indian Horticultural Database, Annual Reports from National Horticultural Board, Food and Agricultural Organization (FAO), APEDA Agriexchange website and Indiaistat Website.

3.2 Period of study

The secondary data was collected from last twenty seven years divided into three periods, first period from 1990-91 to 2004-05 second period from 2005-06 to 2016-17, and third period from 1990-91 up to 2016-17 years.

3.3 Analytical tools and techniques

The data collected from the secondary sources were subjected to appropriate analytical techniques in order to arrive at a meaningful conclusion. The different analytical techniques were used in the studied.

1. Growth rate analysis.
2. The coefficient of variation and instability index.

3. Market share and concentration of Apple export.
4. Nominal Protection Coefficient.

1. Growth rate analysis

To arrive at normal years, a simple average of estimates for twenty seven years from 1990-91 to 2016-17 has been taken. The normal year was considered as a base year for estimating growth rates. By taking time as the independent variables and the area, production, productivity, consumption and export volume and their respective values of the Apple as the dependent variables, the compound growth rates were estimated by using following regression equation.

$$Y = ab^t$$

Where, Y = data on area, production, productivity and export quantity etc. in year't'.

a and b = Parameters of exponential

The compound growth rate was calculated from the fitted exponential regression parameter b.

Average annual compound growth rate was calculated by using the following formula.

$$CGR = [(\text{Antilog } (\log b - 1)] \times 100$$

2. Coefficient of variation and instability indices.

Instability index was used to examine the extent of variation and risk involved in the parameter such as area, production, productivity, and export performance of Apple. In order to study variability in the export trade, an instability index is used as a measure of variability which suggested by Cuddy and Della. The coefficient of variation (CV) was calculated by using the following formula:

Coefficient of variation:

The C.V. was calculated by the formula

$$CV\ (\%) = \frac{\text{standard deviation}}{\text{mean}} \times 100$$

Cuddy and Della Index:

Coefficient of variation defines above does not take trend components prevailing in time series data. In order to have a meaningful measure of instability the formula suggested by Cuddy and Della (1978) was used to compute the degree of variation around the trend.

$$\textbf{Index of Instability} = \frac{\textbf{standard deviation}}{\textbf{mean}} \textbf{ x 100 x } \sqrt{1 - R^2}$$

Here,

R^2 is the coefficient of multiple determination of linear tread

3. Market Share and concentration of Apple export

Market share concentration of the export of Apple was studied by computing the Hirschman's Herfindal Index and Entropy Index.

$$\text{HHI} = \sum_{i=1}^{n} Pi^2$$

Where,

$$\text{Pi} = \frac{Xi}{\Sigma Xi}$$

Xi= Export from i^{th} country

ΣXi = Total world exoprt

Pi = Market share of export to i^{th} country

n = Number of exporting countries

Hirschman's Herfindal Index, its value ranges between 0 and 1, where a value of 0 represents diversified market and 1 represents monopoly structure.

Theil's Entropy index

$$\textbf{EI} = \sum_{i=1}^{n} P_i log\ (1/P_i)$$

It is an inverse measure of concentration having a logarithmic character for increasing diversification EI is increasing. It is also found between 0 and 1. This is used to examine the market share diversification for Apple.

Where,

$$Pi = \frac{Xi}{n}$$

Xi = Quantity of exoprt extended to the i^{th} country

n = number of countries

EI = Theil's entropy

Its value ranges between 0 and log n, where 0 represent perfect competition and vice versa (Singhal and Kumar, 1998)

4. **Measuring Price competitiveness through nominal protection coefficient**

Porter (1990) has argued that the theory of international trade must move beyond comparative advantage to competitive advantage. NPC was computed to determine the extent of competitive advantage enjoyed by the commodity in the context of free trade. Thus, export competitiveness of agricultural commodities has also been assessed by the computing the Nominal Protection Coefficient. The coefficient shed light on whether a country has comparative advantage in the export of that commodity in the free trade scenario or not. NPC is defined as the ratio of the domestic price to the world reference price of the commodity under consideration. Symbolically,

NPC = Pd/ Pb

Where,

NPC= Nominal price

Pd –Tthe domestic Wholesale price of the Apple

Pb - World reference price of the Apple

If NPC> 1, the Apple crop is protected, compared to the situation that would prevail under free trade, and if NPC< 1, the Apple crop is not protected.

The expression 1-NPC reveals price wedge for exoprt, depending upon the sign.

For example, if NPC = 0.75, it indicates, export enjoys price advantage to the tune of 25 per cent, (given 1- NPC multiplied by 100). On the other hand NPC= 1.20, it indicates export disadvantage to the tune of 20 per cent.

CHAPTER IV

RESULT AND DISCUSSION

India share of agriculture commodities for total export was continuously decreasing so, according to the view of objectives, the pertinent data and relevant information to the present study were collected from various sources and analyzed using appropriate techniques. The results of the analysis are presented in this chapter under the following headings.

4.1 Growth, the coefficient of variation and instability analysis on the area, production, and productivity of Apple in India.

4.2 Growth and the coefficient of variation and instability on the area under Apple in major producing states in India.

4.3 Growth and the coefficient of variation and instability on the production of Apple in major producing states in India.

4.4 Growth and the coefficient of variation and instability on the productivity of Apple in major producing states in India.

4.5 India's share of agricultural export to total national export and percentage share in Apple export to agriculture export

4.6 CGR, the coefficient of variation and instability analysis on production, consumption, export quantity and export value of Apple in India.

4.7 The CGR, the coefficient of variation and instability on country wise export quantity of Apple in major countries.

4.8 The CGR, the coefficient of variation and instability on the country wise export value of Apple in major countries.

4.9 Market share and concentration on export quantity and export value of Apple in India. .

4.10 Export competitiveness of Apple in India

4.1 Growth, the coefficient of variation and instability analysis in the area, production, and productivity of Apple in India

This section analyses the impact of new economic policy on the growth and instability in the area, production, and productivity of Apple in India. The analysis is based on the secondary data ranging from 1990-91 to 2016-17. For the purpose of comparison, the period of study has been divided into three periods, the first period (from 1990-91 to 2004-05) and the second period (from 2005-06 to 2016-17) and the third period (from 1990-91 to 2016-2017).

Table 4.1 Growth and instability analysis on the area, production, and productivity of Apple in India

Years	Parameters	Growth, the coefficient of variation and instability		
		Area (In hectare)	Production (In tonnes)	Productivity (tonnes/ hectare)
Period I	CGR	0.95*	0.12	-2.52***
	CV	8.55	10.93	17.11
	CDI	7.44	10.92	12.97
Period II	CGR	1.93**	2.79**	1.13
	CV	10.20	17.02	13.71
	CDI	7.67	13.64	13.07
period III	CGR	1.84***	2.56***	-0.01
	CV	16.84	26.28	15.56
	CDI	8.27	15.58	15.56

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

In order to identify the significant role and the economic status of the Apple in the Indian economy, an attempt has been made at a decadal wise analysis of growth, the coefficient of variation and instability during the

study period. The growth, coefficient of variation and instability were worked out for the third period, and the decadal performance is also studied and the results were presented in Table 4.1.

The Table 4.1 depicted that, the growth of the area of Apple in India was continuously increasing at a rate of 0.95 per cent 1.93 per cent and 1.84 per cent in the first, the second and third period respectively. During the overall reference period for 27 years of the study, the coefficient of variation in the area under Apple was calculated at 16.84 per cent.

The instability indices give the degree of fluctuations around the trend, when there is a perfect stability or changing at a constant rate. India's performance in the area, production, and productivity of Apple analyzed with the help of Cuddy Della Index and is presented in Table 4.1.

Table 4.1 revealed that the area under Apple showed high instability found in the third period with 8.27 per cent than the second period with 7.67 per cent and the second period was higher than the first period with 7.44 per cent.

