A STUDY ON MARKET INTEGRATION AND EXPORT POTENTIAL OF INDIAN COTTON

BY

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ABSTRACT

Cotton is an international crop, being grown in more than 80 countries of the world. In the year 2019-20, India ranks first with total production of 6.42MMT, followed by China with 5.93MMT, USA, Brazil & Pakistan with total production of 4.33, 2.91 &1.35 MMT respectively (Statista). Total export value of cotton worldwide is 55938.04 million USD. India exported 6002.69 million USD, contributing 10.73 percent to the global export share while import share is 3.18 percent of value 1552.01 million USD. China, Bangladesh and Vietnam imported about 41percent of the global import in the year 2019 (ITC).

Cotton is one of the most important fibre and cash crop in India and it plays an important role in the Indian economy as India's textile industry is primarily based on cotton. India is one of the largest producers and exporters of cotton yarn. India's textile industry accounts for about 5 percent of gross domestic product (GDP), and accounts for 59 percent of the national textile production. It accounts for 34 percent of the country's exports. The industry is also the country's second-largest employer after agriculture and directly employs 51 million and 68 million people indirectly, including women (Indian Trade Portal). In India, the states of Gujarat, Maharashtra, Telangana, Madhya Pradesh, Rajasthan, Andhra Pradesh, Karnataka, Haryana, and Punjab are the major cotton producers. India has the distinction of having the largest area under cotton cultivation which is about 41 percent of the world area under cotton cultivation between 12.5 million hectares to 13.0 million hectares (CCI).

A project entitled “A Study on Market Integration and Export Potential of Indian Cotton” was carried out under National Agricultural Higher Education Project – Centre for Advanced Agricultural Science & Technology (NAHEP–CAAST). It has been formulated by ICAR with a total cost of US$165 million for five years starting from 2017-18. Anand Agricultural University has bagged an ICAR-World Bank funded project to establish Centre for Agricultural Market Intelligence at its campus. Total fund sanctioned under the project is Rs.16.89 crore. The project duration is three years and

it has multidisciplinary team covering crops, dairy, food processing, poultry and fisheries. The stipulated objectives of the study are as follows; to understand the cotton market scenario in India, to examine the trend, seasonality and integration of cotton markets in India, to calculate the export potential index of Indian cotton.

For understanding of cotton market scenario, some of major findings reveal that cotton acreage, production, and yield, all have changed dramatically since the cotton development programme was transferred to Mini Mission II of the Technology Mission on Cotton (TMC) in 1999-2000. The cultivated area of cotton in the country, which was 93.42 lakh hectares in the Pre- TMC period (1998-99) eventually increased to 101.32 lakh hectares during 2009-10 and reached to 121.78 lakh ha in 2011-12. In 2002-03, Bt. Cotton was approved for commercial cultivation in India. Cotton production in India has increased by more than fourfold, peaking at 359.02 lakh bales in 2013-14, up from 86.24 lakh bales in 2002-03 (DES, DAC & FW). Current area under cotton cultivation is 133.73 lakh ha with production of 365 lakh bales (Cotton Advisory Board).

The study of major cotton markets of India from 2010-11 to 2019-20 indicated that Cotton arrivals in Gondal, Ganganagar, Warangal, Khargone and in Hinganghat market shows mixed trend with CAGR of 2, 2.78, -12, -3.6 and 13.7 percent respectively. Price trend in all the markets shows similar trend with CAGR of 1.02, 2.76, 2.37, 2.35 and 2.73 percent in markets of Gondal, Ganganagar, Warangal, Khargone and Hinganghat respectively. Seasonal index arrival in all the market indicates that arrival range is high in months of September to January and then starts decreasing depending on the market and lowest in July-August The prices of cotton in all the market are not much volatile (±5 percent). Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa except in few exceptional months.

Market integration explains relationship between markets that are spatially separated. For effective functioning of market, it should be integrated. In an integrated market, price of any product is responsive to price changes in same quality of produce in the other market. Co-integration between the markets are an indicator for efficient functioning of markets. Price among different markets does not show much volatility due to integration among them. The results of Johansen Co-integration test showed that there were at least eight co-integration relationships between nine markets selected for cotton in India. Out of thirty six markets pairing ten market pairs are related to a unidirectional way while twenty six markets are related in a bidirectional manner.

India, being one of the top five cotton exporting countries, it is important to know the potential product for export. The analysis using ITC methodology examined the product wise export potential of Indian cotton in the global cotton trade markets. The result shows that Cotton yarn other than sewing thread (containing >= 85% cotton by weight) (HS Code 5205) has the highest export potential followed by Cotton, neither carded nor combed (HS Code 5201) under the broad category group of cotton.

CERTIFICATE

This is to certify that the project report entitled **"A study on market integration and export potential of Indian cotton"** of M.B.A. (Agribusiness Management) embodies bonafide research work carried out by **Nivedita Bhardwaj (Reg. No. 2040619016)** under my guidance and supervision and no part of this project work has been submitted for any other degree. The assistance, guidance and help received during the course of investigation have been fully acknowledged.

Place: IABMI, Anand
Date: /06/2021

Dr. Mahesh R.Prajapati
(Advisor)

DECLARATION

I hereby declare that the project entitled **"A study on market integration and export potential of Indian cotton"** submitted for the M.B.A. (Agribusiness Management) degree is my original work and this has not formed the basis for the award of any degree, associate ship or other similar titles.

Place: IABMI, Anand Nivedita Bhardwaj

Date: /06/2021 (**Reg. No.** 2040619016)

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Place: IABMI, Anand — Nivedita Bhardwaj

Date: /06/2021 — (**Reg. No**. 2040619016)

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ABBREVIATIONS

GDP	Gross Domestic Product
NAHEP-CAAST	National Agricultural Higher Education Project- Center for Advanced Agricultural Science & Technology
ICAR	Indian Council of Agricultural Research
ITC	International Trade Centre
Agmarknet	Agricultural Marketing Information Network
CAGR	Compound Annual Growth Rate
EPI	Export Potential Index
ADF	Augmented Dickey-Fuller
CCI	Cotton Corporation of India
ICAC	International Cotton Advisory Committee
RCA	Revealed Comparative Advantage

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1. INTRODUCTION

1.1 BACKGROUND

Cotton is one of India's most important fiber and cash crops and plays a leading role in industrial and agricultural economy. It provides the most important raw material in the form of cotton fiber to the cotton textile industry. Cotton gives livelihood to 6 million farmers directly, with about 40 to 50 million people are employed in the cotton trade and processing in India (nfsm.gov.in). The domestic textile industry is one of the largest in the country and has shown remarkable growth in spindle and yarn production over the past 20 years. In terms of technology, India's spin industry has been able to keep pace with international technology trends. India has become one of the major cotton consuming country which is about 23 percent of global cotton consumption (cotcorp.org.in). There are four cultural varieties of cotton. Gossypium arboreum, G. herbaceum, G. hirsutum and G. barbadense.

Cotton is one of the most important fiber crops that play an important role in the history of mankind and civilization. It is also referred to as "white gold" because of its importance to agriculture and industry. Cotton is grown primarily for fibers which is used to make cloth fabrics for people. It is also used for many other purposes, such as making yarn, blending different fibers, and extracting oil from the cotton seeds. Cotton is the backbone of the textile industry and accounts for 59 percent of the national textile production. It accounts for 34 percent of the country's exports. The cottonseed oil content is 15-25 percent depending on the variety. Cotton cake after oil extraction is a good organic fertilizer. Seed of cotton and cotton meal served as feed for cattle.

Cotton prices are determined by a variety of factors, including the inherent properties of the fiber, the purity of the pile, and the degree of contamination. Quality assurance should start at the field level as contamination and cleanliness both depends on harvesting procedures, handling, storage, transportation and processes involved in ginning. Contaminated cotton interferes with the spinning process, and such cotton is usually sold at a discounted price to compensate cleaning costs for the cost of spinning to the spinner. For cottages with the same fiber properties, the price difference can be between 5 percent and 30 percent depending on the degree of contamination.

1.2 GLOBAL STATUS

Table 1.1 Top 10 cotton Producing Countries Worldwide in the year 2019-20

Country	Production in (000 Metric tonnes)
India	6423
China	5933
United States	4336
Brazil	2918
Pakistan	1350
Uzbekistan	762
Turkey	751
Greece	365
Mexico	342
Argentina	305

(**Source:** Statista.com)

In the year 2019-20, India with 6.42 MMT of cotton leads global cotton production, followed by China (5.93 MMT), USA (4.33 MMT), Brazil (2.91 MMT) and Pakistan (1.35 MMT), ranked second, third, fourth and fifth respectively.

Table 1.2 Worldwide top 5 cotton exporting countries

Unit: US Dollar thousand

Country	2015	2016	2017	2018	2019
China	15798722	14965725	15127254	15393581	14142823
USA	5873208	5694143	7635374	8377508	7905838
India	7470346	6262460	6897880	8130128	6002695
Brazil	1449631	1387641	1496816	1733321	2781188
Vietnam	1706681	2096055	2641384	2837337	3055101

(**Source:** ITC)

Export values of cotton in all major 5 countries decreases in the year 2019 as compared to previous year due to impact of COVID-19. China is the major exporter of cotton among all since earlier, followed by USA. India ranks 3rd in export values in the year 2019.

Table 1.3 Worldwide top 5 cotton importing countries

Unit: US Dollar thousand

Country	2015	2016	2017	2018	2019
China	9231143	10254128	7743516	8614958	9890790
Bangladesh	6512530	7150498	5415387	6246957	6896526
Vietnam	4373633	3398791	3376367	4055423	4748347
Turkey	2629313	2264729	2297299	2995031	2508500
Indonesia	1974887	2124446	2096220	2261798	2396849

(**Source:** ITC)

As per the table, China is constant major importer of cotton, followed by Bangladesh, Vietnam, Turkey & Indonesia at 2nd, 3rd, 4th & 5th position respectively.

Table 1.4 World Cotton Balance Sheet (2016-17 to 2018-19)

(Quantity in million bales)

Year Beginning (1Aug)	2016-17	2017-18	2018-19
Beginning Stocks	20.31	18.48	18.76
Production	23.07	26.66	26.05
Consumption	24.78	26.35	26.69
Exports	8.19	9.04	9.4
Imports	8.08	9.01	9.4
Ending Stocks	18.48	18.76	18.13

(**Source:** ICAC)

There is increase in production in the year 2017-18 while slight decreases in the year 2018-19. Consumption is almost same in last 2 years. Export and import both shows positive trend. In the last three years beginning stock was highest in the year 2016-17 at 20.31 million bales and lowest at 18.48 million bales in the year 2017-18. While ending stock is lowest in the year 2018-19 at 18.13 million bales.

1.3 NATIONAL SCENARIO

Table 1.5 State-wise Production of Cotton in India

(Quantity lakh bales)

State	2014-15	2015-16	2016-17	2017-18	2018-19
Punjab	13.00	6.25	9.00	11.50	10.00
Haryana	23.00	14.50	20.50	22.50	23.00
Rajasthan	17.00	15.00	16.50	22.00	26.00
Gujarat	112.00	90.00	95.00	104.00	87.50
Maharashtra	80.00	76.00	88.50	85.00	75.50
MP	19.00	18.00	20.50	20.50	24.00
Telangana	50.50	58.00	48.00	55.00	43.00
AP	26.50	23.75	19.00	20.50	14.50
Karnataka	34.00	19.50	18.00	18.00	15.00
Tamil Nadu	6.00	6.00	5.00	5.50	5.00
Orissa	3.00	3.00	3.00	3.50	4.50
Others	2.00	2.00	2.00	2.00	2.00
Total	**386.00**	**332.00**	**345.00**	**370.00**	**330.00**

(**Source:** DES, DAC & FW, MoA & FW)

Gujarat is the highest cotton producing state which because of favourable soil and climatic condition for cotton cultivation, while Maharashtra is the 2nd highest. These

two states account for approx. 49 percent of total cotton production in India. It is followed by Telangana, MP, Rajasthan and Haryana respectively.

Table 1.6 State-wise area covered under cotton in India

(Area in Lakh ha)

State	2014-15	2015-16	2016-17	2017-18	2018-19
Punjab	4.20	3.39	2.85	2.91	2.84
Haryana	6.48	6.15	5.70	6.69	6.65
Rajasthan	4.87	4.48	4.71	5.84	4.96
Gujarat	27.73	27.22	23.82	26.23	27.09
Maharashtra	41.90	42.07	38.00	42.07	41.19
MP	5.74	5.63	5.99	6.03	6.97
Telangana	17.13	17.73	14.09	18.97	17.94
AP	8.21	6.66	4.72	6.44	5.51
Karnataka	8.75	6.42	5.10	5.46	5.75
Tamil Nadu	1.87	1.42	1.42	1.85	1.4
Orissa	1.27	1.25	1.36	1.45	1.58
Others	0.31	0.50	0.50	0.50	0.50
Total	128.40	122.90	108.20	124.40	122.30

(**Source:** DES, DAC & FW, MoA & FW)

In terms of area under cotton, Maharashtra is at the top followed by Gujarat and Telangana. As compared to previous year, in some states area has increased while in few states there is slight decrease**.**

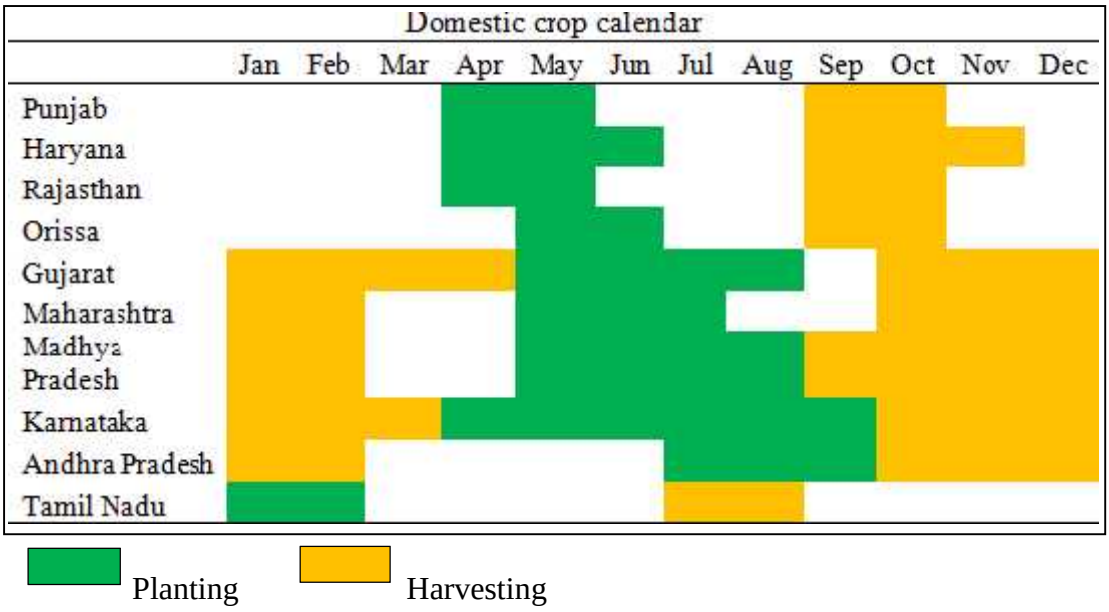
Table 1.7 Cotton Balance Sheet

(Quantity in lakh bales of 170 kg)

Particulars	2014-15	2015-16	2016-17	2017-18	2018-19
SUPPLY					
Opening Stock	33.00	66.23	36.44	43.76	47.12
Production	386.00	338.00	345.00	370.00	361.00
Import	14.00	15.00	30.94	15.80	15.00
Total Supply	**433.39**	**419.00**	**412.38**	**429.56**	**423.12**
DEMAND					
Mill Consumption	278.06	274.00	262.66	275.91	278.00
S.S.I Consumption	26.38	24.00	26.20	27.20	27.00
Non Textile Consumption	5.00	10.00	17.50	11.50	12.00
Total consumption	**309.44**	**308.00**	**306.36**	**314.61**	**317.00**
Export	57.72	62.00	58.21	67.83	65.00
Total Demand	367.16	370.00	364.57	382.44	382.00
Closing Stock	**66.23**	**36.44**	**43.76**	**47.12**	**41.12**

(Source: Cotton Corporation of India)

Opening stock shows an increasing trend in last 3 years while closing stock depicts mixed trend. Total supply as well as total consumption shows movement in same direction. Export and import both were up till 2017-18. While in the year 2018-19, there is slight downfall.