The growth in production of Apple was non-significant in the first period, the second period with 2.79 per cent which is higher than the third period with 2.56 per cent. These growth rates were significant at 5 and 1 per cent level of significance respectively. During the overall reference period for 27 years of the study, the coefficient of variation for total production of Apple was found at the rate of 26.28 per cent.

Table 4.1 also depicted that, the total production of Apple showed high instability in the third period with 15.58 per cent than the second period with 13.64 per cent but the less instability was found in the first period with 10.92 per cent.

The growth in productivity of Apple was recorded negative growth at the rate of 2.52 per cent at 1 per cent level of significance, during the first period period, the second and third period were non-significant. During the over reference period for 27 years of the study, the coefficient of variation in productivity of Apple was calculated 15.56 per cent.

Table 4.1 depicted that, the total productivity under Apple instability was in the third period with 15.56 per cent which was higher than the second period with 13.07 per cent of instability and second period was higher than the first period with 12.97 per cent of instability.

It concluded that, during the third period from 1990-91 to 2016-17, the area and production of Apple have registered a positive and significant growth at 1 per cent level of significance but the productivity growth was non-significant , and the coefficient of variation was found to be less in case of area and productivity compared to the production.

4.2 Growth, the coefficient of variation and instability in the area under Apple in major producing states in India.

The growth, coefficient of variation and instability were worked out for the period of 1990-91 to 2016-17, and the periodical performance of major Apple producing states was studied and the results were presented in Table 4.2. For the purpose of comparison, the period of study has been into three periods, the first period (from 1990-91 to 2004-05) and the second period (from 2005-06 to 2016-17) and the third period (from 1990-91 to 2016-2017).

The study was conducted on major Apple producing states in India viz., Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, and other minor producing states in India. During the third period, Jammu & Kashmir growth rate was increasing at a rate of 3.65 per cent followed by other minor states with a negative growth rate of 3.10 per cent, Arunachal Pradesh with 3.04 per cent, and Himachal Pradesh with 1.98 per cent at 1 per cent level of significance.

During study period Jammu & Kashmir, Himachal Pradesh and other minor states growth rate were decreased from the first period to the second period but Arunachal Pradesh negatively increased, mainly due to changing Apple crop cultivation to other crops like Grape, paddy, sugarcane, and other fruits and vegetables. During the third period, growth of the area at different states under study were found around 1.84 per cent

annually. It was mainly because of favourable climatic conditions and affordable Apple prices in the markets.

Table 4.2 Growth, the coefficient of variation and instability in the area under Apple in Major producing states in India

(Area in hectare)

Years	Parameters	Growth, the coefficient of variation and instability				
		Jammu & Kashmir	Himachal Pradesh	Arunachal Pradesh	Other states	Total
Period I	CGR	2.98***	2.31***	3.33***	-8.34**	0.95*
	CV	13.76	11.58	15.52	36.28	8.55
	CDI	2.68	6.05	4.01	29.00	7.44
Period II	CGR	2.76**	2.08***	-3.44	-1.00	1.93**
	CV	14.20	7.43	31.42	10.32	10.20
	CDI	10.63	1.34	29.81	9.73	7.67
period III	CGR	3.65***	1.98***	3.04***	-3.10***	1.84***
	CV	30.01	15.78	39.61	37.63	16.84
	CDI	8.31	4.69	30.88	32.65	8.27

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

The instability analysis showed that higher instability was found in other minor states in the first period with 29.00 per cent followed by Himachal Pradesh with 6.05 per cent, Arunachal Pradesh with 4.01 per cent and Jammu and Kashmir with 2.68 per cent. In case of the second period and third period, similar instability pattern was found. It can be understood from the analytical table that, there was a positive and significant growth with low instability in the area in all major Apple producing states in India over the 27 years of study period. The coefficient of variation for Apple production in India during the third period was found at 16.84 per cent.

Thus, the first hypothesis was accepted and there was a positive growth on the area of Apple with 1.84 per cent at 1 per cent level of significance during the third study period.

4.3 Growth, the coefficient of variation and instability on the production of Apple in major producing states in India.

The results of growth and the coefficient of variation in production under Apple in major producing states in India were presented in Table 4.3

Table 4.3 Growth, the coefficient of variation and instability on the production of Apple in major producing states in India

(Production in tonnes)

Years	Parameters	Growth, the coefficient of variation and instability				
		Jammu & Kashmir	Himachal Pradesh	Arunachal Pradesh	Other states	Total
Period I	CGR	3.41***	1.22	-0.83	-17.88***	0.12
	CV	17.24	36.62	25.13	62.55	10.93
	CDI	8.18	36.44	24.79	37.41	10.92
Period II	CGR	2.99**	3.83***	4.68***	-4.81***	2.79**
	CV	15.97	38.33	66.01	21.91	17.02
	CDI	11.86	36.21	63.61	15.39	13.64
period III	CGR	4.12***	3.79***	1.80	-6.44***	2.56***
	CV	33.96	47.67	59.81	73.65	26.28
	CDI	10.53	40.62	56.87	58.27	15.58

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

From the Table 4.3, it was observed that, CGR for Apple production in other minor states were negatively increased with 6.44 per cent, Jammu & Kashmir was increased at a rate of 4.12 per cent followed by Himachal Pradesh with 3.79 per cent at 1 percent level of significance, and Arunachal Pradesh growth was non-significant, during the third period. It also showed that other minor states growth rate was negative in both first and second period mainly due to decreased productivity and unfavourable climatic conditions for the crop growth. In Jammu & Kashmir and Himachal

Pradesh production of Apple were increased mainly due to increased area under Apple cultivation and favourable climatic conditions for its cultivation. The third period CGR of production under Apple in different states of India was calculated at 2.56 per cent at 1 per cent level of significance which means the production increased annually by 2.56 per cent over the study period. The coefficient of variation in production during the third period was found at 26.28 per cent.

Further, the instability analysis on the production of Apple was presented in Table 4.3 showed that, higher instability found in other minor states in the first period with 37.41 per cent followed by Himachal Pradesh with 36.62 per cent, Arunachal Pradesh with 24.79 per cent and Jammu & Kashmir with 8.18 per cent. In case of the second period and third period, similar instability pattern was found. It can be understood from the analytical table that, there was a positive and significant growth with low instability in total production in all major Apple producing states in India over the 27 years of study period.

Thus the first hypothesis was accepted and there was a positive growth in production of Apple with 2.56 per cent at 1 level of significance during the third study period.