(**Source:** commoditiescontrol.com)

Figure 1.1 Domestic Crop Calendar of Cotton

Cotton is primarily a kharif crop and it takes 6 to 8 months for maturity. It's sowing and harvesting time differs slightly as per the climate and geographical locations. In Punjab, sowing time is April-May and harvesting time is Sep-Oct. While in Gujarat and Maharashtra, it is sown in May-July and harvesting starts in Sep-Oct & lasts till Feb.

1.4 Evolution of Indian Cotton Market

1.4.1 British Era (1615-1900)

East India Company opened a trading office and factory for the manufacture of cotton products in 1615. The first plant was established in Surat and the second plant was established in Madras in 1639. In the 1640s, the direct trade of cotton products to England began through the port of Calicut. The 18th century British Industrial Revolution strengthened Lancashire's textile industry with new production facilities, inventing spinning and loom machines within a modern factory system. By 1793, London's East India Company (i) revised its policy to increase imports of raw materials. And (ii) increase exports of manufactured goods in the UK. In 1801, Britain's imports

of raw cotton was placed at $56 million, and India was the main source of this raw material. In 1850, India accounted for nearly one-sixth of Britain's total textile exports and became the UK's largest consumer of textiles. Thus, India has evolved from a supplier of industrial cotton products to a supplier of raw cotton to a British textile mill. In 1861, India accounted for 31 percent of all raw cotton imported to Britain. In 1862, the first American war year, India's contribution reached to 90 percent of British cotton imports. By 1864, cotton from India fell to 67 percent. During the four years of the Civil War, the Western India formed “the great cotton stay” after the United States returned to trade after 1865 and it lost its position in the world's largest cotton market. One of the most important factors is the counterfeiting of Indian cotton. (Unsuccessful trials of exotic cotton) Deterioration of Indian cotton, which has cut prices of Indian cotton on the British market since 1865. It was clear that long-term competition with the United States required more attention to improve the quality of Indian cotton. This was specified in May 1861 by the Cotton Supply Association of Manchester to warn the country's cotton producers and exporters. There have been three major objections to India's use of short-staple cotton. Spinning produced more waste. Orleans 10 ponds raw cotton produce 9 ponds while Indian cotton, produces 7 ponds. Due to its short length, it requires 12 revolutions per inch, while the US version requires 8 revolutions per inch. U.S. cotton with long staples has been sold for 8-12 cents per pound since 1866, so British producers will prefer these in place of adulterated Indian cotton at 8-12 cents per pound. India's failure was very obvious.

1.4.2 Setting up of the Indian Cotton Committee (1900-1970)

Before the outbreak of World War I in 1914, the world's total cotton production was about 25.5 million bales (392 lbs/bale), 15 million bales in the United States and 4-5 million bales in India comprising desi cotton which is almost exclusively short staple lengths (less than 1 inch). With local consumption of U.S. cotton by the U.S. textile industry (nearly 60 percent of production) in 1915-18 and the declining availability of cotton in the Lancashire industry, the British Empire was turning to India to increase and improve productivity in terms of fiber quality. At the time, India was the largest cotton producer in the empire and the second largest country in the world. The President of the Parliament established the "Indian Cotton Committee" in 1917 to explore the possibilities of expanding the production of long-staple cotton fabrics in India after reviewing the work done in the various states of India for the production of long-staple

cotton in India. . In the five years ending 1917-18, the total amount of cotton exported from India to Britain amounted to 215,000 bales.

In 1928, the Royal Agricultural Commission recommended the creation of regulated markets to improve trade practices and build markets in the state. In 1923, a law was passed to increase taxes on cotton used by textile factories or exported from the country. Thus, the Indian Central Cotton Committee has become an official body providing funds that can be used to promote agricultural and technical research on cotton. In 1924, the Central Cotton Indian Commission established the Cotton Technology Research Institute [now known as the Central Institute for Research on Cotton Technology (CIRCOT)] in Mumbai on January 1, 1924 under the auspices. Diversity between 1924 and 1937, seed reproduction, agronomics, pest and disease control, physiology. The Indian government drafted a model bill in 1938 and sent it to all states.

1.4.3 Early Hybrid Phase, 1970 - 1990

An important outcome of the initial research program on cotton was the development of a commercial hybrid. In 1970, the introduction of H-4 intra- hirsutum hybrid cotton paved the way for a hybrid boom, a unique era in cotton history. After that, excellent cotton hybrids, which were often shorter than previous varieties, were released for cultivation in India. An important result of this development is the emergence of cotton-wheat crop rotation as the dominant crop cultivation model in northern India (Ramasundaram et al. 2004). This phase was also linked to marketing and institutional initiatives, including the creation of the 1971-72 Intensive Cotton Development Program (ICDP) and the Cotton Corporation of India (CCI) in the early 1970s.

In 1971, to ensure the lowest prices for producers, the Maharashtra state government introduced a proprietary cotton procurement system to the state under Maharashtra Raw Cotton (purchase, processing and marketing). Also at this time, the Commission for Agricultural Cost and Prices (CACP) began recommending support prices for basic cotton varieties such as F-414, H-777 (medium size) and H-4 (long-staple). Founded in 1976, Central Institute of Cotton Research, Nagpur (CICR) has supported new research and development. This policy had a significant impact on cotton production.

Cotton cost estimates from the Department of Economic Statistics are available since 1976. The period from 1976-77 to 1991-92 is considered an early hybrid phase in most

states in India. The benefits of this stage started to disappear in the early 1990s when cotton production and profitability began to decline.

1.4.4 Late Hybrid Phase, 1991 to 2001(Before Bt Cotton)

Currently, the most important development has been the changing role of the public and private sectors in research, with the private sector playing a leading role in seed and pesticide research. The Indian government launched the Cotton Technology Mission in the late 1990s. Another important development was the Agreement on Textile and Exports (ATC), which came into force in 1995 as part of the WTO agreement. Subsequent agricultural reforms increased production costs and reduced profitability, which led to a difficult situation, especially in rainfed cotton areas (Raghavan, 2008).

Major problem associated with cotton in this phase was pest damage because crops were severely affected by cotton bollworms. Existing cotton varieties were not resistant to pests, and heavy pesticide application raised the cost of production and caused environmental pollution, which worsened human and animal health, increasing pesticide resistance cause resurgence of minor pests. CICR (1998) reported that cotton bollworms caused 50 percent damage to total production.

Despite efforts to increase cotton production and productivity, the situation did not improve significantly during this period. This development laid the foundation for the introduction of transgenic cotton in India in 2002-2003.

Table 1.8 Cotton area, production & yield scenario during 1991-2000

Year	Area (Lakh ha)	Production (Lakh bales of 170 kg each)	Yield(kg lint/ha)
1991-92	76.66	97.06	216.00
1992-93	75.42	114.02	257.00
1993-94	73.20	107.41	249.00
1994-95	78.71	118.88	257.00
1995-96	90.35	128.61	242.00
1996-97	91.20	142.30	265.00
1997-98	88.68	108.50	208.00
1998-99	93.42	122.90	224.00
1999-2000	87.10	115.30	225.00

(**Source:** DES, DAC & FW, MoA & FW, Krishi Bhavan, New Delhi)

Cotton production area increased slightly from 76.66 lakh hectares in 1991-92 to 93.42 lakh hectares in 1998-99 as in table above. Cotton production rose from 97.06 lakh bales in 1991-92 to 142.30 lakh bales in 1996-97 before declining to 115.30 lakh bales by the decade's end. Cotton productivity remained stable at around 216-265 kg per hectare.

1.4.5 After Bt. Cotton (2002-2015)

Cotton acreage, production, and yield have all changed dramatically since the cotton development programme was transferred to Mini Mission II of the Technology Mission on Cotton (TMC) in 1999-2000. The cultivated area of cotton in the country, which was 93.42 lakh hectares in the Pre- TMC period (1998-99) eventually increased to 101.32 lakh hectares during 2009-10 and reached to 121.78 lakh ha in 2011-12 as in table below. This marginally decreased to 119.80 lakh ha in 2012-13.

From 2014 to 2015, TMC's MM II was merged with the National Food Security Mission (NFSM). Cotton coverage increased to 128.19 lakh hectares in 2014-15, surpassing the previous high of 121.78 lakh hectares. Cotton crop area coverage was at an all-time high. **In 2002-03, Bt. Cotton was approved for commercial cultivation in India.** Since its introduction, Bt. Cotton has proven to be an effective bollworm-inhibiting alternative to conventional cotton varieties, increasing yield and income. As a result, Bt cotton has quickly surpassed conventional cotton in terms of adoption. Cotton production in India has increased by more than fourfold, peaking at 359.02 lakh bales in 2013-14, up from 86.24 lakh bales in 2002-03. Cotton production in India has increased as a result of the introduction of Bt cotton.

Cotton area, yield, and production have increased in the country due to favourable climatic conditions, improved agricultural practises, and accelerated technology transfer under TMC's MM-II programme. However, due to delayed/insufficient rainfall in the country's major cotton-growing states of Maharashtra, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, and Rajasthan, cotton production fell slightly to 342.20 lakh bales in 2012-13. Cotton production reached an all-time high of 359.02 lakh bales in 2013-14, an all-time high in cotton history. Cotton production fell to 348.05 lakh bales in 2014-15 and 301.47 lakh bales in 2015-16 due to drought in Maharashtra in 2014-15, pest infestation in some cotton-producing zones, particularly in the north zone (Punjab), and drought in Maharashtra in 2015-16. Cotton area decreased dramatically

to 105 lakh hectares in 2016-17, owing to fears of whitefly infestation in the north, pink boll worm infestation in the central and south zones, and the decision of Andhra Pradesh and Telangana states to divert cotton land to pulses and oilseeds. Over the years, India's cotton yield has increased significantly (Status Paper of Indian Cotton).

Table 1.9 Area, Production & Yield of Cotton in India from 2001-02 to 2015-16

Year	Area	Production (Lakh bales of 170 kg each)	Yield(kg lint / ha)
2001-02	91.30	100.00	186.00
2002-03	76.70	86.24	191.00
2003-04	76.00	137.29	307.00
2004-05	87.90	164.29	318.00
2005-06	86.80	185.00	362.00
2006-07	91.44	226.32	421.00
2007-08	94.10	258.80	467.00
2008-09	94.10	222.80	403.00
2009-10	101.32	240.22	403.00
2010-11	112.40	330.00	499.00
2011-12	121.78	352.00	491.00
2012-13	119.77	342.20	486.00
2013-14	119.60	359.02	510.00
2014-15	128.19	348.05	462.00
2015-16	118.72	301.47	432.00

(**Source:** DES, DAC & FW, MoA & FW, Krishi Bhavan, New Delhi)

Cotton yields rose from 186 kg per hectare in 2001-02 to 510 kg per hectare in 2013-14, but production fell in 2014-15 and 2015-16 due to the drought condition. According to DES's preliminary estimates, the cotton season 2016-17 will likely produce an all-time high yield in cotton history. The table above shows year-by-year data on cotton area, production, and yield in India.

1.4.6 Current Scenario 2016 -2019

India's cotton production increased from 119 lakh bales in 1991 - 92 to 321 lakh in 2016 – 17. It has increased by 190 percent and further increased to 365 lakh bales in the year 2019-20. Nearly two-thirds of cotton in India is produced in the states of Maharashtra, Gujarat, Andhra Pradesh and Telangana, collectively known as "Indian Cotton Baskets". During fiscal 2017, India’s contribution to the total global harvested cotton was 26 percent. About 62 percent of cotton in India is produced in rainfed areas, and

38 percent on irrigated lands. All four known cultivated cotton varieties are grown in India.

Table 1.10 Area, Production & Yield of Cotton in India from 2016-17 to 2019-20

Year	Area (Lakh ha)	Production (Lakh bales of 170kg each)	Yield (kg/ha)
2016-17	108.26	345.00	542.00
2017-18	125.86	370.00	500.00
2018-19	126.14	333.00	449.00
2019-20*(P)	133.73	365.00	464.00

(Source: Cotton Advisory Board)

India's largest cotton producing states are Gujarat, Maharashtra, Telangana, Madhya Pradesh, Rajasthan, Andhra Pradesh, Karnataka, Haryana and Punjab.

Table 1.11 Cotton Export by India 2006-07 to 2019-20

Year	Quantity in lakh bales of 170 kgs	Value in Rs. Crores
2006-07	58.00	5267.08
2007-08	88.50	8365.98
2008-09	35.00	3837.13
2009-10	83.00	10270.21
2010-11	76.50	14483.31
2011-12	129.57	23488.59
2012-13	101.43	17462.87
2013-14	116.96	23153.24
2014-15	57.72	9499.87
2015-16	69.07	11434.80
2016-17	58.21	11676.00
2017-18	67.59	13976.71
2018-19	43.55	9502.72
2019-20*(P)	47.04	8731.32

(**Source:** cotcorp.org.in/statistics)

Indian cotton industry is focused on apparel exports, accounting for about 51 percent of all apparel exports in fiscal year 2018. About 74 percent of clothing exported from India is made of cotton. Cotton is freely exported from India, and the main exporting countries are the United States, Bangladesh, China, Vietnam, Pakistan, Indonesia, Taiwan and Thailand. Bangladesh has been the largest importer of Indian cotton since fiscal year 2015 (investindia.gov.in).

India's cotton exports are expected to increase by 50 percent this year to 75 lakh bales in the 2020-2021 crop year, which starts in October, with a recovery in global demand from China and Bangladesh. Exports could increase further if Pakistan opens its market for Indian cotton. Trade between the two countries has been suspended since 2019.

Cotton prices rose nearly 5 percent in 1 month due to limited supply and strong demand from exports and factories or mills. Over the past year, prices have growth of 20 percent. During November -December 2020, Indian yarn demand in China has returned to pre-covid levels. Pakistan may allow cotton imports from India through in hopes of a gradual recovery of bilateral trade relations (economic times).

Table 1.12 Cotton Consumption by Organized Sector Textile Mills (Non SSI Mills) and Small Scale Spinning Mills (SSI)

Quantity in lakh bales

Year	Non SSI Mills		SSI Mills	
	Annual Consumption	Monthly Consumption	Annual Consumption	Monthly Consumption
2000-01	149.36	12.45	10.97	0.91
2001-02	147.00	12.25	11.70	0.98
2002-03	142.42	11.87	11.63	0.97
2003-04	150.39	12.53	13.00	1.08
2004-05	163.98	13.67	16.57	1.58
2005-06	180.00	15.00	19.00	1.67
2006-07	194.89	16.24	21.26	1.32
2007-08	195.67	16.31	22.08	1.59
2008-09	190.00	15.83	20.00	1.58
2009-10	219.00	18.25	23.00	1.92
2010-11	221.77	18.48	24.46	2.04
2011-12	223.59	18.63	22.12	1.84
2012-13	251.74	20.97	23.59	1.97
2013-14	268.03	22.34	25.20	2.10
2014-15	278.06	23.17	26.38	2.20
2015-16	270.20	22.50	27.08	2.26
2016-17	262.70	22.00	26.21	2.18
2017-18	280.11	23.33	26.18	2.18
2018-19	270.78	22.57	22.43	1.87
2019-20(P)*	233.70	19.48	20.33	1.69

(**Source:** cotcorp.org.in/statistics)

1.5 COTTON MARKETING SYSTEM

- From a farmer's point of view, it is clear that marketing is as important as trying to increase productivity through unit time and resource efficiency per unit.
- Marketing is at the heart of the design of all products because it is the process of obtaining monetary value.
- Cotton is primarily one of the most important cash crops and plays an important role in the country's agricultural economy.

1.5.1 Channels of Movement of Cotton from Producer to Textile Mill

Cotton trays go through a variety of pathways from producer to consumer. Distribution channels are groups of interconnected intermediaries that sell products from farmers to consumers.

It is estimated that about 80 percent of the marketed surplus sold by private distribution channels, and the remaining 20 percent comes from institutional distribution channels, including cooperatives and the Indian Cotton Corporation.

Thus, there are 8 marketing channels identified for cotton. The more common channels are:

Producer - Village trader - Itinerant trader - Wholesaler (in regulated market) – Miller – Consumer

Producer- Village trader/merchant - Commission agent - Miller – Consumer

Producer - Village trader - Itinerant trader - Wholesaler (in unregulated market) – Lint market – Commission agent - Miller – Consumer

Producer - Cooperative society – Cooperative ginning and processing factory – Terminal market - Miller – Consumer

Producer- Cooperative State govt. agencies – Central govt. procurement agencies (CCI) – Miller - Consumer

Producer – Trader - CCI – Miller – Consumer

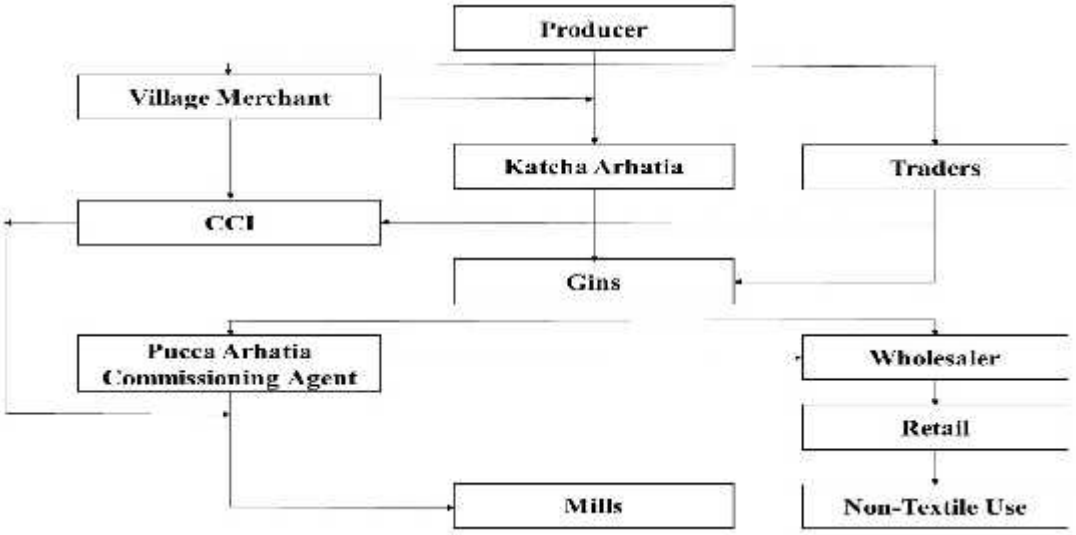


Figure 1.2 Cotton Market Chain

Three marketing channels for cotton in India: private trade, government trade and cooperative marketing. The Agriculture Produce Marketing Committee (APMC) is the primary market infrastructure in the country for commodity trading. The main function of these markets or obligations is to regulate market methods such as weighing, selling methods, grading and payment. It also provides storage, lodging and accommodation for buyers, sellers, and more. For services, the market charges buyers 1 percent of the value of the goods. India's cotton marketing chain is very fragmented. APMC was created as a marketing platform for the sale of basic agricultural products by the the Agricultural Produce Marketing Committee (Regulations) Act in 1963. The purpose of setup was to create a controlled infrastructure for agricultural products that did not exist until now. It features a variety of intermediaries in the form of commissioning agents (katcha arhatia and pukka arhatia) and village merchants. In the fragmented system, the problem of information asymmetry, along with the problem of lack of awareness among raw material producers and the problem of lack of quality and standards, leading to poor price-quality linkages, poor price realisation to primary producers and low awareness of good practices among them.

Regulated Markets and Cotton Marketing.

- Generally, kapas is purchased by the village merchant and stored in godowns of the regulated market rented out to the commission agents.
- These stocks are sold to ginners and other participating traders by secret tender system.

- It is obvious that more than 75 per cent of the kapas brought to the regulated market is by village merchants only.
- In general, the kapas is not brought by growers for sale directly.
- Thus, under the existing system, the Regulated Market acts more as a facilitative organization for effecting transactions between two different intermediaries rather than between the primary producer and the trader.
- The weighmen charges also needed to be paid by the buyer.

Cooperatives and cotton marketing

- Serves as a supporting organization providing markets, stores, and funds to suppliers or manufacturers.
- Their services are only available to members.
- However, non-members who bring the product directly are recognized as members without paying membership fees and admission fees.
- Manufacturers and traders gather on the market and products are sold in secret or open auctions.
- If the price is not satisfactory, the farmer can store the product for 3 months for a rent-free society and then save it for a minimum rent.
- Farmers can borrow 60 percent of the value of the product stored on the farm.
- To facilitate trade, 1 percent of the commission's production value comes from member farms and 2 percent from trade purchases.
- In addition, 13 companies have companies that handle bee and stake sales.
- You can also keep lint up to get a loan.
- These facilities and concessions are used more often by merchants than by farmers.
- Like regulated markets, these associations operate as organizations that facilitate business between different traders rather than between manufacturers and traders.
- Cooperative marketing organizations purchase and process products directly from farmers and provide fluff to the National Textile Corporation's spinning and cooperative spinning mills.

Role of Cotton Corporation of India

- Cotton Corporation in India was established to curb price declines by intervening in the open market and buying surpluses at guaranteed lowest prices.
- Cotton Corporation of India has stabilized the cotton market through large acquisitions in recent years.

Marketing Charges

- Cotton sellers and buyers are required to pay a number of fees and deductions when selling or buying on the harvest market.
- This includes fees, brokerage, handling, warehousing, container rental and municipal fees and taxes, and markets.
- Unfairly high-quality brands are also removed.
- The prices are not uniform and different market fees are not charged. This not only varies from region to region, but from market to market in the same region.
- Producers who prefer regulated markets and marketing cooperatives benefit from the fact that they do not have to pay all these costs. And even if they pay for it, the nominal fees are just nominal.

1.5.2 Marketing Activities:

Grading and Storage

- Grading is the sorting of objects by quality, size, etc.
- The quality of cotton, which is usually put on the market within a year, varies widely and depicting the need for grading.
- Cotton grade is a quality determination technology related to staple quality and length, which has a great influence on spinning quality and market value.
- Color, luster, brightness, moisture and purity are all factors that determine the quality of a cotton.
- Staples are usually identified by the length of lint and character.
- The longer the yarn, the stronger and better the fiber.
- Character is represented by staple uniformity, strength and fineness of fibre.
- The character of the lint is affected by season, soil, rainfall and facilities are provided and grading is done by officials of the State Department of Agriculture for nominal charges. In order to improve marketing, , "the Agricultural Produce

(Grading and Marking) Act" was passed in the year 1937, by which grade designations are prescribed for several agricultural commodities.

Transport

- This is an important factor in cotton marketing.
- Bull carts are generally used for the transport of kapas from the farm to the grower's house and then to the town markets.
- Sometimes this is also done with a head load.
- People also cycle trays to nearby markets when small amounts are involved.
- Vehicles are used to transport cotton from the village to the secondary market, and are often used to transport the kapas from the secondary market to ginning mills and to consuming centres.
- Railways serves as an important mode of transport for moving full-pressed bales from pressing centres after ginning to terminal markets or consuming centres.
- Railways are used mostly for trading of cotton between two states.

Weights and Measures

- One of the downside in cotton marketing is the multiplicity of weight and measurements used in the transaction.
- The standards of Weights Act of 1939 was introduced to establish metric weight standards since April, 1962.
- In ginning mills, lint is sold in candy, where a candy equals 355.6 kgs or 784 pounds, and seed is usually sold either in quintals or in bags of 45 kgs.
- While in case of pressing factories, loose lint is converted into full-pressed bales of 170 or 180 kgs and sold to textile mills.
- Apart from these, the scales used in cotton trade are: (i) hand scales, (ii) spring balance, (iii) iron beam scales, (iv) portable plat-form balance and (v) weight-bridges.

1.6 PROFILE OF CENTRE ESTABLISHED UNDER NAHEP-CAAST

National Agricultural Higher Education Project - Centre for Advanced Agricultural Science & Technology (NAHEP-CAAST), AAU, Anand

National Agricultural Higher Education Project (NAHEP) has been formulated by ICAR with a total cost of US$ 165 million (Rupees 1100 crores at the exchange rate of Rs. 66.75 = 1US$) for five years starting from 2017-18. The project is proposed on 50:50 cost sharing basis between the World Bank and the Government of India, implemented at the Education Division, ICAR, New Delhi. Overall, the project aims to develop resources and mechanism for supporting infrastructure, faculty and student advancement, and providing means for better governance and management of agricultural universities, so that a holistic model can be developed to raise the standard of current agricultural education system that provides more jobs and is entrepreneurship oriented and on par with the global agriculture education standards.

The mandate of ICAR/DARE includes promotion and coordination of education in agriculture, agro-forestry, animal husbandry, fisheries, home science and allied sciences in the country. ICAR is now embarking upon an ambitious step in further strengthening the National Agricultural Education system in the country through National Agricultural Higher Education Project (NAHEP) with financial assistance of the World Bank by investing on infrastructure, competency and commitment of faculty, and attracting talented students to agriculture.

The project would benefit all the Agricultural Universities (AUs), i.e. 63 State Agricultural Universities modelled on the US Land Grant University pattern, 5 Deemed to be Universities (DUs), three Central Agricultural University (CAUs) and four Central Universities (CUs) with Agriculture Faculty.

Anand Agricultural University has bagged an ICAR-World Bank funded project to establish Centre for Agricultural Market Intelligence at its campus. Total fund sanctioned under the project is Rs. 16.89 crore. The project duration is three years and

it has multidisciplinary team covering crops, dairy, food processing, poultry and fisheries. The Project has been sanctioned under National Agricultural Higher Education Project of the Indian Council of Agriculture Research. The project has a total strength of 31 staff members of which 25 have been recruited.

Experts from country's premium institutes including IIM-Ahmedabad, Institute of Rural Management (IRMA), Indian Space Research Organization (ISRO), Junagadh Agricultural University, the National Cooperative Dairy Federation of India (NCDFI) apart from three foreign universities including Australia's Western Sydney University and The Papua New Guinea University of Technology and US Texas Tech University are involved in the project.

The major objectives of this project includes price forecasting and behaviors, export competitiveness, evaluation of e-National Agriculture Market (eNAM), market institutions and capacity building of faculty, students, farmers and other stake holders.

1.7 OBJECTIVES OF THE STUDY

1) To understand the cotton market scenario in India
2) To examine the trend, seasonality and integration of cotton markets in India
3) To calculate the Export Potential Index of Indian cotton

2. REVIEW OF LITERATURE

Ghosh (2003) assessed intra-state and inter-state spatial integration of wheat markets in India using the method of cointegration and analysed that even though the regional markets were geographically dispersed, the prices across different market centres within and across the selected states had exhibited long-run spatial linkages, suggesting that all the exchange locations are integrated and the prices provide relevant market signals.

Singh *et al*. (2003) used time series data on export values and export volumes obtained from the FAO website. This study has shown that cotton waste has a positive outlook for the international market using the composite index method. Cotton export rates vary over the period of the study.

Sheikh (2014) in his paper entitled "Competitiveness of cotton export of India" uses shift share analysis for time series data collected from various secondary sources from 1993-94 to 2011-12 and analysed the growth trends and competitiveness of India's cotton export during the reform era. He concluded that India has reached a position of leading cotton production and exports. Cotton's competitiveness is increasing mainly due to market share effect. Thus the growing world demand for cotton has worked positively for India. Hence, increasing global demand for cotton has had a positive impact on India. However, there is a need to improve export infrastructure, come up with market policies and guide exporters accordingly.

Palansingh *et al*. (2017) in his paper concluded that cotton production is in a declining trend at a CAGR of -0.74 percent, using secondary data from APEDA. Yield per hectare is growing at an average annual growth rate of 1.74 percent. India's cotton exports increased by 11.36 percent per year on average. The total export is fluctuating trend and it was registered a CAGR of 6.99 percent. Total exports are highly volatile at a CAGR of 6.99 percent. The share of cotton exports tends to grow at an average annual growth rate of 4.08 percent. Data were collected between 1992-93 and 2005-06. Time series analysis was performed to calculate the seasonal export index, understand the structure of monthly exports, and understand the causes.

Singh (2017) collected data between 1992-93 and 2005-06. Time series analysis was performed to calculate the seasonal export index and to understand the structure of monthly exports.

Marwa *et al.* (2017) explored the relationship between agricultural producer prices and consumer prices for the same raw material in Suma Terra, southern Indonesia, through a case study rice production and consumption in Indonesia. Analysis methods are Linear Least Squares (OLS) regression model and IMC (Exponential Market Link) model. The survey results show an integration between producer-level rice prices and consumer-level rice prices. Another result of this study is that high price differences at the local market level are associated with long-term rice spread in southern Sumatera. In particular, local market governments need to intervene in pricing policy through the reduction of distribution channels.

Nithilan (2018) concluded that India has increased cotton production and improved production quality as world demand increases day by day. We are still a leader in production as India has optimal climatic conditions for growing this crop, but due to high domestic consumption, India has shrunk to second place in market exports. Therefore, the government is taking steps to increase exports by increasing the production area.

Mahesh *et al.* (2018) investigated the price and range of cotton, i.e. growth, seasonality and volatility in Haryana's selected cotton market. Monthly data on cotton prices and income were collected between 2005-06 and 2016-17. In this study, a compound growth rate, moving average method, and coefficient of variation were used. The results indicated a noticeable rise in cotton prices in the selected markets, and the increase in income was positive, but not significant in all markets except the Uklana and Fatehabad markets, which experienced negative growth due to changes in pruning patterns. Seasonal analysis shows that cotton supply for selected markets was highest between October and January (high season) and lowest between February and May (lean season). The annual price of the selected cotton market remained near stable with fluctuations of less than 10 percent, and the coefficient of variation ranged from 28.50 to 30.88 percent, including presence and small quantity confirmations for the period of the selected cotton and cotton market. Higher volatility over the duration of the study.

Increasing volatility can be managed using risk management strategies such as inventory management and crop insurance, future markets.