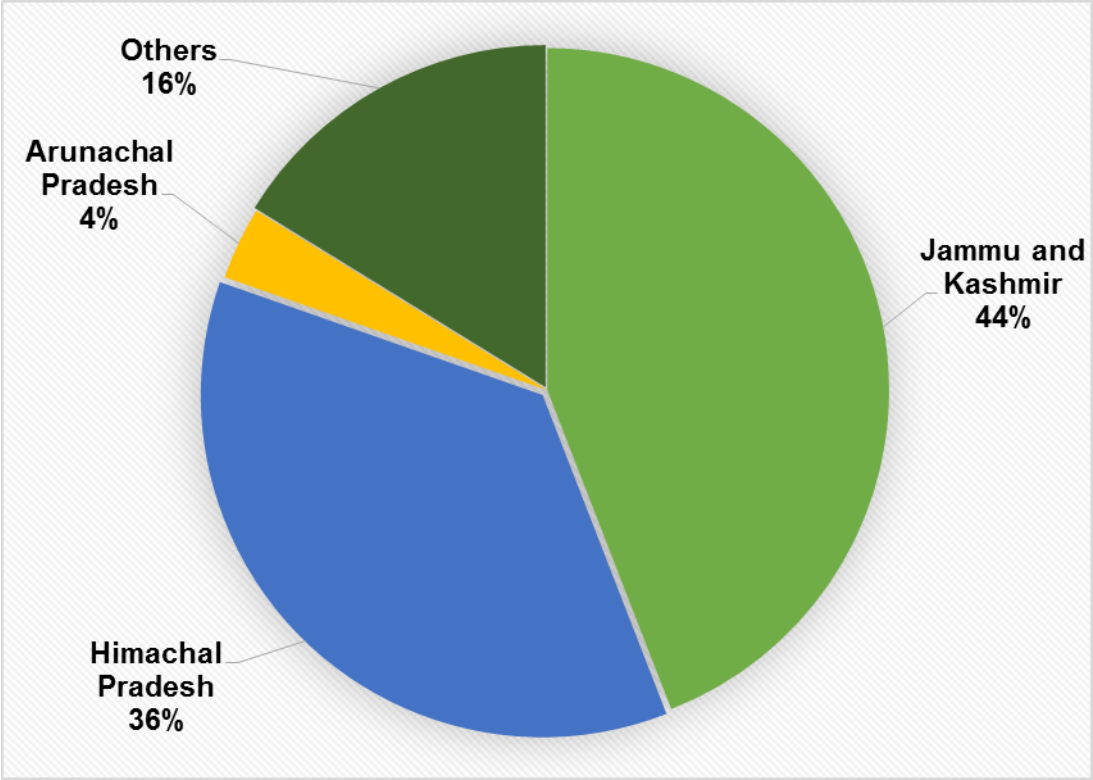

Fig. 1 State wise percentage share under the area of Apple cultivation from 1990-91 to 2016-17

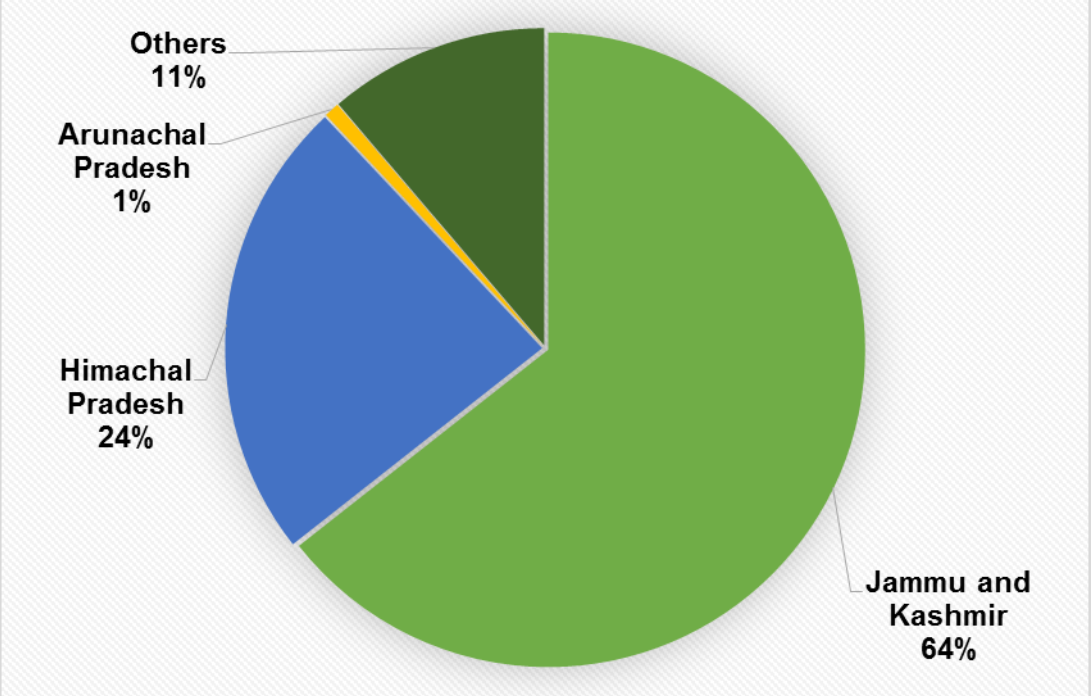

Fig. 2 State wise percentage share of Apple production from 1990-91 to 2016-17

4.4 Growth, the coefficient of variation and instability on the productivity of Apple in major states in India.

The growth, coefficient of variation and instability were worked out for the period of 1990-91 to 2016-17, and the periodical performance of major Apple producing states was studied and the results presented in Table 4.4

Table 4.4 Growth, the coefficient of variation and instability on the productivity of Apple in major producing states in India

(Tonnes/hectare)

Years	Parameters	Growth, the coefficient of variation and instability on the productivity of Apple				
		Jammu & Kashmir	Himachal Pradesh	Arunachal Pradesh	Others States	Total
Period I	CGR	0.42	-1.03	-4.01**	-9.46***	-2.52***
	CV	7.30	34.62	28.41	52.13	17.11
	CDI	7.07	34.50	21.88	34.54	12.97
Period II	CGR	0.24	1.75	8.45**	-1.92	1.13
	CV	13.45	37.02	42.47	49.08	13.71
	CDI	13.42	36.56	31.31	48.54	13.07
period III	CGR	0.46*	1.80	-1.19	-2.13	-0.01
	CV	11.10	38.67	34.69	50.27	15.56
	CDI	10.45	37.24	33.51	47.62	15.56

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

The study was conducted on Apple productivity in major states viz., Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, and other minor producing states in India. During the third period, Jammu & Kashmir growth rate was 0.46 per cent at 10 per cent level of significance and, Himachal Pradesh, Arunachal Pradesh and other minor states, respectively were non-significant.

During the study of state wise productivity, the growth rate of Jammu & Kashmir was increased in the third period than the first and

second period. Arunachal Pradesh growth rate was decreased in the third period but in the first period it was negatively increased at 1 per cent level of significance and in the second period it was significant at 5 per cent level of significance. Mainly due to changing Apple crop cultivation to other crops like grape, paddy, sugarcane, and other fruits and vegetables. The third period growth of productivity in different states under study found non-significant. It was mainly because of unfavourable climatic conditions and affordable Apple prices in the markets.

The instability analysis showed that, higher instability found in other major states in the first period with 34.54 per cent followed by Himachal Pradesh with 34.50 per cent, Arunachal Pradesh with 21.88 per cent, and Jammu & Kashmir with 7.07 per cent. In case of the second period and third period, similar instability pattern was found. It can be understood from the analytical table that, there was a positive growth with low instability in the area of Apple producing states in India over the 27 years of study period. The coefficient of variation in Apple productivity in India during the third period was calculated at 15.54 per cent.

Thus the first hypothesis was rejected and there was non-significance growth on the productivity during the third study period.

4.5 India's share of agricultural export to total national export and percentage share in Apple export to agriculture export

Total export from India has been studied in relation to Apple export to agricultural export and figures for India's total export, agricultural export and Apple export are presented in Table 4.5. It was observed from the Table 4.5 that, during 1990-91 to 2016-17, the total national export was increased from Rs. 32, 52,728.00 lakhs to Rs. 18,49,42,875.55 lakhs with a growth rate of 17.44 per cent. While agricultural export in 1990-91 was Rs. 6,01,276.00 lakhs which have increased to Rs. 2,27,55,400.00 lakhs in 2016-17 with a growth rate of 15.08 per cent and Apple export in 1990-91 was Rs. 185.10 lakhs which increased Rs. 22,582.66 lakhs in 2016-17 with a growth rate of 14.58 per cent per year.

Table 4.5 India's share of Agricultural export to total national export and percentage share of Apple export to Agricultural export

Rs. (In lakhs)

Years	Total National Exports	Total Agricultural Export	Apple Export	% share in Agriculture Exports	% share of Apple exports to Agricultural Exports
1990-91	32,52,728.00	6,01,276.00	185.10	18.49	0.031
1991-92	44,04,181.00	7,83,813.00	859.83	17.80	0.110
1992-93	53,68,826.00	9,04,030.00	739.69	16.84	0.082
1993-94	69,74,885.00	12,58,655.00	666.76	18.05	0.053
1994-95	82,67,340.00	13,22,276.00	677.99	15.99	0.051
1995-96	1,06,33,535.00	20,39,774.00	976.25	19.18	0.048
1996-97	1,18,81,797.38	24,16,129.00	1,354.95	20.33	0.056
1997-98	1,29,27,770.02	24,84,345.00	1,142.26	19.10	0.046
1998-99	1,39,75,315.65	25,51,064.00	1,002.24	18.25	0.039
1999-00	1,59,56,177.56	25,51,064.00	884.18	16.03	0.035
2000-01	2,03,57,101.09	28,65,737.00	416.02	14.23	0.015
2001-02	2,09,01,797.34	29,72,861.00	1,342.31	14.22	0.045
2002-03	2,55,13,727.66	34,65,394.00	1,571.89	13.58	0.045
2003-04	2,93,36,674.75	37,26,652.00	1,317.63	12.70	0.035
2004-05	3,75,33,952.62	41,60,265.00	2,633.69	11.08	0.063
2005-06	4,56,41,786.15	49,21,696.00	3,811.57	10.78	0.077
2006-07	5,71,77,928.52	62,41,142.00	3,153.92	10.92	0.051
2007-08	6,55,86,352.18	79,03,972.00	3,330.79	12.05	0.042
2008-09	8,40,75,505.87	85,95,167.00	5,222.01	10.22	0.061
2009-10	8,45,53,364.38	89,34,133.00	3,210.34	10.57	0.036
2010-11	11,36,96,426.38	1,17,48,361.00	5,974.70	10.28	0.051
2011-12	14,65,95,939.96	1,87,60,933.00	9,147.11	12.80	0.049
2012-13	16,34,31,828.96	2,32,04,111.00	5,151.39	14.20	0.022
2013-14	19,05,01,108.86	2,68,46,905.00	8,623.77	15.85	0.032
2014-15	18,96,34,841.76	2,40,64,200.00	5,292.72	12.69	0.022
2015-16	17,16,37,804.58	2,15,39,600.00	20,832.59	6.26	0.194
2016-17	18,49,42,875.55	2,27,55,400.00	22,582.66	5.86	0.208
CGR	**17.44*** **	**15.08*** **	**14.58*** **		

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

Though over the years agricultural export has increased many folds, the share of agricultural export has decreased to 12.30 per cent in 2016-17 from 18.49 per cent in 1990-91. Therefore; according to the calculation we found that, agricultural share may decline further. It needs the attention of

policy makers to promote and encourage agricultural export of the country to increase agricultural share. Further Apple export from India has been studied with relation to agricultural export and figures for Apple export and agricultural export was presented in Table 4.5

Thus the first hypothesis was accepted and there was a positive growth in total national export with 17.44 per cent, total agricultural export with 15.08 per cent and Apple export with a growth rate of 14.58 per cent at 1 level of significance during the overall study period.

4.6 CGR, the coefficient of variation and instability analysis on production, consumption, export quantity and export value of Apple in India.

The result of growth, the coefficient of variation and instability in production, consumption and export quantity and their respective values of Apple in India during the reference period were illustrated in Table 4.6. In order to identify the significant role and the economic status of Apple in the world as well as in Indian economy, an attempt has been made at decadal wise analysis of growth, the coefficient of variation and instability during the study period. The growth, coefficient of variation and instability was worked out for the period of 1990-91 to 2016-17 and the decadal performance was also studied and the results were presented in Table.4.6

The Table 4.6 showed that, the compound growth rate for production of Apple found non-significant for the first period of study, the CGR calculated for the second period with 2.79 per cent at 5 per cent level of significance and growth rate of third period was 2.56 per cent, at 1 percent level of significant. The third period compound growth rate of production in India calculated at 2.56 per cent per annum, which means the production increase annually by 2.56 per cent. The coefficient of variation on production under Apple was found at 26.28 per cent over the study period.

In case of consumption of Apple, growth rate found non-significant for the first period of study, the CGR calculated for the second period with 2.88 per cent at 5 per cent level of significance and growth rate of the third

period was 2.52 per cent, at 1 percent level of significance. During the overall reference period for 27 years of the study, the coefficient of variation in consumption under Apple was found at 26.00 per cent.

Table 4.6 Growth, the coefficient of variation and instability on production, consumption and export quantity and export value of Apple in India.

Particulars	Parameters	Period wise growth, the coefficient of variation and instability		
		Period I	Period II	Period III
Production (In tonnes)	CGR	0.12	2.79**	2.56***
	CV	10.93	17.02	26.28
	CDI	10.92	13.64	15.58
Consumption (In tonnes)	CGR	0.07	2.88**	2.52***
	CV	10.86	17.12	26.00
	CDI	10.86	13.53	15.55
Export (In tonnes)	CGR	6.18*	-3.54	7.66***
	CV	57.08	29.10	65.18
	CDI	51.03	25.67	28.08
Export value (In lakhs)	CGR	9.63***	8.40***	12.73***
	CV	54.77	39.52	89.85
	CDI	40.79	26.72	35.39

Note: *** Significance at 1% level of probability, ** Significance at 5% level of probability, * Significance at 10% level of probability.

Table 4.6 reveals that, in case of export quantity, high instability found in the first period with 51.03 per cent than the third period with 28.08 per cent and lowest instability found in the second period with 25.67 per cent. The export value showed high instability found in the third period with 12.73 per cent than the first period with 9.63 per cent and the second period with 8.40 per cent.

Regarding consumption high instability found in the third period with 15.55 per cent than the second period with 13.53 per cent and the first

period with 10.86 per cent. The production showed the high degree of instability in the third period with 15.58 per cent than the first period with 10.92 per cent and the second period with 13.64 per cent under the study. The growth rate of export of Apple quantity in the first period calculated at 6.18 per cent per annum, at 10 level of significance. In the second period, export was non-significant. However, growth has further increased to 7.66 per cent at 1 per cent level of significance during the third period. During the overall reference period for 27 years of the study, the coefficient of variation in export under Apple quantity was found at 65.18 per cent and the Table 4.6 also inferred that there was a high degree of variation in the parameter with a high growth rate under study.

From table 4.6 in view of the export value of Apple, the first period was positive and significant growth rates were observed with 9.63 per cent at 1 per cent level of significance. Similarly, the growth rates for export values in the second period decreased to 8.40 per cent at 1 per cent level of significance. However, growth has further increased to 12.73 per cent at 1 per cent level of significance in the third period. During the overall reference period for 27 years of the study, the coefficient of variation in export under Apple value calculated was at 89.85 per cent.

Thus the second hypothesis was accepted and there was a positive export performance of Apple with 7.66 per cent in quantity and 12.73 per cent growth rate in value at 1 per cent level of significance during the third period.

4.7 Growth, the coefficient of variation and instability on the Country wise export quantity of Apple from India in major Countries.

The results of growth and coefficient of variation on export under Apple in major countries from India were presented in Table 4.8 for the period of 27 years from 1990-91 to 2016-17.

Table 4.7 Growth, the coefficient of variation and instability on Country wise export quantities of Apple from India in major Countries

(In Tonnes)

Years	Parameters	Selected countries growth, the coefficient of variation and instability				
		Bangladesh	**Nepal**	**UAE**	**Other countries**	**Total**
Period I	CGR	5.41	32.18**	8.65	-5.88	6.18*
	CV	60.22	193.52	136.49	104.06	57.08
	CDI	56.04	160.33	130.26	102.7	51.03
Period II	CGR	-7.22**	9.26**	2.58	3.61	-3.54
	CV	38.86	50.92	167.57	144.26	29.10
	CDI	29.71	39.36	167.48	143.88	25.67
Period III	CGR	6.46***	35.19***	-0.47	-4.21	7.66***
	CV	67.38	117.57	172.45	117.68	65.18
	CDI	51.82	61.90	172.43	115.31	42.78

Note: *** Significance at 1% level of probability, ** Significance at 5% level of probability, * Significance at 10% level of probability

From the Table 4.7, it was observed that the CGR for Apple export in Nepal increased with a growth rate of 35.19 per cent at 5 per cent level of significance and Bangladesh, UAE and other minor countries were non-significant growth rates in the first period. In the second period Bangladesh had negative growth rate with 7.22 per cent and Nepal growth rate was increased with 9.22 per cent both at 5 per cent level of significance. The UAE and other minor countries were non-significant in the second period. In the third period Bangladesh and Nepal growth rate were increased at 1 per cent level of significance and The UAE and other minor countries were non-significant. The CGR of Apple export quantity in different countries during 1990-91 to 2016-17 calculated at 7.66 per cent at 1 per cent level of significance which means the export quantity increased annually by 7.66 per cent over the study period. The coefficient of variation of Apple export during the third period found at 65.218 per cent.