Jishnu *et al.* (2017) tested market integration of cotton wholesale prices among major cotton producing states in India. States which were selected for the study includes Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Andhra Pradesh, Odisha, Karnataka and Tamil Nadu. The study revealed that cotton prices are stationary at first difference and all the prices are integrated of the order I (1). Therefore concluded that all states market of cotton under study are converged to long run equilibrium.

Singh *et al.* (2019) in paper entitled "Export Performance and Revealed Comparative Advantage of India for Handloom Industry" measured export performance of handloom products having different HS codes by applying different RCA indices. The indices are computed for these traded products from the period of the year 2008 to 2017. It is calculated through the Balassa Index and Lafay index. RCA indices showed important measure through comparative advantage and reflected better insights for the competitiveness of the studied industry and concluded that some commodities of handloom industry have a significant comparative advantage and have excellent export performance, and some commodities need to revive the conditions.

3. MATERIALS AND METHODS

A systematic designing of the study is essential for any scientific enquiry. The present chapter deals with the study area, data collection, analytical tools and techniques adopted to fulfill the specific objectives of the study.

3.1 DESCRIPTION OF THE STUDY AREA

India is leading producer of cotton. Top cotton markets on the basis of arrivals have been taken in the study from all major cotton producing states in India which includes Gujarat, Maharashtra, Telangana, Madhya Pradesh, and Rajasthan.

Table 3.1 Area under Cotton in Major Cotton Growing States

State	Area under cotton (in lakh ha)
Maharashtra	41.19
Gujarat	27.09
Telangana	17.94
Madhya Pradesh	6.97
Rajasthan	4.96

Figure 3.1 Map showing area of study

3.2 SOURCES OF DATA

The study was entirely based on secondary data from available literature, private and government websites & authentic publications available.
Major data source was ITC (International Trade Center) statistics & Agmarknet.

3.3 YEAR AND PERIOD OF THE STUDY

The study was conducted for the data between a period of 2001-2019

3.4 DATA COLLECTION

The study utilized time series data on prices and arrivals collected from different published sources. For understanding cotton market scenario from British era to current status, Different research papers have been referred.

In order to examine trend and seasonality of cotton markets, top five markets from each major cotton producing states were taken as a representation of Indian cotton market and price and arrival data was collected from agmarknet for the year 2010-11 to 2019-20 while for market integration, top 9 markets were taken into consideration from same source.

For assessment of export potential, export values of all labelwise 4-digit product code of Indian cotton was analyzed to know the potential export from year 2001 to 2019.

3.5 ANALYTICAL TOOLS AND TECHNIQUES EMPLOYED

To fulfill the specific objectives of the study based on the nature and extent of availability of data, the following analytical tools and techniques were adopted.

3.5.1 Trend

Variables which were selected for Trend analysis have been estimated with the help of linear equation. The linear trend was examined with the least square method.

$Y = a + bX$

Where, Y= Dependent Variable (Arrivals and Price of cotton)

X= Independent Variable (Time)

b= Regression Coefficient

a= Intercept / Constant

$$b = \frac{\sum_{i=1}^{n} x}{\sum_{i=1}^{n} x^2}$$

Where $x = X-\overline{X}$

$y = Y-\overline{Y}$

and $a = \overline{Y} - b\overline{X}$

$$\overline{Y} = \frac{\sum_{i=1}^{n} Y}{n}, \quad X = \frac{\sum_{i=1}^{n} X}{n}$$

Compound Annual Growth Rate:

The compound annual growth rate (CAGR) over a given period for all variables were calculated by fitting the exponential function given below:

$Y = a\ b^t$ ……(1)

Where, Y = Price/Arrival of cotton

a = constant

b = regression co-efficient

t = time variable

Natural log on both the sides of eq. (1) has been taken to convert it in to linear form.

Log Y = log a + t log b …… (2)

CAGR (%) = [(antilog of b)-1] x 100

3.5.2 Seasonality Analysis

For calculation of seasonal indices, the ratio to moving average method has been used in the study. The method used employed following procedures.

In first step, the centered twelve month moving average was calculated from the original data.

In second step, original data was divided by the centered moving average.

Y = TSCI

$Y / MA = \frac{TSCI}{TC} = SI$

Y = Original price series

TSCI = Components of data series as Trend, Seasonal, Cyclic & Irregular component
The irregular component was then eliminated by averaging the data for each month over the years that we got in second step. After averaging the data, it was multiplied by hundred and the result obtained is seasonal index for each month.

3.5.3 Co-Integration Analysis

Cointegration analysis has been done by using EViews software.

The condition necessary for co-integration is time series data should be stationary. If original data series is non stationary, then first differenced of the series is tested. The most widely used test for unit root is the Augmented Dickey-Fuller test (ADF). It is an augmented version of Dickey-Fuller test, developed by statisticians David Dickey and Wayne Fuller (1981). It is employed for testing null hypothesis that the series has a unit root or in other words, it is not stationary.

The ADF test is calculated with the following equation,

$\Delta Y_t = \beta_t + \delta Y_{t-1} + \alpha_i + \sum_{i=1}^{n} \Delta Yt - i + \varepsilon_t$

Where, $\Delta Y_t = (Y_t - Y_{t-1})$; $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$

The extent of integration will determine whether the prices of cotton markets are in parity with the different markets. Co-integration between the major market prices has been evaluated by regressing the prices of cotton in different markets. The residual was examined here for the order of integration. The basic relationship which is commonly used to test the existence of market integration is

$P_{it} = \alpha_o + \alpha_1 P_{jt} + \varepsilon_t$

Where, P_i and P_j = price series of a specific commodity in two markets i and j

$\boldsymbol{\varepsilon_t}$ = residual term

Johansen (1988) has developed a multivariate system of equations approach, which allows for simultaneous adjustment of two or even more than two variables. The Johansen's test based on the error-correction representation is as follows:

$\Delta Z_t = \varphi_k \Delta z_{t-k} + \pi z_{t-1} + \mu + \varepsilon_t$

Where, z_t is n*1 vector of I(1) processes (price of n market). The rank of π equals the number of co-integrating vectors, which is tested by maximum eigen value and likelihood ratio test statistics. μ is a constant term has been used to capture the left out

variables. The number of lags used in the model was decided on the basis of Akaike Information Criterion (1974).

Granger Causality Test

When co-integration relationship is present for two variables, a Granger causality test can be used to analyse the direction of this co-movement relationship.

The Granger causality test analyses whether the unrestricted equation,

$$Y_t = \alpha_0 + \sum_{i=1}^{t} \alpha_i Y_{t-1} + \sum_{j=1}^{t} \alpha_{2j} Y_{t-1} X_{t-j} + \varepsilon_t \text{ with } 0 < i, j < T$$

Yield better results than the restricted equation.

$$Y_t = \beta_0 + \sum_{i=1}^{t} \alpha_i Y_{t-1} + \varepsilon_t \quad \text{with} \quad \sum_{j=1}^{t} \alpha_{2j} Y_{t-1} X_{t-j} = 0 \text{ (The null hypothesis)}$$

i.e, if Ho, in which $\alpha_{21} = \alpha_{22} = \ldots\ldots = \alpha_2 T = 0$, is rejected then one can state variable X_t "Granger causes variable Y_t"

Vector Error Correction Model

It is employed to determine the speed of adjustment at which given model returns to equilibrium after an exogenous shock.

$$\Delta Y_t = \beta_{y0} + \sum_{i=1}^{p} \beta_{yi} \Delta Y_{t-1} + \sum_{i=1}^{p} \delta_{yi} \Delta X_{t-i} - \lambda_y (Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \varepsilon_t$$

$$\Delta X_t = \beta_{x0} + \sum_{i=1}^{p} \beta_{xi} \Delta Y_{t-1} + \sum_{i=1}^{p} \delta_{xi} \Delta X_{t-i} - \lambda_x (Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \varepsilon_t$$

Where $Y_t = \alpha_0 + \alpha_1 X_t$ is the long run relationship between the two variables

λ_y and λ_x are the error correction parameters that measure how Y & X react to deviations from long run equilibrium.

3.5.4 Export Potential Index

The Export Potential Indicator measures the potential export value of a particular product for an exporter and target market based on an economic model that combines exporter supply, target market demand, and export market entry conditions and bilateral trade relationship between these countries. For export products existing now, supply is

measured based on historical data on export performance. Compare potential export values to actual export values to find products and markets with maximum growth potential.

The components of the Export Potential Indicator (EPI) begin with the division of a country's total exports by supply (revealed comparative advantage - GSP (Balassa's, 1965)) and global demand. The potential share of a country's export products in a given target market deviates from this division due to

1) Lack of trade data to accurately reflect supply potential and
2) A specific situation in the target market causing its demand to deviate from global demand

EPI takes these factors into account. Based on historical data, it is possible to predict what a country may export to a particular market in the future.

A. Supply side

Supply capacity is based on a dynamic and refined version of Balassa's RCA and includes:

RCA - Balassa's RCA compares the share of a product in a country's total exports with the share of this product in world exports. It reveals whether the country has a relative advantage (RCA ≥ 1) or disadvantage (RCA < 1) in exporting products. It is used to evaluate the competitiveness of the country in exporting certain product with respect to the world.

RCA (Balassa Index) = Xi/Xn ÷ Yi/Yn

Where, Xi is the export of India for product i
Xn is export of India all product
Yn is the world export of product i
Yn is world export for all product

Growth of RCA - Static comparative advantages shows the products a country is currently exporting competitively, the dynamic version of comparative advantage envisions future competitive export products. The growth factor for each product is calculated as the ratio of comparative advantage over a given period of years. These

results are used to project RCA. It assesses whether the share of a particular product in a country's exports has grown faster than the growth in global exports of that product in terms of its share of global exports.

$$\text{Growth of RCA} = \frac{R\ (L\ y\ ) - R\ (F\ Y\ )}{R\ (L\ y\ ) + R\ (F\ Y\ )} * 100$$

$$\text{Growth of RCA Index} = \frac{X - X(m\ )}{X(m\ ) - X(m\ )} * 100 \qquad \text{where X = Growth of RCA}$$

$$\text{RCA Index} = \frac{X - X(m\ )}{X(m\ ) - X(m\ )} * 100 \qquad \text{where X = Log of RCA}$$

Export-import ratio - Declared exports often include re-exports that are not linked to a country's capacity to produce goods (for eg,export of second-hand goods imported a few years ago). Therefore, the RCA is adjusted at the ratio at which imports exceed exports. As a result, products competitively exported by a country based on the Balassa's RCA will be downgraded if that country's trade balance is negative (adjustment factors do not apply in case of positive trade balance; i.e. a product is not upgraded if exports exceed imports).

Global tariff disadvantage - The 'revealed advantage' of a country in exporting certain product as included in the trade data also includes information on tariff benefits. Commodities for which a country has a tariff advantage in global markets will be important in the current structure of trade. However, this does not mean that the product also represents export opportunities in a particular target market (or region) and may actually offer less favorable market conditions for entry. Thus, the benefit of global tariffs reduces the RCA of the product. Global tariff disadvantages upgrade it. This effect is stronger for price-sensitive products.

B. Demand Side

Demand conditions are depicted through a dynamic version of demand shares and account for the openness of the target market for the exporting country's products.

Share in market demand - The share in market demand indicates the relative importance of a product in the total imports of the target market. It estimates market size for a particular product compared to all products in the global market.

Share in world exports = $\frac{W \quad e \quad o \; p \quad i}{W \quad e \quad o \; a \; p} * 100$

Growth of share in market demand – The growth in share of market demand reveals the products that have recently experienced relative changes in demand and enables potential demand forecasting. The ratio of demand shares between the given period is computed for each product. Empirical data will show how the growth factor is combined with static demand share.

Growth of share in world export = $\frac{S \quad in \; la \quad y \quad -S \quad in \; fi \quad y}{S \quad in \; la \quad y \quad +S \quad in \; fi \quad y} * 100$

Growth of Share Index = $\frac{X - X(m \quad)}{X(m \quad) - X(m \quad)} * 100$ where X = Growth of share in world export

Share Index = $\frac{X - X(m \quad)}{X(m \quad) - X(m \quad)} * 100$ where X = Log of Share

Tariff advantage in the target market - . If the tariff applied to the exporting country is lower than the tariff applied to other suppliers, the exporter will gain a market tariff advantage, increasing its export potential. Conversely, if the tariff applied to the exporting country is higher than the tariff applied to the competitor, the exporter faces tariff disadvantage that reduce the ability to export the product to the specified market.

Distance factor - Various products have different sensitivity to distance. Perishable products, for example, are distance-sensitive, so usually imported from neighboring countries. Distance is not much important for durable goods. Information about the average trading distance of a product can help in determining the best product to export to a particular market. Exporters close to the market give preference to products with an advantage in proximity (high trade sensitivity to distance). These are products that, on average, are sold over short distances. Exporters far from the market prioritize products for which distance is less important (lower trade sensitivity to distance). These are products that, on average, are traded over long distances. The closer the correspondence between the distance from the exporter to the target market and the average distance at which the target market imports the product (the smaller the absolute difference), the higher will be the export potential of the product.

Aggregate results - The combination of modified supply and demand shares depicts the potential share of a product in a target market.

Export Performance Index =

$$\frac{(\text{RCA index of product i} * \text{Wt. of RCA index}) + (\text{Growth of RCA index of product i} * \text{Wt. of RCA index growth})}{\text{Weight of RCA index} + \text{Weight of RCA index growth}}$$

World Demand Index =

$$\frac{(\text{Share index of product i} * \text{Wt. of Share index}) + (\text{Growth of Share index of product i} * \text{Wt. of Share index growth})}{\text{Weight of Share index} + \text{Weight of Share index growth}}$$

Export Potential Index = Average of Export Performance Index and World Demand Index

This methodology has been developed by ITC.

3.6 ASSUMPTIONS OF THE STUDY

- It was assumed that data obtained from Agmarknet and ITC are reliable
- The months in which price data was not available, it was assumed that its value will be same as that of nearby market
- The months in which arrival data was not available, it is assumed that its value will be same as that of same month in previous year or average of succeeding and preceding month

4. RESULT AND DISCUSSION

4.1 TREND IN ARRIVALS AND PRICE OF COTTON IN TOP MARKETS OF INDIA

In order to examine trend and seasonality of cotton markets, top five markets in terms of arrivals from each major cotton producing states were taken as a representation of Indian cotton market and price and arrival data was collected from agmarknet for the year 2010-11 to 2019-20. These markets were Gondal (Gujarat), Ganganagar (Rajasthan), Warangal (Telangana), Khargone (Madhya Pradesh), Hinganghat (Maharashtra)

Its CAGR has been calculated to find overall growth in the given years. The results obtained are depicted in the following chart.

4.1.1 Trend in Cotton Arrival

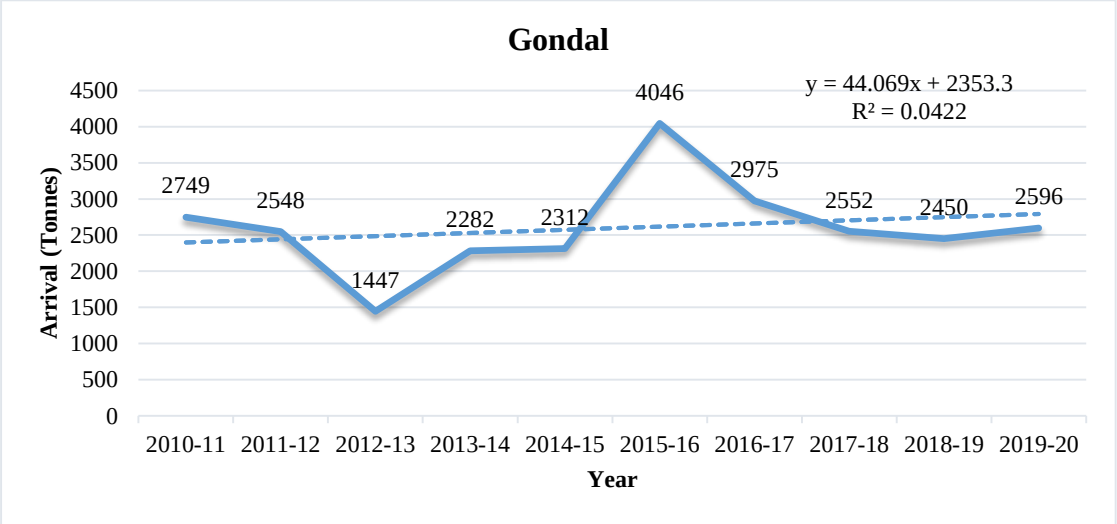


Figure 4.1 Trend in Cotton Arrival in Gondal Market

It could be seen from the graph that there is very less fluctuations in the arrival of Gondal market with CAGR of 2.08 percent

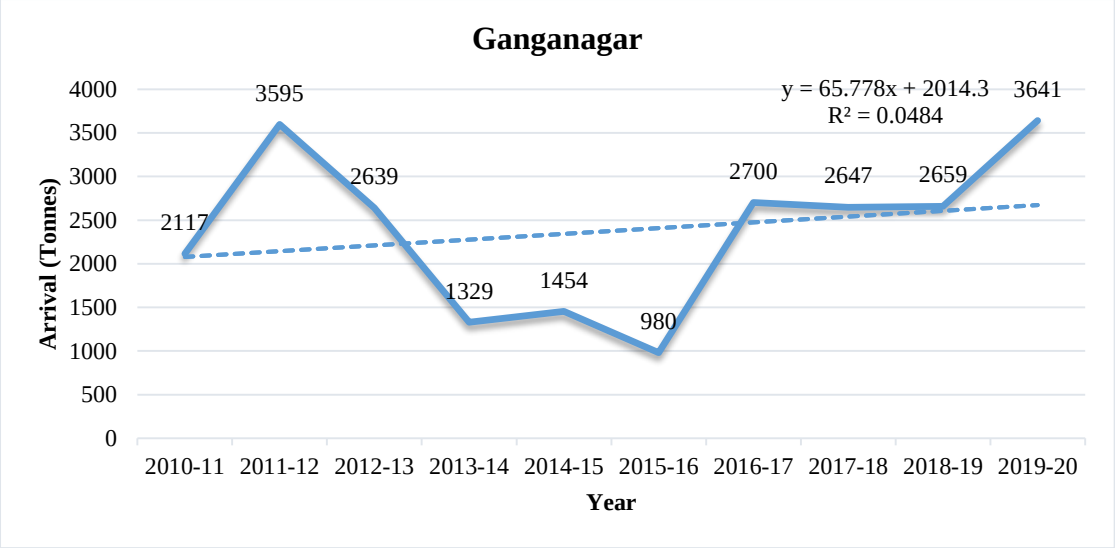


Figure 4.2 Trend in Cotton Arrival in Ganganagar Market

It can be inferred from the chart that arrivals in Ganganagar market shows mixed trend as first it increases, then decreases in subsequent 2-3 years and again started increasing in the consecutive years. CAGR is 2.78 percent

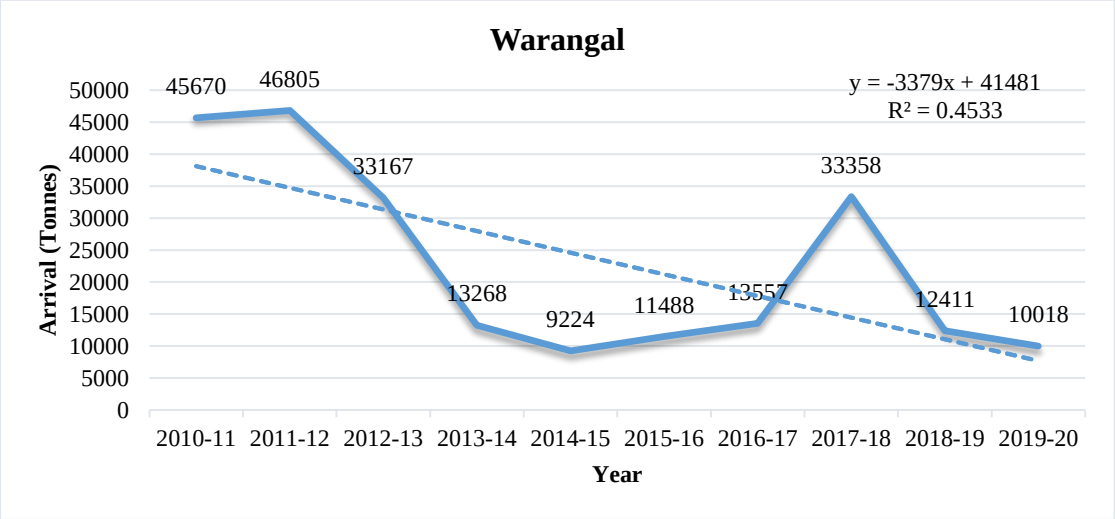


Figure 4.3 Trend in Cotton Arrival in Warangal Market

Arrivals in Warangal market decreases initially then shows slight increase and again decreases with CAGR of -12.82 percent.

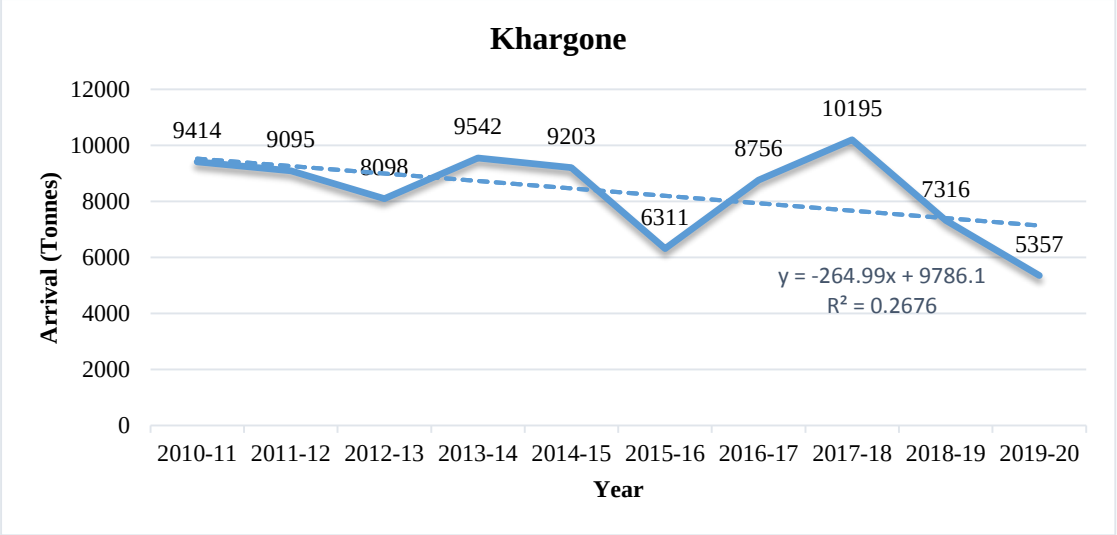


Figure 4.4 Trend in Cotton Arrival in Khargone Market

Arrivals in Khargone doesn't show much volatility in initial years then shows small up and down trends subsequently with CAGR of -3.6 percent.

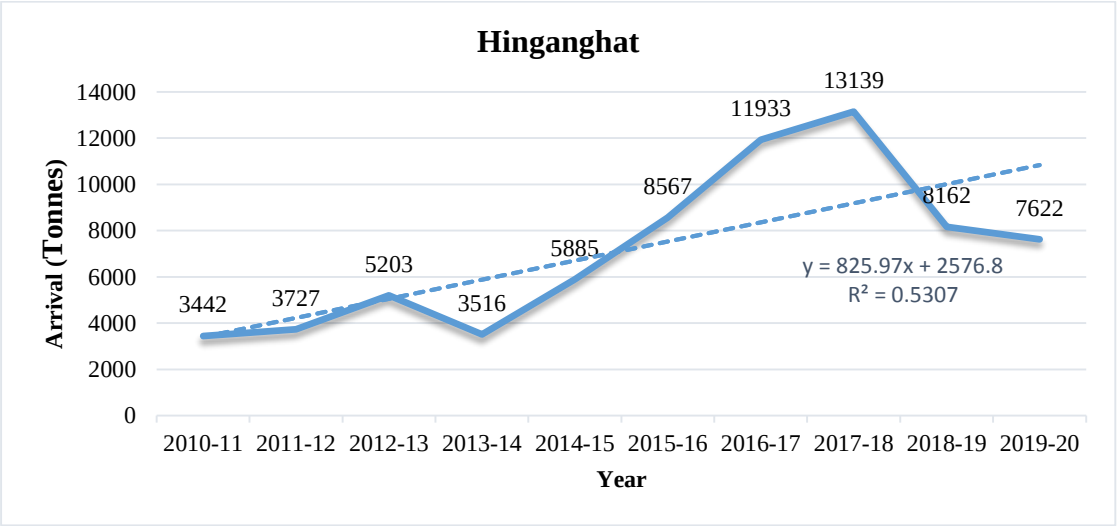


Figure 4.5 Trend in Cotton Arrival in Hinganghat Market

Arrival in Hinganghat market of Wardha shows upward trend with CAGR of 13.79 percent.