From Table 4.7. Depicted that higher instability was found in UAE in the third period with 172.43 per cent followed by other minor countries with 115.31 per cent, Nepal with 61.90 per cent and Bangladesh with 51.82 per cen. In case of the second period and third period, similar instability pattern found and there was a positive and significant growth with low instability in total production in all major Apple producing states in India over the 27 years of study period.

Thus the second hypothesis was accepted and there was a positive growth in Country wise export quantity of Apple from India in major Countries with 7.66 per cent at 1 per cent level of significance during the third study period.

4.8 The CGR, coefficient of variation and instability on the country wise export value of Apple in major countries

The growth, coefficient of variation and instability was worked out for the period of 1990-91 to 2016-17 and the periodical performance of major Apple value export countries wise studied and the results were presented in Table 4.9. For the purpose of comparison, the period of study has been divided into three periods, the first period (from 1990-91 to 2004-05) and the second period (from 2005-06 to 2016-17) and the third period (from 1990-91 to 2016-17).

The studied conduct on export value of Apple in major countries, Bangladesh, Nepal, United Arabic Emirate, and other minor countries in the world. During the third study period, Nepal with a growth rate of 41.35 per cent, Bangladesh with 10.94 per cent were increased at 1 per cent level of significance. United Arabic Emirate and other minor countries were non-significant growth rate. But during the third period, there was a positive growth rate with 12.73 per cent, at 1 per cent level of significance.

The instability analysis showed that, higher instability were found in other major countries in the third period with a growth rate of 304.38 per cent followed by United Arabic Emirate with 220.72 per cent, Nepal with 64.96 per cent, and Bangladesh with 43.29 per cent instability. In case of the first and second period, similar instability pattern was found.

Table.4.8 CGR, the coefficient of variation and instability on the country wise export value of Apple in major countries.

(Value in lakhs)

Years	Parameters	Country wise growth, the coefficient of variation and instability				
		Bangladesh	**Nepal**	**UAE**	**Other countries**	**Total**
Period I	CGR	9.50***	30.59**	9.67	2.60	9.63***
	CV	58.13	188.95	151.10	95.64	54.77
	CDI	46.20	153.20	141.99	95.30	40.79
Period II	CGR	1.67	24.16***	24.15	33.72	8.40***
	CV	39.40	74.92	165.04	258.18	39.52
	CDI	38.81	29.41	160.00	229.07	26.72
Period III	CGR	10.94***	41.35***	8.63	3.20	12.73***
	CV	83.07	150.36	230.40	307.40	89.85
	CDI	43.29	64.96	220.72	304.38	35.39

Note: *** denotes significant at 1 per cent level of probability, ** significant at 5 per cent level of probability, * Significance at 10% level of probability

There was a positive and significant growth with low instability in export value of Apple in all major countries from India over the 27 years of study period. The coefficient of variation in export value from India during the overall study period was calculated at 89.85 per cent.

Thus the second hypothesis was accepted and there was positive growth in Country-wise export value of Apple from India in major Countries with 12.73 per cent at 1 per cent level of significance during the third study period.

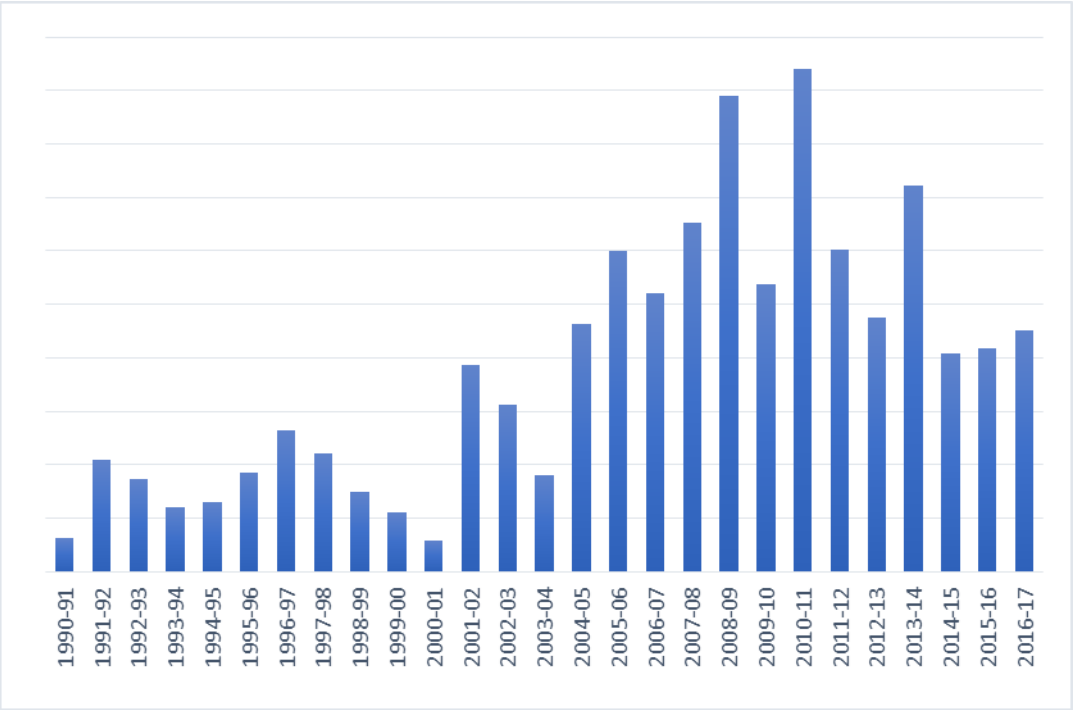

Fig.3 Export quantity of Apple from India (during 1990-91 to 2016-17)

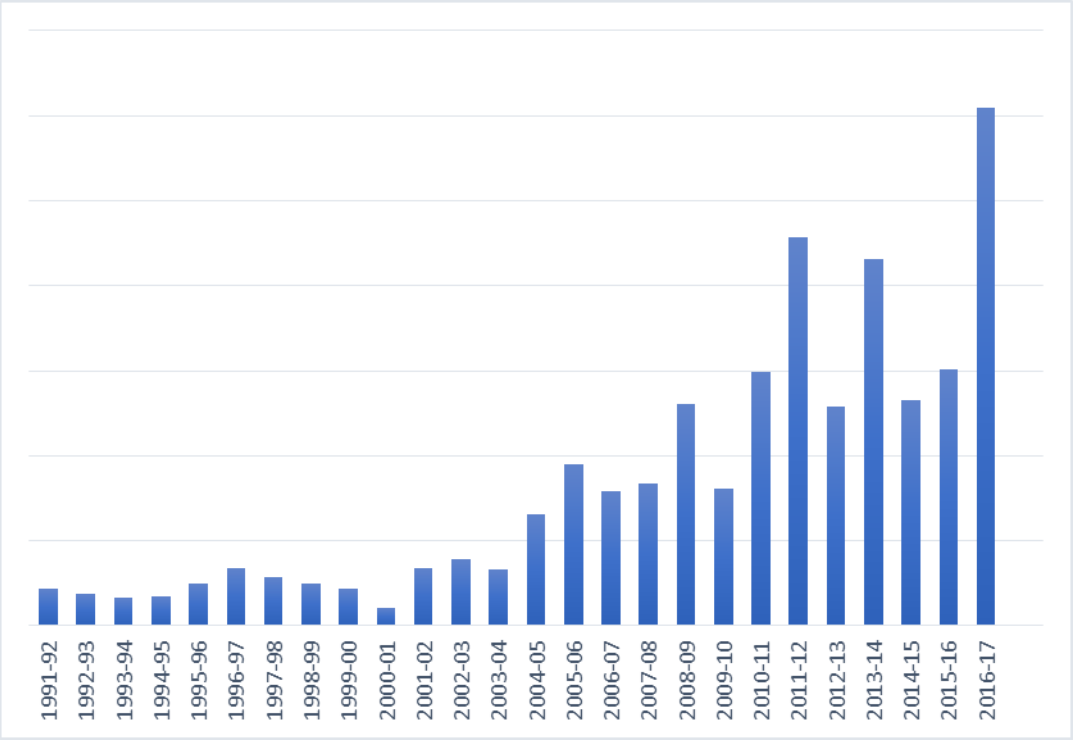

Fig.4 Export value of Apple from India (during 1990-91 to 2016-17)

4.9 Market share and concentration on export quantity and export value of Apple from India.

The market share and concentration for the Apple exported quantities and values were studied by using, Hirschman's Herfindal Index and Thiel's Entropy index from 1990-91 up to 2016-17, during the 27 years and the results obtained are presented in Table 4.9.

Table.4.9 Market share and concentration on export quantity and export value of Apple in India.

(In tonnes and lakhs)

z	Year	HHI		Theil's Entropy	
		Quantity	Value	Quantity	Value
1	1990-91	0.93	0.89	0.08	0.12
2	1991-92	0.98	0.97	0.03	0.04
3	1992-93	0.94	0.91	0.07	0.09
4	1993-94	0.60	0.53	0.27	0.30
5	1994-95	0.72	0.65	0.20	0.23
6	1995-96	0.85	0.81	0.14	0.16
7	1996-97	0.91	0.85	0.10	0.13
8	1997-98	0.91	0.87	0.09	0.12
9	1998-99	0.81	0.82	0.16	0.16
10	1999-00	0.97	0.95	0.03	0.06
11	2000-01	0.60	0.54	0.31	0.3
12	2001-02	0.99	0.97	0.02	0.04
13	2002-03	0.79	0.83	0.16	0.14
14	2003-04	0.57	0.67	0.30	0.27
15	2004-05	0.81	0.83	0.17	0.16
16	2005-06	0.82	0.81	0.16	0.17
17	2006-07	0.78	0.76	0.17	0.19
18	2007-08	0.68	0.68	0.22	0.22
19	2008-09	0.71	0.72	0.24	0.24
20	2009-10	0.86	0.83	0.12	0.14
21	2010-11	0.85	0.78	0.14	0.19
22	2011-12	0.77	0.73	0.18	0.20
23	2012-13	0.76	0.61	0.17	0.25
24	2013-14	0.74	0.59	0.20	0.31
25	2014-15	0.55	0.47	0.31	0.37
26	2015-16	0.50	0.50	0.31	0.32
27	2016-17	0.49	0.33	0.33	0.48

Hirschman's Herfindal index shows the market share of Apple exported quantities and values and its value ranges are between 0 and 1, where a value of 0 represents diversified market and 1 represents

monopoly structure. But Theil's Entropy index is an inverse measure of concentration having a logarithmic character for increasing diversification. It is also found between 0 and 1. This is used to examine the market share diversification for the exported quantities and values of Apple. Its value ranges between 0 and logs n, where 0 represent perfect competition and vice versa (Singhal and Kumar, 1998). According to the Table 4.9 there were most diversified market for Apple export quantity in 2014-15, quantity was 0.55 per cent with value rate of 0.47 per cent and the market competition for Indian Apple export quantity increased in the same year at a rate of 0.31 per cent with the value of 0.37 per cent. In 2015-16 export quantity was 0.50 per cent with value rate of 0.50 per cent and the market competition quantity increased in the same year at a rate of 0.13 per cent with the value of 0.32 per cent. And in 2016-17 the export quantity was 0.49 per cent with value rate of 0.33 per cent and the market competition of Apple export quantity increased in the same year at the rate of 0.33 per cent with the value of 0.48 per cent per annum.

4.10 Export competitiveness of Apple in India

The competitiveness of Apple in India is illustrated in the era of globalization, foreign trade policies have given high importance to boost up the agricultural export. This has resulted in cutthroat competition among world nations in the trade scenario of various commodities and in this connection a country's export was decided by its efficiency promotion and its price competitiveness. Under the WTO regime, the bilateral agreements between the countries as per which the trade of different items have taken place not much importance. Hence, examining the export competitiveness of the commodities of interest for a country was utmost importance. In this context, the competitiveness of Indian Apple export was examined using Nominal Protection Coefficient (NPC). The nominal protection coefficients of Apple was calculated for the year 1990-91 to 2016-17 under exportable hypothesis and the results of the analysis were presented in Table 4.10.

Table 4.10 Export competitiveness of Apple in India

(Rs. /tonnes)**Error! Not a valid link.**

Trade competitiveness basically depends upon the level of domestic prices relative to international prices. If the domestic price of a commodity is lower than the net export price, the commodity is export competitive otherwise it is not.

From Table 4.10 it can be seen that, since 1990-91, the domestic price of Apple was less than the international price. Indian Apple experienced the highest export advantages at the rate of 83.16, 82.35, 82.25 and 80.35 per cent during the year 2009-10, 2007-08, 2010-11 and 2006-07 years respectively, the countries like Bangladesh and Nepal would be the stable importers of the Indian Apple in the future, and the countries like UAE and other minor countries were least stable importers so government should be take more initiation on pricing strategies, market facilities and policies for these countries, which would help in stabilizing the prices and would maximize profit to farmers. The level of domestic price related to international price was much lower, which facilitated export advantages but except in 1999-00 and 2016-17, during the twenty-seven years (1990-91 to 2016-17) of the study period.

Thus the overall hypothesis was accepted and there was scope to increase the export of Apple with the highest advantage of 83.16 per cent during the overall study period.

CHAPTER V

SUMMARY AND CONCLUSION

India is the second largest producer of fruits next to China and fifth largest producer of Apple in the world, there was increasing acceptance of horticulture produce from the country. The horticulture sector has emerged as an essential part of agriculture, offering a wide range of option to the farmers for crop diversification. It also provides plentiful opportunities for sustaining a large number of agro-industries which generate substantial employment opportunities. Fruits play an important role in providing food and nutritional security as well as sustainable income to farmers.

Although production and consumption are small in per capita terms growth in both production and consumption has been sluggish despite rising incomes. Almost all Apple produced in India was used for fresh consumption, with only small quantity used for processing into products such as Apple juice, jelly, or jam. The present study is an attempt to analyze production, export potential of Apple in India since it was also one of the major producers of Apple in the world. The study will also help planners and policy makers to frame appropriate policies related to Apple production, marketing, and export.

Objectives

1. To study the performance of area, production, and productivity of Apple in India.
2. To study the export performance of Apple.
3. To examine the market share and concentration of export of Apple.
4. To study the export and competitiveness of Apple.

The present study based on secondary data. In order to analyze the growth rate, coefficient of variation, instability and nominal protection coefficient of area, production, consumption, export quantity and their respective values were collected from various publications, official records and web sources such as India Agristat, Agriexchange, Indian horticulture

national board, Food and Agricultural Organization (FAO) of the United Nations. For the years 1990-91 to 2016-17. The following statistical tools were employed to assess the export performance of Apple in India, such as CGR, Instability, and the coefficient of variation, Market share, and concentration. For the purpose of comparison, the period of study has been divided into three periods, the first period (from 1990-91 to 2004-05) and the second period (form 2005-06 to 2016-17) and the third period (from 1990-91 to 2016-2017).

5.1 Growth, the coefficient of variation and instability analysis in the area, production, and productivity of Apple in India.

The calculation depicted that, the growth of the area of Apple in India was continuously increasing at a rate of 0.95 per cent 1.93 per cent and 1.84 per cent in the first, the second and third period respectively. During the overall reference period for 27 years of the study, the coefficient of variation in the area under Apple was calculated at 16.84 per cent.