4.1.2 Trend in Prices of Cotton

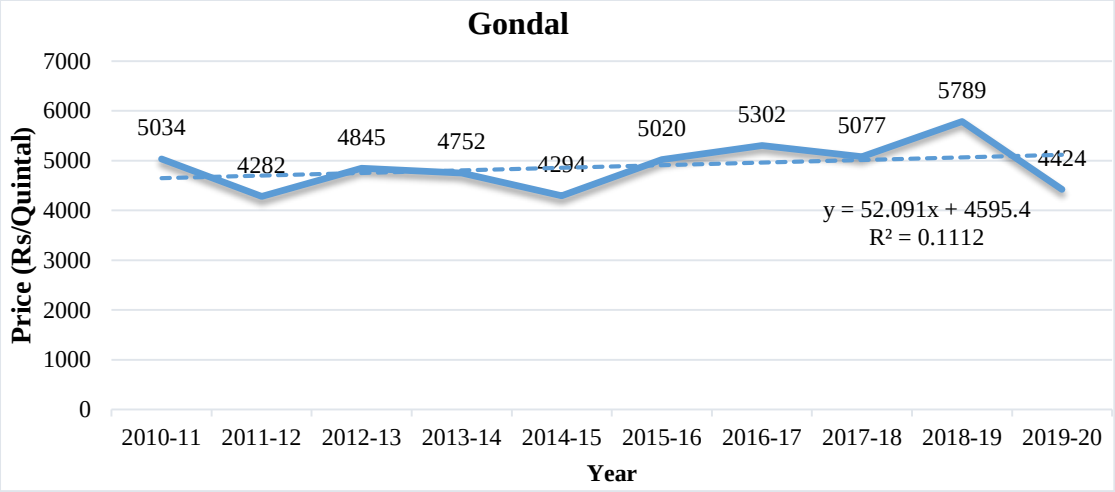


Figure 4.6 Trend in Cotton Prices in Gondal Market

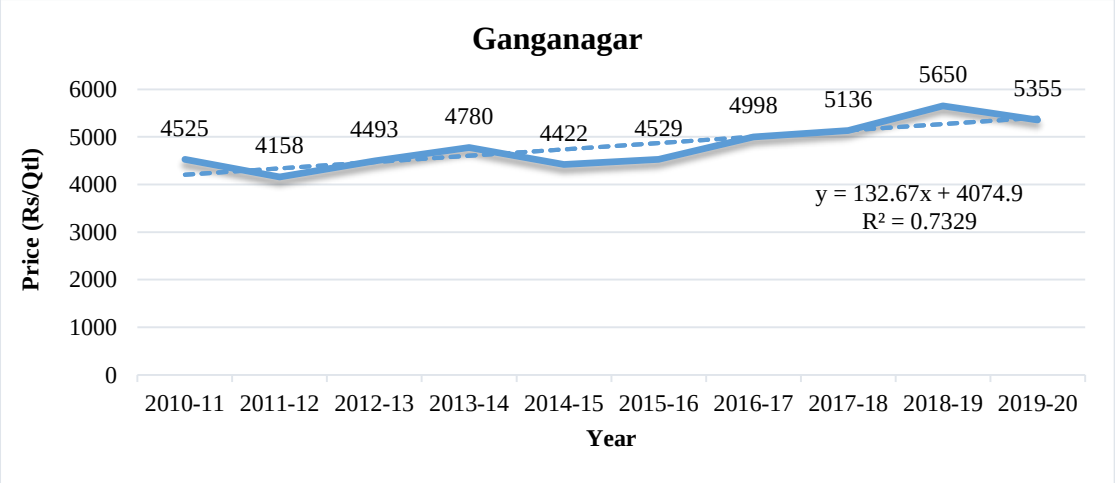


Figure 4.7 Trend in Cotton Price in Ganganagar Market

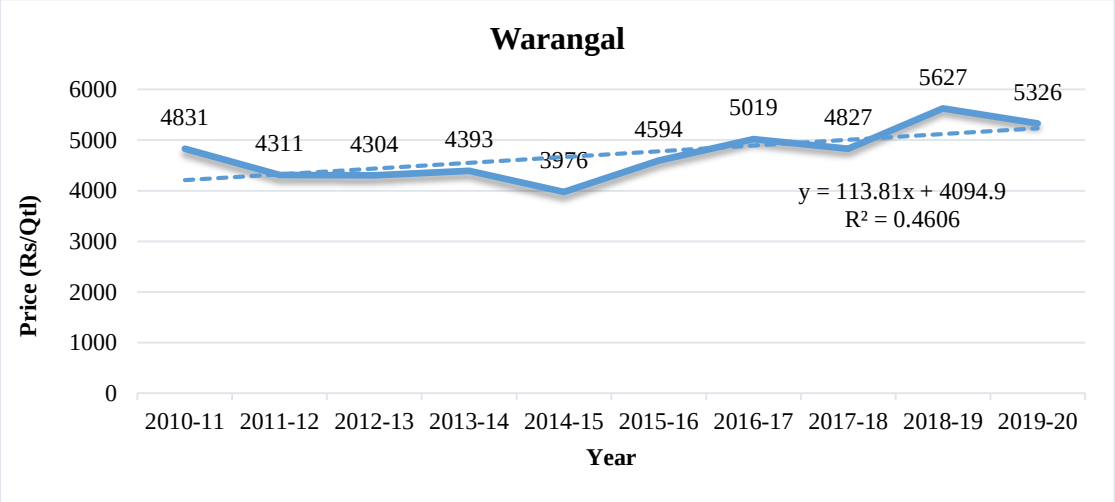


Figure 4.8 Trend in Cotton Price in Warangal Market

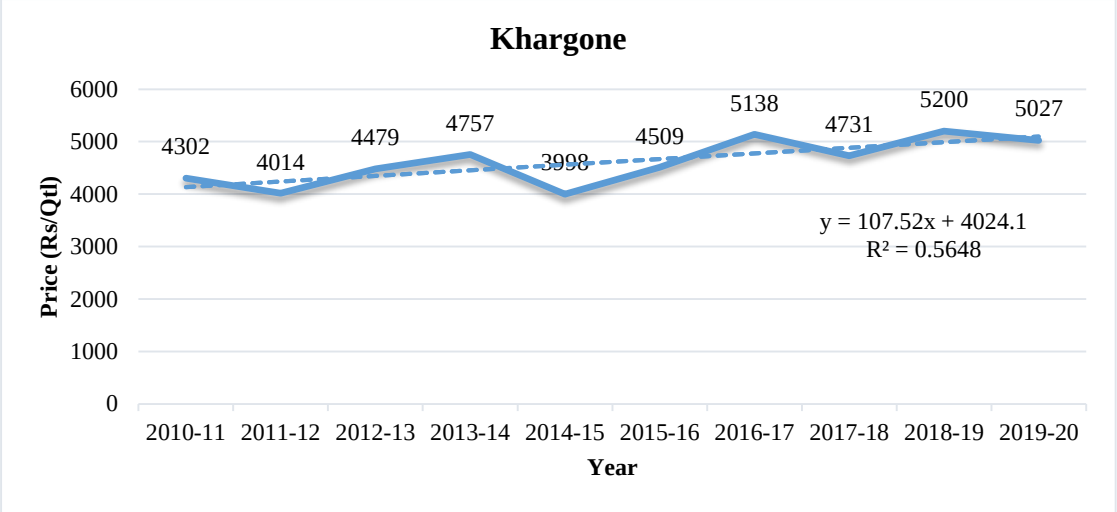


Figure 4.9 Trend in Price in Khargone Market

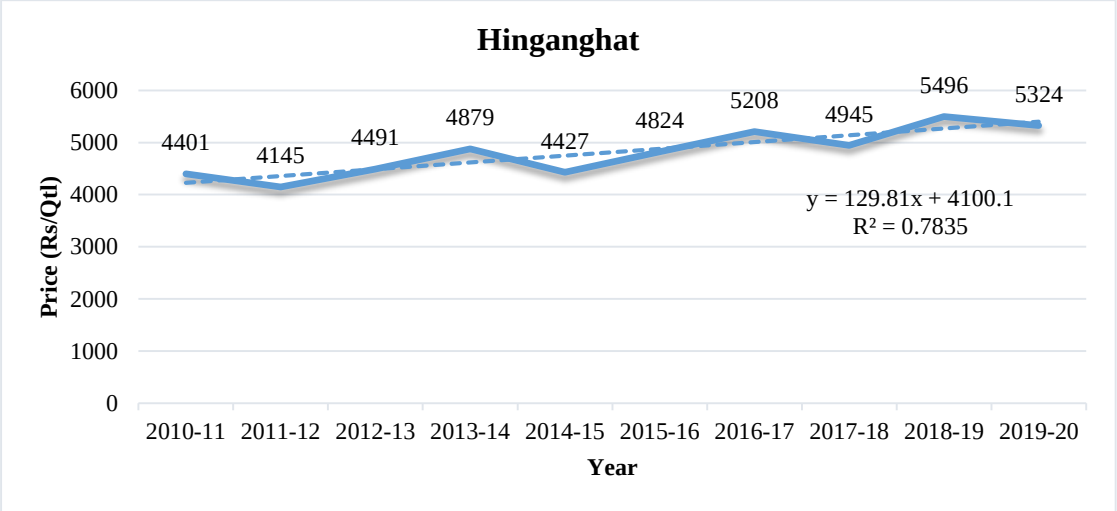


Figure 4.10 Trend in Cotton Price in Hinganghat Market

It is clear from the above given chart that price trend in all the markets shows similar trend in the range between Rs 4000-5500/qtl except in few cases i.e, rise or fall in prices in subsequent years as compared to previous year follow more or less same pattern in all the markets.

CAGR computed for price in the given year is 1.02, 2.76, 2.37, 2.35 and 2.73 percent in markets of Gondal, Ganganagar, Warangal, Khargone and Hinganghat respectively.

4.2 SEASONALITY OF COTTON IN INDIA

Ten years seasonal price indices for Cotton in top 5 markets of India are calculated for the 2005 to 2020 marketing year (October to September). The indices were developed from monthly market prices received by Agmarknet.

Seasonal price and arrival indices measure monthly price movement and arrival movement about the average annual price and arrivals. Average annual prices and arrivals were assigned an index of 100 and the monthly indices were percentages of the annual averages. The cotton marketing year runs from 1st October to 30th September and data from 2005-06 to 2019-20 are included. By using the marketing year as a base, Monthly index values were calculated for each year, then averaged over the ten year period as previously done. The ten year monthly seasonal price index is presented in chart.

The lines in monthly seasonal prices indicate seasonal index values, the range within whichprices and arrivals lies. This is indication of seasonal pattern consistency.

Table 4.1 Price and Arrival Index of Cotton in Gondal

Month	Price Index	Arrival Index
Oct	97	113
Nov	96	179
Dec	98	232
Jan	102	235
Feb	102	158
Mar	102	80
Apr	102	63
May	99	50
Jun	100	30
Jul	103	21
Aug	102	14
Sep	97	28

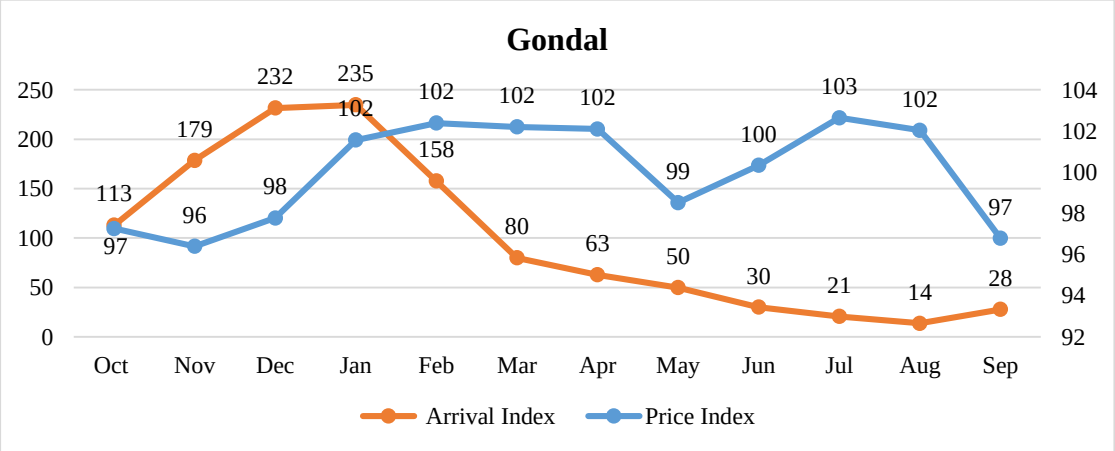


Figure 4.11 Seasonal Price and Arrival index of Cotton

The line of seasonal index arrival of cotton in Gondal market of Gujarat indicates that arrival range is increasing from October to January (being the highest) as harvest starts from last of September or October, and then starts falling in the subsequent months, with August(having least arrivals). The prices of cotton in Gondal market are not much volatile (±5 per cent). Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa except in the month of May.

Table 4.2 Price and Arrival Index of Cotton in Khargone

Month	Price Index	Arrival Index
Oct	94	432
Nov	101	423
Dec	98	420
Jan	102	395
Feb	100	279
Mar	102	141
Apr	120	91
May	120	62
Jun	101	15
Jul	96	14
Aug	96	1
Sep	68	209

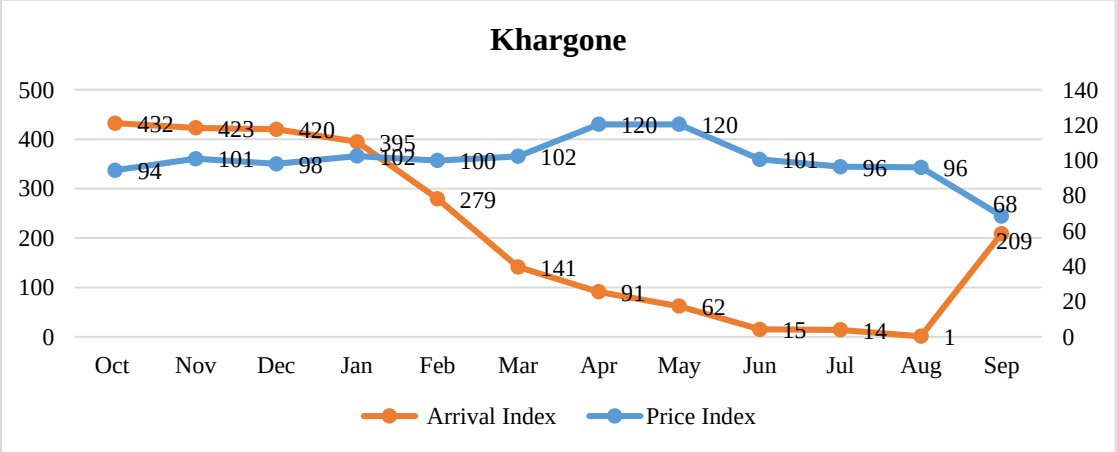


Figure 4.12 Seasonal Price and Arrival Index of Cotton in Khargone

The line of seasonal index arrival of cotton market Khargone indicates that arrival is highest in October and small variation between months of November to January (as harvest starts from last of September or October, and then starts steep decline in the subsequent months, with August(having least arrivals).

The prices of cotton in Khargone market are not much volatile (±5 per cent). Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa.

Table 4.3 Price and Arrival Index of Cotton Hinganghat (Wardha)

Month	Price Index	Arrival Index
Oct	101	37
Nov	100	157
Dec	100	277
Jan	100	354
Feb	96	332
Mar	95	227
Apr	113	216
May	96	109
Jun	98	23
Jul	98	1
Aug	98	1
Sep	106	0.2

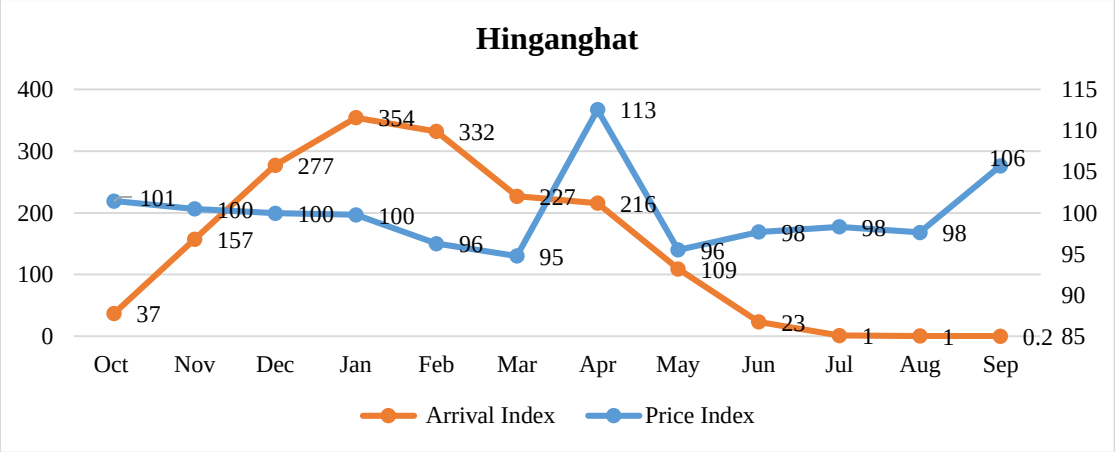


Figure 4.13 Seasonal Price and Arrival Index of Cotton Hinganghat (Wardha)

The line of seasonal index arrival of cotton in Hinganghat market indicates that arrival range is increasing from October to January (being the highest) as harvest starts from October and then starts falling in the subsequent months, with August (having least arrivals).

The prices of cotton in Gondal market are not much volatile (±5 per cent). Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa except in the month of March & May.

Table 4.4 Price and Arrival Index of Cotton in Ganganagar

Month	Price Index	Arrival Index
Oct	99	67
Nov	99	123
Dec	98	184
Jan	103	104
Feb	104	89
Mar	104	59
Apr	99	7
May	96	1
Jun	103	1
Jul	100	0.2
Aug	100	0.1
Sep	97	12

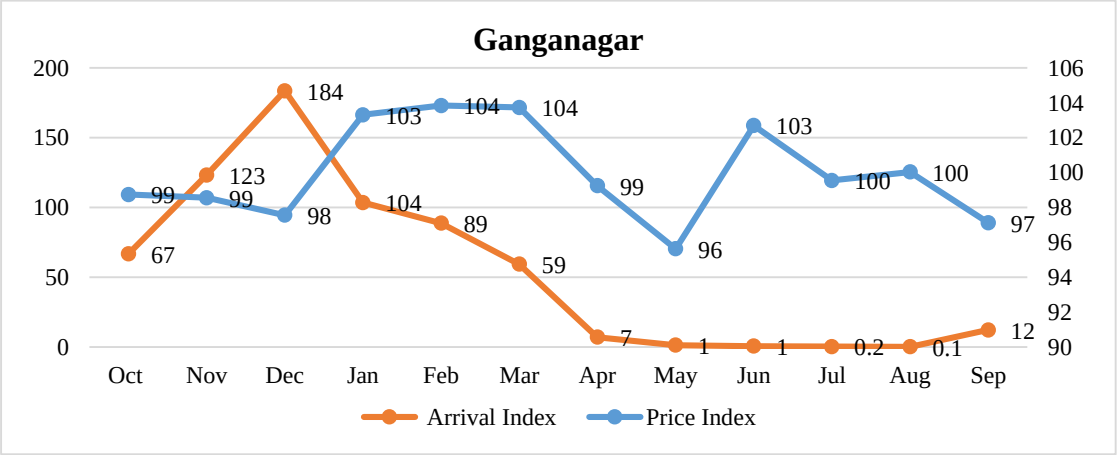


Figure 4.14 Seasonal Price and Arrival Index of Cotton in Ganganagar

The line of seasonal index arrival of cotton in Ganganagar market indicates that arrival range is increasing from October to December (being the highest) as harvest starts from October and then starts falling in the subsequent months, with August (having least arrivals).

The prices of cotton in Ganganagar market are not much volatile (±5 per cent).

Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa except in the month of April & May.

Table 4.5 Price and Arrival Index of Cotton in Warangal

Month	Price Index	Arrival Index
Oct	95	588
Nov	93	831
Dec	95	464
Jan	96	728
Feb	96	814
Mar	100	655
Apr	102	434
May	97	223
Jun	103	246
Jul	107	200
Aug	108	182
Sep	108	145

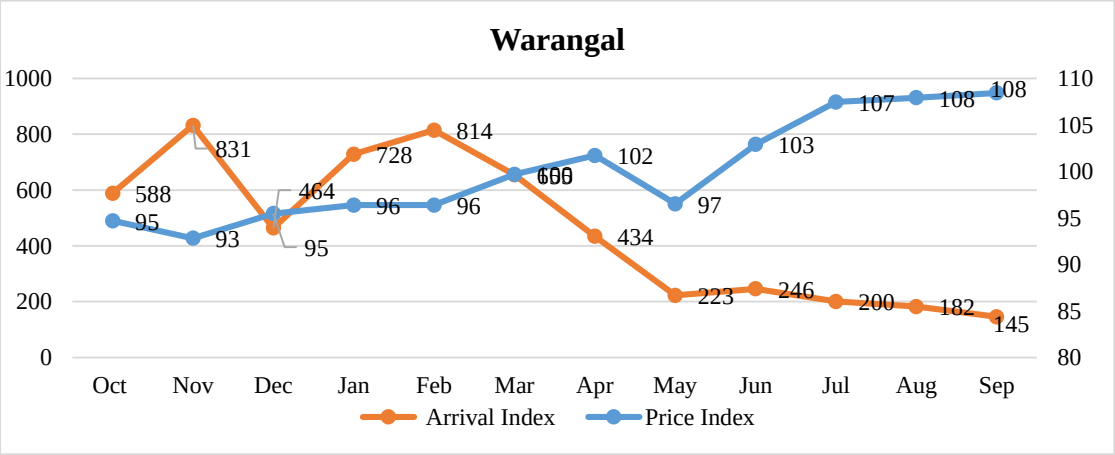


Figure 4.15 Seasonal Price and Arrival Index of Cotton in Warangal

The line of seasonal index arrival of cotton in Warangal market indicates that arrival range increases from October to November, then declines in January and again starts increasing till February(being the highest), then starts falling in the subsequent months, with August(having least arrivals).