5.2 Growth, the coefficient of variation and instability in the area under Apple in major producing states in India.

The study was conducted on major Apple producing states in India viz., Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, and other minor producing states in India. During the third period, Jammu & Kashmir growth rate was increasing at a growth rate of 3.65 per cent followed by other minor states with a negative growth rate of 3.10 per cent, Arunachal Pradesh with 3.04 per cent, and Himachal Pradesh with 1.98 per cent at 1 per cent level of significant.

5.3 Growth, the coefficient of variation and instability on the production of Apple in major producing states in India.

The CGR for Apple production in other minor states were negatively increased with 6.44 per cent, Jammu & Kashmir was increased at a rate of 4.12 per cent followed by Himachal Pradesh with 3.79 per cent at 1 percent level of significant, and Arunachal Pradesh growth was non-significant, during the third period. It also showed that, other minor states growth rate in production was negative in both first and second period mainly due to

decreased productivity and unfavourable climatic conditions for the crop growth. In Jammu & Kashmir and Himachal Pradesh production of Apple were increased mainly due to increased area under Apple cultivation and favourable climatic conditions for its cultivation. The third period CGR of production under Apple in different states of India was calculated at 2.56 per cent at 1 per cent level of significant which means the production increased annually by 2.56 per cent over the study period. The coefficient of variation in production during the third study period was found at 26.28 per cent.

5.4 Growth, coefficient of variation and instability on the productivity of Apple in major states in India.

During the study of state wise productivity, the growth rate of Jammu & Kashmir was increased in the third period than the first and second period. Arunachal Pradesh growth rate was decreased in the third period but in the first period it was negatively increased at 1 per cent level of significant and in the second period it was significant at 5 per cent level of significance. Mainly due to changing Apple crop cultivation to other crops like grape, paddy, sugarcane, and other fruits and vegetables. The third period growth of productivity in different states under study found non-significant. It was mainly because of unfavourable climatic conditions and affordable Apple prices in the markets.

5.5 India's share of agricultural export to total national export and percentage share of Apple export to agriculture export

The total national export increased with a growth rate of 17.44 per cent and agricultural export a with growth rate of 15.08 per cent and Apple export with a growth rate of 14.58 percent, the share of agricultural export has decreased to 12.30 per cent in 2016-17 from 18.49 per cent in 1990-91. Therefore; according to the calculation, we found that the agricultural share may decline further. It needs the attention of policy makers to promote and encourage agricultural export to increase agricultural share.

5.6 CGR, the coefficient of variation and instability analysis on production, consumption, export quantity and export value of Apple in India.

The compound growth rate for production of Apple found non-significant for the first period of study, the CGR calculated for the second period with 2.79 per cent at 5 per cent level of significant and growth rate of third period was 2.56 per cent, at 1 percent level of significance. The third period compound growth rate of production in India calculated at 2.56 per cent per annum, which means the production increase annually by 2.56 per cent. The coefficient of variation for production under Apple was found at 26.28 per cent over the study period.

The export value of Apple during the first period was positive and significant growth rate was observed with 9.63 per cent at 1 per cent level of significance. Similarly, the growth rates for export values in the second period decreased to 8.40 per cent at 1 per cent level of significance. However, growth has further increased to 12.73 per cent at 1 per cent level of significance during the third period. During the overall reference period for 27 years of the study, the coefficient of variation in export under Apple value calculated at 89.85 per cent.

5.7 Growth, the coefficient of variation and instability on the Country-wise export quantity of Apple from India in major Countries.

The CGR for Apple export in Nepal increased with a growth rate of 35.19 per cent at 5 per cent level of significant and Bangladesh, UAE and other minor countries were non-significant growth rates in the first period. In the second period Bangladesh had negative growth rate with 7.22 per cent and Nepal growth rate was increased with 9.22 per cent both at 5 per cent level of significance. The UAE and other minor countries were non-significant in the second period. In the third period Bangladesh and Nepal growth rate were increased at 1 per cent level of significant and The UAE and other minor countries were non-significant. The CGR of Apple export quantity in different countries during 1990-91 to 2016-17 calculated at 7.66 per cent at 1 per cent level of significance which means the export quantity

was increased annually by 7.66 per cent over the study period. The coefficient of variation of Apple export during the third period was found at 65.218 per cent.

5.8 The CGR, coefficient of variation and instability on country wise export value of Apple in major countries

The studied conduct on export value of Apple in major countries, Bangladesh, Nepal, United Arabic Emirate, and other minor countries in the world. During the third study period, Nepal with a growth rate of 41.35 per cent, Bangladesh with 10.94 per cent were increased at 1 per cent level of significance. United Arabic Emirate and other minor countries were non-significant growth rate. But during the third period, there was a positive growth of 12.73 per cent, at 1 per cent level of significant.

5.9 Market share and concentration on export quantity and export value of Apple in India.

There was the most diversified market for Apple export quantity in 2016-17 at a rate of 0.49 per cent with value rate of 0.33 per cent and the market competition for India Apple export quantity increased in the same year at a rate of 0.33 per cent with the value of 0.48 per cent per annum.

5.10 Export competitiveness of Apple in India

The domestic price of Apple was lower than the international price. So Indian Apple experienced the highest export advantage 83.16 per cent during the year 2009-10. The countries like Bangladesh and Nepal would be the stable importers of Indian Apple in the future, and countries like UAE and other minor countries were least stable importers. The level of domestic price related to international price was much lower, which facilitated export advantages but except in 1999-00, 2016-17, during the twenty-seven years (1990-91 to 2016-17) of the study period.

Conclusions

- Apple export values were Rs.185.10 lakhs in 1990-91 which have increased to Rs. 9194.60 lakhs in 2016-17 with growth rate increased by 14.58 per cent per year.

- The calculation depicted that, the growth of the area of Apple in India was continuously increasing at a rate of 0.95 per cent 1.93 per cent and 1.84 per cent in the first, the second and third period at 10, 5 and 1 per cent level of significant respectively.
- The instability index for area of Apple cultivation in India, during the first period was less at 7.44 per cent as compared to second period 7.67 per cent and the third period 8.27 per cent.
- The consumption of Apple in India showed high instability in the third period with 15.55 per cent than in the second period with 13.53 per cent and first period with 10.86 per cent.
- The CGR of Apple export quantity in different countries during 1990-91 to 2016-17 calculated at 7.66 per cent at 1 per cent level of significance which means the export quantity increased annually by 7.66 per cent over the study period.
- The export quantity showed high instability in first period with 51.03 per cent than the second period with 25.67 per cent and second period was less than the third period with 28.08 per cent and the export value showed high instability found in first period with 40.79 per cent than the second period with 26.72 per cent and the third period with 35.39 per cent.
- The instability for major states in the area of Apple cultivation showed higher instability for other minor states 32.65 per cent followed by Arunachal Pradesh 30.88 per cent, Jammu & Kashmir 8.31 per cent and lowest instability found in Himachal Pradesh 4.69 per cent per year.
- The instability for other minor states in the production of Apple showed higher instability were found at the rate of 58.27 per cent followed by Arunachal Pradesh 56.87 per cent, Himachal Pradesh 40.62 per cent and lowest instability found in Jammu & Kashmir 10.53 per cent per annum.
- The instability for major states in productivity of Apple cultivation showed higher instability at the rate of 47.62 per cent followed by

Himachal Pradesh 37.24 per cent, Arunachal Pradesh 33.51 per cent and lowest instability found in Jammu & Kashmir 10.45 per cent per annum.

- There were most diversified market for Apple export quantity in 2016-17 at rate of 0.49 per cent with value rate of 0.33 per cent. The market competition for India Apple export quantity increased in the same year at a rate of 0.33 per cent with the value of 0.48 per cent per annum.
- Indian Apple experienced highest export advantage of more than 83.16 per cent during the year 2009-10 except in 1999-00, 2016-17 years.

Policy implications

The following policy implications emerging from the study of export performance of Apple in India.