The prices of cotton in Gondal market are not much volatile (±5 per cent). Moreover, Price is more in months having least arrivals as compared to previous month and vice-versa except in the month of January & May.

4.3 COTTON MARKET PRICE INTEGRATION

4.3.1 ADF unit root test for prices of cotton markets in India

Co-integration is a statistical property of the variable in time series or when the error term is stationary in regression modeling. When there is a linear combination of non-stationary random variables, the combined variable are known to be co-integrated. Therefore co- integration means that there is some linear combination of a set of variables which are stationary.

A unit root verification test based on the Augmented Dickey Fuller test was performed to test the stationarity of cotton price series. From Table above , it can be concluded that the p values for the Augmented Dickey-Fuller test exceed the critical (5%) indicated in the McKinnon Statistical Table at level indicating that given series are non-stationary depicting that unit root exists.

Table 4.6 ADF unit root test for prices of Cotton markets of India

	ADF(CV=5%)(-2.8776)	
Market	**Level**	**First Difference**
Amreli	-2.69535 (0.0768) *	-9.47430 (0.0000)
Botad	-2.90396 (0.0469)	-9.739437 (0.0000)
Gondal	-2.49894 (0.1174) *	-11.04014 (0.0000)
Patan	-2.77194 (0.0644)*	-15.14755 (0.0000)
Rajkot	-1.96701 (0.3013) *	-9.91065 (0.0000)
Hinganghat	-1.30097 (0.6289) *	-17.90359 (0.0000)
Khargone	-2.68049 (0.0794) *	-13.07756 (0.0000)
Ganganagar	-2.17223 (0.0.2173) *	-12.18594 (0.0000)
Warangal	-2.46854 (0.1249) *	-13.92946 (0.0000)

**Mackinnon (1996) one –sided p-values*

**Null hypothesis: price series has a unit root*

**Figure in parenthesis is probability.*

When the first difference is taken, each series values get stationary which can be seen as p value for all markets are less than the critical value (5%) and hence free from the unit root effect. The results of Augmented Dickey-Fuller (ADF) unit root results of cotton showed that the level data are non-stationary, but their first differences are stationary. Thus, all market price series are integrated by order 1, i.e. I (1).

4.3.2 Johansen Co-integration Test Results for Indian Cotton Market

Based on Johansen's co-integration method, the integration between markets were analyzed using E-Views software. As per the trace test result given in table for cotton prices, showed that the trace statistics value was greater than the critical value at 5 per cent level. Therefore, we obtained at least 8 cointegrating equations at 5% significance level. This indicates that the model's variables have a long-term equilibrium/co-movement among series of market prices during the study period. The existence of co-integration is essential for the long-term efficiency of the market.

The co-integration has been studied for series of cotton prices in major markets in India. The trace test and the Eigen value statistics obtained through the Johansen Co-integration rank test are presented in following

Table 4.7 Johannsen Co-integration test values

Hypothesized	Eigen value	Trace statistic	5% Critical Value	Prob.**
None*	0.380574	401.1921*	197.3709	0.0000
At most 1*	0.357188	315.9369*	159.5297	0.0000
At most 2*	0.289317	237.2782*	125.6154	0.0000
At most 3*	0.279010	176.4861*	95.75366	0.0000
At most 4*	0.193508	118.2570*	69.81879	0.0000
At most 5*	0.173604	79.9761*	47.85613	0.0000
At most 6*	0.127898	46.0348*	29.79707	0.0003
At most 7*	0.104400	21.6757*	15.49471	0.0051
At most 8	0.011446	2.0492	3.841466	0.1523

*Trace test indicates 8 co integrating eqn(s) at the 0.05 level

*Denotes rejection of the hypothesis at the 0.05 level

** Mackinnon –Haug-Michelis(1999) p-values

The results of Johansen Co-integration test showed that there were at least eight co-integration relationships between nine markets selected for cotton in India at a significance level of 5%, which implies that even if markets are geographically dispersed, the prices are integrated. The above discussion suggests that even though the markets are integrated, there could still be disequilibrium in the short run due to the price adjustments across the markets which may not occur instantaneously or concurrently.

4.3.3 Pairwise Granger Causality Test

The co-integration tests performed above indicate only the existence of long run relationship among prices of the cotton in nine markets. The direction of the relationship among markets and price series is equally important for which Granger Causality Tests are performed. Granger causality identifies the direction of causation of price between two markets. Causation can occur in two ways - bidirectional where shocks in either market of a market pair are transferred to the other market and unidirectional where shocks in one market affect other market, but the reverse does not happen.

Out of thirty six markets pairing ten market pairs are related to a unidirectional way while twenty six markets are related in a bidirectional manner

Table 4.8 Pairwise Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	
GUJARAT__BOTAD_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause GUJARAT__BOTAD_	179	2.89455 8.53730	0.0906* 0.0039***	Bi
GUJARAT__GONDAL_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause GUJARAT__GONDAL_	179	0.36108 11.0725	0.5487* 0.0011***	Uni
GUJARAT__PATAN_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause GUJARAT__PATAN_	179	1.57044 43.8418	0.2118 4.E-10***	Uni
GUJARAT__RAJKOT_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause GUJARAT__RAJKOT_	179	0.61526 12.2704	0.4339 0.0006***	Uni
MAHARASHTRA__WARDHA_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause MAHARASHTRA__WARDHA_	179	8.07997 15.2530	0.0050*** 0.0001***	Bi
RAJASTHAN__GANGANAGAR_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	9.46761 8.04370	0.0024*** 0.0051***	Bi
TELANGANA__WARANGAL_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause TELANGANA__WARANGAL_	179	1.06307 8.17397	0.3039 0.0048***	Uni
MP__KHARGONE_ does not Granger Cause GUJARAT__AMRELI_ GUJARAT__AMRELI_ does not Granger Cause MP__KHARGONE_	179	9.34669 7.87208	0.0026*** 0.0056***	Bi
GUJARAT__GONDAL_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause GUJARAT__GONDAL_	179	5.62720 5.15596	0.0188** 0.0244**	Bi
GUJARAT__PATAN_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause GUJARAT__PATAN_	179	7.63758 15.0432	0.0063*** 0.0001***	Bi
GUJARAT__RAJKOT_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause GUJARAT__RAJKOT_	179	5.01899 5.59916	0.0263** 0.0191**	Bi
MAHARASHTRA__WARDHA_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause MAHARASHTRA__WARDHA_	179	7.99874 8.90493	0.0052*** 0.0032***	Bi

RAJASTHAN__GANGANAGAR_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	16.6219 1.14685	7.E-05*** 0.2857	Uni
TELANGANA__WARANGAL_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause TELANGANA__WARANGAL_	179	6.83561 5.44058	0.0097*** 0.0208**	Bi
MP__KHARGONE_ does not Granger Cause GUJARAT__BOTAD_ GUJARAT__BOTAD_ does not Granger Cause MP__KHARGONE_	179	7.28415 5.47386	0.0076*** 0.0204**	Bi
GUJARAT__PATAN_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause GUJARAT__PATAN_	179	6.91804 22.8873	0.0093*** 4.E-06***	Bi
GUJARAT__RAJKOT_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause GUJARAT__RAJKOT_	179	2.26025 3.78585	0.1345 0.0533*	Uni
MAHARASHTRA__WARDHA_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause MAHARASHTRA__WARDHA_	179	8.04890 12.7144	0.0051*** 0.0005***	Bi
RAJASTHAN__GANGANAGAR_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	12.3100 2.80044	0.0006*** 0.0960*	Bi
TELANGANA__WARANGAL_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause TELANGANA__WARANGAL_	179	2.25763 6.05882	0.1347 0.0148**	Uni
MP__KHARGONE_ does not Granger Cause GUJARAT__GONDAL_ GUJARAT__GONDAL_ does not Granger Cause MP__KHARGONE_	179	12.0905 4.91510	0.0006*** 0.0279**	Bi
GUJARAT__RAJKOT_ does not Granger Cause GUJARAT__PATAN_ GUJARAT__PATAN_ does not Granger Cause GUJARAT__RAJKOT_	179	35.4292 1.69417	1.E-08*** 0.1948	Uni
MAHARASHTRA__WARDHA_ does not Granger Cause GUJARAT__PATAN_ GUJARAT__PATAN_ does not Granger Cause MAHARASHTRA__WARDHA_	179	18.5076 16.1893	3.E-05*** 8.E-05***	Bi
RAJASTHAN__GANGANAGAR_ does not Granger Cause GUJARAT__PATAN_ GUJARAT__PATAN_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	47.8580 5.13392	8.E-11*** 0.0247**	Bi
TELANGANA__WARANGAL_ does not Granger Cause GUJARAT__PATAN_ GUJARAT__PATAN_ does not Granger Cause TELANGANA__WARANGAL_	179	22.8733 2.15040	4.E-06*** 0.1443	Uni
MP__KHARGONE_ does not Granger Cause GUJARAT__PATAN_ GUJARAT__PATAN_ does not Granger Cause MP__KHARGONE_	179	14.3212 15.8334	0.0002*** 0.0001***	Bi
MAHARASHTRA__WARDHA_ does not Granger Cause GUJARAT__RAJKOT_ GUJARAT__RAJKOT_ does not Granger Cause MAHARASHTRA__WARDHA_	179	9.72779 16.2952	0.0021*** 8.E-05***	Bi

RAJASTHAN__GANGANAGAR_ does not Granger Cause GUJARAT__RAJKOT_ GUJARAT__RAJKOT_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	11.7402 7.50601	0.0008*** 0.0068***	Bi
TELANGANA__WARANGAL_ does not Granger Cause GUJARAT__RAJKOT_ GUJARAT__RAJKOT_ does not Granger Cause TELANGANA__WARANGAL_	179	1.14463 6.50730	0.2861 0.0116**	Uni
MP__KHARGONE_ does not Granger Cause GUJARAT__RAJKOT_ GUJARAT__RAJKOT_ does not Granger Cause MP__KHARGONE_	179	14.9642 7.12221	0.0002*** 0.0083***	Bi
RAJASTHAN__GANGANAGAR_ does not Granger Cause MAHARASHTRA__WARDHA_ MAHARASHTRA__WARDHA_ does not Granger Cause RAJASTHAN__GANGANAGAR_	179	22.8730 22.6329	4.E-06*** 4.E-06***	Bi
TELANGANA__WARANGAL_ does not Granger Cause MAHARASHTRA__WARDHA_ MAHARASHTRA__WARDHA_ does not Granger Cause TELANGANA__WARANGAL_	179	9.74981 8.82159	0.0021*** 0.0034***	Bi
MP__KHARGONE_ does not Granger Cause MAHARASHTRA__WARDHA_ MAHARASHTRA__WARDHA_ does not Granger Cause MP__KHARGONE_	179	12.7158 31.6613	0.0005*** 7.E-08***	Bi
TELANGANA__WARANGAL_ does not Granger Cause RAJASTHAN__GANGANAGAR_ RAJASTHAN__GANGANAGAR_ does not Granger Cause TELANGANA__WARANGAL_	179	6.04277 26.8360	0.0149*** 6.E-07***	Bi
MP__KHARGONE_ does not Granger Cause RAJASTHAN__GANGANAGAR_ RAJASTHAN__GANGANAGAR_ does not Granger Cause MP__KHARGONE_	179	12.6609 19.1789	0.0005*** 2.E-05***	Bi
MP__KHARGONE_ does not Granger Cause TELANGANA__WARANGAL_ TELANGANA__WARANGAL_ does not Granger Cause MP__KHARGONE_	179	25.3710 6.57996	1.E-06*** 0.0111**	Bi

*** indicates significant at 5 per cent probability level.*

**** indicates significant at 1 per cent probability level.*

** indicates significant at 10 per cent probability level.Uni: Unidirectional, Bi: Bidirectional*

Table 4.9 Vector Error Correction estimates of Cotton

Error Correction:	D(AMRELI)	D(BOTAD	D(GONDAL	D(PATAN	D(RAJKOT	D(MAHARAS	D(MP__KHA	D(RAJASTH	D(TELANGA
CointEq1	-0.003316	-0.023640	-0.021801	0.052785	-0.004794	0.002499	-0.069647	-0.032843	0.048204
	(0.01377)	(0.01528)	(0.01306)	(0.01474)	(0.01164)	(0.01316)	(0.01534)	(0.01377)	(0.01384)
	[-0.24083]	[-1.54740]	[-1.66877]	[3.57999]	[-0.41185]	[0.18991]	[-4.54023]	[-2.38464]	[3.48347]
D(GUJARAT AMRELI_(	-0.020843	-0.023033	0.287296	0.264491	0.207457	0.037135	0.176286	0.192740	0.265845
	(0.12459)	(0.13822)	(0.11820)	(0.13340)	(0.10532)	(0.11904)	(0.13879)	(0.12461)	(0.12520)
	[-0.16729]	[-0.16663]	[2.43061]*	[1.98268]	[1.96976]*	[0.31196]	[1.27017]	[1.54673]	[2.12338]*
D(GUJARAT BOTAD_(	0.131264	0.341436	0.194018	0.173372	0.145667	-0.030174	0.213055	-0.005432	-0.136645
	(0.06892)	(0.07646)	(0.06539)	(0.07380)	(0.05826)	(0.06585)	(0.07678)	(0.06893)	(0.06926)
	[1.90455]	[4.46530]*	[2.96723]*	[2.34932]*	[2.50018]*	[-0.45822]	[2.77498]*	[-0.07880]	[-1.97296]*
D(GUJARAT GONDAL	-0.046856	-0.124588	-0.205063	-0.147426	-0.028837	0.112054	-0.262721	-0.083821	-0.122227
	(0.12847)	(0.14253)	(0.12188)	(0.13756)	(0.10860)	(0.12275)	(0.14311)	(0.12849)	(0.12910)
	[-0.36472]	[-0.87411]	[-1.68246]	[-1.07173]	[-0.26553]	[0.91287]	[-1.83574]	[-0.65233]	[-0.94676]