1. The trend analysis and compound annual growth rate revealed that productivity of Indian Apple was declining over the years. High density planting should be promoted in Apple producing areas. Similarly old orchards with low producing trees can be replaced with high yielding varieties which have high market demand both domestically as well as internationally in order to increase productivity.
2. In order to export, Apple and optimize export earnings, quality control labs can be established and quality assessment may be made mandatory in order to cope up with improvement in export.
3. As the change in area and productivity were contributing more towards instability in Apple production, the government should be take more initiation on pricing strategies, market facilities and policies, which would help in stabilizing the prices and would maximize profit to farmers. This is necessary to meet the increasing domestic demand on the one hand and to maintain the monopoly supply position at the international market on the other.

CHAPTER VI

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APPENDIX-I

Area, Production and Productivity of Apple in India Error! Not a valid link. **(Source: http://www.indiastat.com)**

APPENDIX-II

State Wise area under Apple in India (In Hectare) Error! Not a valid link. (Source: http://www.indiastat.com)

APPENDIX III

State wise production under Apple in India (In tonnes)Error! Not a valid link. (Source: http://www.indiastat.com)

APPENDIX IV

State wise productivity under Apple in India (In tonnes/Hectare) Error! Not a valid link. (Source: http://www.indiastat.com)

APPENDIX V

Percentage share in Apple export to total agricultural export in lakhs

Years	Total National Exports	Total Agricultural Export	Apple Export	% share in Agriculture Exports	% share of Apple exports to Agricultural Exports
1990-91	32,52,728.00	6,01,276.00	185.10	18.49	0.031
1991-92	44,04,181.00	7,83,813.00	859.83	17.80	0.110
1992-93	53,68,826.00	9,04,030.00	739.69	16.84	0.082
1993-94	69,74,885.00	12,58,655.00	666.76	18.05	0.053
1994-95	82,67,340.00	13,22,276.00	677.99	15.99	0.051
1995-96	1,06,33,535.00	20,39,774.00	976.25	19.18	0.048
1996-97	1,18,81,797.38	24,16,129.00	1,354.95	20.33	0.056
1997-98	1,29,27,770.02	24,84,345.00	1,142.26	19.10	0.046
1998-99	1,39,75,315.65	25,51,064.00	1,002.24	18.25	0.039
1999-00	1,59,56,177.56	25,51,064.00	884.18	16.03	0.035
2000-01	2,03,57,101.09	28,65,737.00	416.02	14.23	0.015
2001-02	2,09,01,797.34	29,72,861.00	1,342.31	14.22	0.045
2002-03	2,55,13,727.66	34,65,394.00	1,571.89	13.58	0.045
2003-04	2,93,36,674.75	37,26,652.00	1,317.63	12.70	0.035
2004-05	3,75,33,952.62	41,60,265.00	2,633.69	11.08	0.063
2005-06	4,56,41,786.15	49,21,696.00	3,811.57	10.78	0.077
2006-07	5,71,77,928.52	62,41,142.00	3,153.92	10.92	0.051
2007-08	6,55,86,352.18	79,03,972.00	3,330.79	12.05	0.042
2008-09	8,40,75,505.87	85,95,167.00	5,222.01	10.22	0.061
2009-10	8,45,53,364.38	89,34,133.00	3,210.34	10.57	0.036
2010-11	11,36,96,426.38	1,17,48,361.00	5,974.70	10.28	0.051
2011-12	14,65,95,939.96	1,87,60,933.00	9,147.11	12.80	0.049
2012-13	16,34,31,828.96	2,32,04,111.00	5,151.39	14.20	0.022
2013-14	19,05,01,108.86	2,68,46,905.00	8,623.77	15.85	0.032
2014-15	18,96,34,841.76	2,40,64,200.00	5,292.72	12.69	0.022
2015-16	17,16,37,804.58	2,15,39,600.00	20,832.59	6.26	0.194
2016-17	18,49,42,875.55	2,27,55,400.00	22,582.66	5.86	0.208

(Source: http://www.indiastat.com)

Source: http://www.agriexchange.apeda.gov.in.com

APPENDIX VI

Apple production, consumption, export quantity and their value in India Error! Not a valid link. **(Source: http://www.indiastat.com)**Error! Not a valid link. **Source: http://www.agriexchange.apeda.gov.in.com)**

APPENDIX VII

Country wise export of Apple from India (In tonnes)Error! Not a valid link.Source: http://www.agriexchange.apeda.gov.in.com)

(Source: http://www.fao.org/faostat

APPENDIX VIII

Country wise export of Apple from India (In lakhs)

Year	Bangladesh	Nepal	UAE	Others	Total
1990-91	174.29	2.19	1.35	7.28	185.10
1991-92	847.62	8.65	1.41	2.16	859.83
1992-93	703.53	0.60	2.02	33.54	739.69
1993-94	421.52	2.51	0.62	242.11	666.76
1994-95	527.85	0.42	0.46	149.26	677.99
1995-96	875.42	7.09	1.77	91.97	976.25
1996-97	1,248.58	4.53	4.79	97.05	1,354.95
1997-98	1,064.00	7.42	1.92	68.92	1,142.26
1998-99	904.14	7.71	2.56	87.83	1,002.24
1999-00	860.18	0.70	1.78	21.53	884.18
2000-01	271.60	0.64	2.09	141.70	416.02

2001-02	1,320.37	3.02	0.13	18.79	1,342.31
2002-03	1,422.25	143.76	1.28	4.59	1,571.89
2003-04	1,057.09	205.94	20.80	33.81	1,317.63
2004-05	2,399.39	170.08	10.48	53.75	2,633.69
2005-06	3,425.66	275.96	14.49	95.45	3,811.57
2006-07	2,715.51	418.35	15.26	4.81	3,153.92
2007-08	2,681.05	641.35	0.01	8.39	3,330.79
2008-09	4,370.58	649.17	37.21	165.05	5,222.01
2009-10	2,909.82	289.07	0.26	11.18	3,210.34
2010-11	5,235.25	550.58	188.00	0.87	5,974.70
2011-12	7,691.86	1,392.28	0.22	62.75	9,147.11
2012-13	3,787.37	1,359.12	0.11	4.79	5,151.39
2013-14	6,375.98	1,863.07	34.17	350.56	8,623.77
2014-15	2,968.66	2,088.45	32.43	203.18	5,292.72
2015-16	3,306.17	2,640.86	22.24	33.12	6,002.39
2016-17	3,182.29	2,988.24	29.61	2,994.46	9,194.60

(Source: http://www.agriexchange.apeda.gov.in.com)

(Source: http://www.fao.org/faostat

APPENDIX IX

Years	Domestic Price Pd (In Rs./tonnes)	Border price Pb (In Rs./tonnes)
1990-91	6,006.26	28,003.15
1991-92	8,224.17	27,358.10
1992-93	8,575.14	30,656.50
1993-94	11,136.88	31,228.40
1994-95	10,418.89	30,995.65
1995-96	10,532.42	35,411.25
1996-97	10,246.29	38,363.85
1997-98	10,317.83	35,065.45
1998-99	13,478.66	32,518.50
1999-00	16,146.91	29,685.60
2000-01	14,687.60	30,058.00
2001-02	6,933.14	33,356.40

2002-03	10,072.26	36,242.50
2003-04	14,587.71	39,481.05
2004-05	11,342.71	44,169.30
2005-06	12,690.59	45,785.25
2006-07	12,112.98	61,658.80
2007-08	10,199.86	57,788.50
2008-09	11,721.10	57,376.20
2009-10	11,943.08	70,935.55
2010-11	12,691.34	71,500.80
2011-12	30,422.23	60,348.75
2012-13	21,639.14	62,383.65
2013-14	23,889.84	63,713.65
2014-15	25,976.95	63,022.05
2015-16	28,812.51	64,754.77
2016-17	40,715.33	65,245.93

(Source: http://www.agriexchange.apeda.gov.in.com)

(Source: http://www.fao.org/faostat)