D(GUJARAT PATAN_(	-0.060769	-0.101362	-0.079082	-0.084831	-0.130340	0.109748	-0.218588	-0.283815	0.042140
	(0.07832)	(0.08690)	(0.07431)	(0.08386)	(0.06621)	(0.07484)	(0.08725)	(0.07834)	(0.07871)
	[-0.77587]	[-1.16648]	[-1.06425]	[-1.01153]	[-1.96855]*	[1.46653]	[-2.50526]*	[-3.62294]*	[0.53541]
D(GUJARAT RAJKOT_	0.227084	-0.001589	0.023215	0.186720	-0.054810	-0.039394	-0.013916	0.122227	0.010680
	(0.14798)	(0.16418)	(0.14039)	(0.15845)	(0.12510)	(0.14139)	(0.16485)	(0.14801)	(0.14871)
	[1.53454]	[-0.00968]	[0.16536]	[1.17842]	[-0.43815]	[-0.27862]	[-0.08442]	[0.82581]	[0.07182]
D(MAHARASHTRA W	0.127945	0.017224	0.045065	0.017781	0.103450	-0.326957	0.156067	0.088967	-0.028730
	(0.08030)	(0.08909)	(0.07618)	(0.08598)	(0.06788)	(0.07672)	(0.08945)	(0.08031)	(0.08069)
	[1.59338]	[0.19334]	[0.59155]	[0.20680]	[1.52401]	[-4.26163]*	[1.74473]	[1.0776]	[-0.35604]
D(MP KHARGONE_(-1	0.168989	0.071582	0.153827	0.003792	0.157432	-0.102931	0.043226	0.167063	0.067526
	(0.06816)	(0.07562)	(0.06466)	(0.07298)	(0.05762)	(0.06512)	(0.07593)	(0.06817)	(0.06849)
	[2.47930]*	[0.94660]	[2.37884]*	[0.05197]	[2.73227]*	[-1.58053]	[0.56929]	[2.45058]*	[0.98586]
D(RAJASTHAN GANG	0.187232	0.242428	0.193224	0.147045	0.103615	0.040734	0.332907	-0.108479	0.138330

	(0.08352)	(0.09267)	(0.07924)	(0.08943)	(0.07061)	(0.07980)	(0.09304)	(0.08354)	(0.08393)
	[2.24165]*	[2.61617]*	[2.43844]*	[1.64421]	[1.46748]	[0.51043]	[3.57793]*	[-1.29853]	[1.64810]
D(TELANGANA WAR	-0.021407	0.091599	0.019077	-0.049272	0.125909	-0.027604	0.195140	-0.148225	-0.227176
	(0.08549)	(0.09484)	(0.08110)	(0.09153)	(0.07227)	(0.08168)	(0.09523)	(0.08550)	(0.08590)
	[-0.25042]	[0.96581]	[0.23523]	[-0.53830]	[1.74231]	[-0.33796]	[2.04914]*	[-1.73358]	[-2.64451]*
C	6.155670	8.924095	10.32508	8.680498	7.717037	19.18775	4.344959	23.12909	11.04732
	(24.7927)	(27.5061)	(23.5213)	(26.5465)	(20.9586)	(23.6884)	(27.6187)	(24.7973)	(24.9142)
	[0.24829]	[0.32444]	[0.43897]	[0.32699]	[0.36820]	[0.81001]	[0.15732]	[0.93272]	[0.44341]

4.3.4 Vector Error Correction Model

The error correction term or speed of adjustment determine the speed or rate at which given model returns to equilibrium after an exogenous shock. In other words, it shows that the system corrects its previous period disequilibrium at speed of coefficient present monthly, because the set of data we have taken, is monthly. The coefficient should lie between 0 and 1, 0 suggests no adjustment one-time period later, while 1 indicates complete adjustment. The negative sign of coefficient indicates a convergence towards long term equilibrium due to any short-term shock. The co-efficient of ECM was positive for Patan, Hinganghat and Warangal markets, this shows that shocks were further deviating from the long term equilibrium and remained volatile in short run. However, price remained stable over the long term, as markets found to be cointegrated discussed in above table.

In case of Amreli market co-efficient of 1 month lagged of Khargone and Ganganagar market price was positive and significant. It means that price discovery occurred in Amreli market are transmitted to Khargone and Ganganagar market. In Botad market co-efficient of 1 month lagged of its own lag and Ganganagar was found positive and significant. In case of Gondal market co- efficient of 1 month lagged of Amreli, Botad, Khargone and Ganganagar market price was positive. In Patan market the co- efficient of one month lagged of Amreli and Botad found to be positive and significant. In Rajkot market co- efficient of 1 month lagged of Amreli, Botad, Khargone and Warangal found positive and significant. In Khargone market co-efficient of 1 month lagged of Botad, Ganganagar and Warangal market price was positive and significant. In Ganganagar market co- efficient of 1 month lagged of Khargone found positive and significant. In Warangal market the positive co-efficient of 1 month lagged of Amreli and Ganganagar market shows that price discovery occurred in Warangal market to Amreli and Ganganagar market.

The impact of lagged prices in the independent and dependent markets are positive as well as negative in the identified integrated markets. This suggests that, in the short-term, price shocks are contemporaneously transmitted in these markets but not fully (Acharya *et al*., 2012). This indicates that these markets are well integrated in the short-term.

4.4 COTTON PRODUCT WISE EXPORT POTENTIAL ASSESSMENT

Table 4.10 Cotton Product Wise Export Potential Assessment

Code	Product label	Potential wise Rank	Export Potential Index	World Demand Index	Export perfor-mance Index	Share Index	Growth of share index	Log of share	Growth of share in world exp. (2001-2019)	Share in world exports 2001-2019	RCA index	Growth of RCA index	Log of RCA	Growth of RCA 2001-2019	RCA 2001-2019
5201	**Cotton, neither carded nor combed**	**2**	81.32	79.22	83.43	99.90	58.53	1.38	17.07	23.81	66.86	100.00	0.10	2.69	1.25
5202	Cotton waste, incl. yarn waste and garnetted stock	7	67.64	55.13	80.14	60.30	49.96	-0.09	-0.08	0.82	60.29	100.00	0.00	-1545.39	1.01
5203	Cotton, carded or combed	11	49.58	49.16	50.00	56.04	42.29	-0.25	-15.42	0.57	0.00	100.00	-0.84	-3523.32	0.14
5204	Cotton sewing thread, whether or not put up for retail sale	10	61.55	41.05	82.06	48.62	33.48	-0.52	-33.04	0.30	64.11	100.00	0.06	-45198.6	1.14
5205	**Cotton yarn other than sewing thread, containing >= 85% cotton by weight excluding that put**	**1**	83.50	75.92	91.07	98.18	53.67	1.31	7.33	20.57	82.13	100.00	0.31	176.32	2.04
5206	Cotton yarn containing predominantly, but <	5	62.60	69.39	55.81	72.70	66.08	0.37	32.16	2.35	11.63	100.00	-0.68	-375.31	0.21

	85% cotton by weight excluding sewing thread														
5207	Cotton yarn put up for retail sale excluding sewing thread	12	70.27	40.55	100.00	59.89	21.20	-0.10	-57.59	0.79	100.00	100.00	0.56	-11783.4	3.63
5208	**Woven fabrics of cotton, containing >= 85% cotton by weight & weighing <= 200 g/m²**	**3**	72.61	74.20	71.01	100.00	48.40	1.38	-3.19	24.01	42.02	100.00	-0.25	68.52	0.56
5209	Woven fabrics of cotton, containing >= 85% cotton by weight and weighing > 200 g/m²	6	65.72	64.69	66.75	95.09	34.29	1.20	-31.42	15.81	33.49	100.00	-0.37	-4.47	0.43
5210	Woven fabrics of cotton, containing predominantly, but < 85% cotton by weight, mixed principally	9	55.76	60.82	50.69	80.27	41.37	0.65	-17.25	4.47	1.38	100.00	-0.82	-2363.59	0.15
5211	Woven fabrics of cotton, containing predominantly, but < 85% cotton by weight, mixed principally	4	67.24	73.11	61.37	81.38	64.84	0.69	29.68	4.92	22.74	100.00	-0.52	-67.47	0.30
5212	Woven fabrics of cotton, containing predominantly, but < 85% cotton by weight, other than those	8	67.03	56.26	77.81	68.12	44.40	0.20	-11.20	1.59	55.62	100.00	-0.06	-8725.57	0.87

4.4.1 Result

The analysis using methodology developed by ITC examined the product wise export potential of Indian cotton in the global trade markets of cotton. According to the analysis, Cotton yarn other than sewing thread (containing >= 85% cotton by weight) (HS Code 5205) has the highest Export Potential Index 83.50 with World Demand Index 75.92 and Export Performance Index 91.07. In second position the product Cotton, neither carded nor combed (HS Code 5201) has the Export Potential Index 81.32 with World Demand Index 79.22 and Export Performance Index 83.43 followed by Woven fabrics of cotton, containing >= 85% cotton by weight and weighing <= 200 g/m² (HS Code 5208) has the Export Potential Index 72.61 with World Demand Index 74.20 and Export Performance Index 71.01 at third position.

4.4.2 Remark

The world's most famous Indian cotton yarns are available in form of greige, bleached, mercerized, gassed, twisted, dyed or an endless range of fashion yarns like melange, stretch, blends, high twist and more, used in a variety of applications in fashion, apparel, home textiles, socks and industrial textiles. India can meet various group of customer requirement, being small or big, regular or customised, premium or basic. In the present scenario, Indian yarn is widely used in the international market as it regularly meets the needs of importers with unmatched efficiency and economy in countries such as USA, Italy, Spain, Japan, China, Korea, Taiwan, Bangladesh and Vietnam etc. (Texprocil)

4.4.3 Export Highlights

- Exports of cotton yarn and textiles account for approximately 23 percent of India's total textile and apparel exports.
- India's cotton production in 2018-19 was 33 million bales, 170 kg each.
- Textiles and apparel exports in 2018-19 amounted to US$36.22 billion.
- For 2018-19 years. Exports of cotton yarn, cotton fabrics and cotton products were US$3.95 billion and US$5.95 billion, respectively.
  (**Source:** Indian Trade Portal)

5. SUMMARY AND CONCLUSION

The project entitled “A Study on Market Integration and Export Potential of Indian Cotton” was carried out for NAHEP-CAAST, AAU, Anand from February 2021 to May 2021 for a period of 4 months. The study was based on the secondary source of data.

5.1 SUMMARY

India's cotton production increased from 100 lakh bales in 2001-02 to 345 lakh in 2016 - 17, a growth of more than 200 percent. Nearly two-thirds of cotton in India is produced in the states of Maharashtra, Gujarat, Andhra Pradesh and Telangana. During fiscal 2017, India’s contribution to the total global harvested cotton was 26 percent. About 62 percent of cotton in India is produced in rainfed areas, and 38 percent on irrigated lands (investidia.gov.in). All four known cultivated cotton varieties are grown in India. Annual Cotton Consumption by Organised Sector Textile Mills have increased significantly from 149 lakh bales in 2000-01 to 2707 lakh bales in the year 2018-19. While export from India have decreased from 58 lakh bales in 2006-07 to 43 lakh bales in 2018-19.

The study of cotton markets from 2010-11 to 2019-20 indicated that cotton arrivals in Gondal market showed very less fluctuations with CAGR of 2.08 percent, Ganganagar & Warangal market shows mixed trend with CAGR 2.78 and -12.82 percent respectively. Khargone showed small up and down trends subsequently with CAGR of -3.6 percent and arrival in Hinganghat market of Wardha showed upward trend with CAGR of 13.79 percent. Price trend in all the markets showed similar trend in the range between Rs. 4000-5500/qtl except in few cases i.e., rise or fall in prices in subsequent years as compared to previous year follow more or less same pattern in all the markets. CAGR computed for price in the given year is 1.02, 2.76, 2.37, 2.35 & 2.73 percent in markets of Gondal, Ganganagar, Warangal, Khargone and Hinganghat respectively.

Seasonal index arrival in all the market indicated that arrival range is high in months of September to January and then starts decreasing depending on the market and lowest in July-August as arrival of Gondal & Hinganghat, is highest in January, Warangal in

February, Khargone in October and Ganganagar in December. The prices of cotton in all the market are not much volatile (±5 per cent).

The results of Johansen Co-integration test showed that there were at least eight co-integration relationships between nine markets selected for cotton in India at a significance level of 5 percent. The direction of the relationship among markets and price series is equally important which identifies the direction of causation of price between two markets. Causation can occur in two ways - bidirectional where shocks in either market of a market pair are transferred to the other market and unidirectional where shocks in one market affect other market, but the reverse does not happen. Out of thirty six markets pairing nine market pairs are related to a unidirectional way while twenty seven markets are related in a bidirectional manner.

In 1 month lagged time, price discovery occurred in Amreli market are transmitted to Khargone and Ganganagar market; price discovery occurred in Botad market, transmitted to Ganganagar market; price discovery occurred in Gondal market, transmitted to Amreli, Botad, Khargone and Ganganagar market; price discovery occurred in Patan market, transmitted to Amreli and Botad market; price discovery occurred in Rajkot market, transmitted to Amreli, Botad, Khargone and Warangal market; price discovery occurred in Khargone market, transmitted to Botad, Ganganagar and Warangal market; price discovery occurred in Ganganagar market, transmitted to Khargone market; price discovery occurred in Warangal market, transmitted to Amreli and Ganganagar market.

The analysis using methodology developed by ITC examined the product wise export potential of Indian cotton in the global trade markets of cotton. According to the analysis, Cotton yarn other than sewing thread (containing >= 85% cotton by weight) (HS Code 5205) has the highest Export Potential Index 83.50 with World Demand Index 75.92 and Export Performance Index 91.07. In second position the product Cotton, neither carded nor combed (HS Code 5201) has the Export Potential Index 81.32 with World Demand Index 79.22 and Export Performance Index 83.43 followed by Woven fabrics of cotton, containing >= 85% cotton by weight and weighing <= 200 g/m² (HS Code 5208) has the Export Potential Index 72.61 with World Demand Index 74.20 and Export Performance Index 71.01 at third position.

5.2 CONCLUSION

Cotton domestic consumption showed increasing scenario due to high demand by textile mills in the country since the year 2001. Cotton production and yield increased after the 2001-02 due to introduction of Bt cotton (resistant against bollworms).

Arrivals in cotton markets showed mixed trend but fluctuation range varied as per the markets while that of prices showed very less fluctuations in the consecutive years. Seasonality indices of price and arrivals showed that prices were more in the months of least arrivals and less in months of more arrivals.

Market integration analysis revealed that eight markets are cointegrated in spite of geographical separation and change in price in one market transmitted to another in certain time may be because of technological advancement thereby reducing transportation and communication gap. Price among different markets doesn't show much volatility due to integration among them. Cointegration between the markets are an indicator for efficient functioning of markets.

As per the export is concerned, under broad category product label of cotton, export potential of Cotton yarn other than sewing thread (containing >= 85% cotton by weight) (HS Code 5205) is highest because of high world demand and export performance index. Indian cotton is the cheapest in the world compared to the US, Brazil and Australia, so it has great potential to export. Countries purchase cotton regularly because our cotton price is 15 percent below COTLOOK A Index, the international market price for raw cotton.

Overall, it can be concluded that India's cotton economy will continue to grow at a good pace, and India's cotton and textile industry will play a bigger role in the international market.

5.3 SUGGESTIONS

There is a need to develop infrastructure facilities for storage of cotton, considering seasonal changes in arrivals and prices

In recent years, cotton production has been growing at a very slow pace. Hence to enhance the growth rate, farmers should have easy access to modern production technologies, pure and high-quality seeds, essential resources and credit through networking and communication with concerned organizations, including research institutions.

Exports continue to be key point to India. For further strengthening Indian cotton economy through sustained exports, more emphasis should be given to those products having high export potential as having HS code 5205 followed by 5201.

As in India, mostly medium staple cotton is produced, emphasis should also be given on production of long staple cotton along with quality improvement as per the international and domestic market demand.

In order to gain the comparative advantage of Indian cotton in export markets and its continuing existence in the global market, status of commercial production and behavior of competing countries, particularly China and the United States, must be monitored properly by exporters, domestic decision makers and manufacturers. In addition, appropriate responses must be taken on time to enhance the competitiveness of these products in the target import market.

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