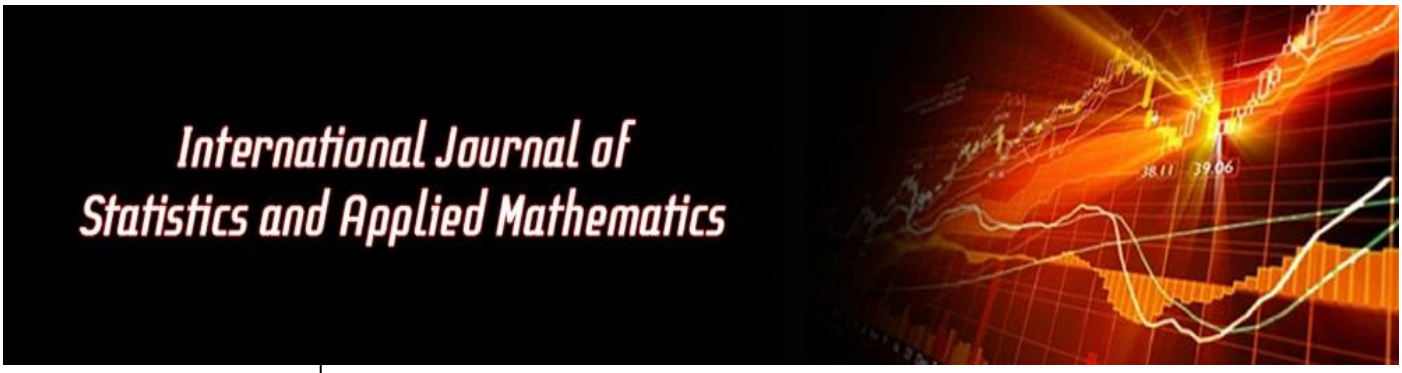
International Journal of Statistics and Applied Mathematics 2025; 10(3): 47-51



ISSN: 2456-1452
Maths 2025; 10(3): 47-51

www.mathsjournal.com
Received: 06-02-2025
Accepted: 08-03-2025

KM Zankat
Ph.D. Scholar, PG Institute of ABM, Junagadh Agricultural University, Junagadh, Gujarat, India

JD Bhatt
Associate Professor, PG Institute of ABM, Junagadh Agricultural University, Junagadh, Gujarat, India

Corresponding Author:
KM Zankat
Ph.D. Scholar, PG Institute of ABM, Junagadh Agricultural University, Junagadh, Gujarat, India

Growth and instability in Indian cotton: An analysis of area, production, yield and exports

KM Zankat and JD Bhatt

DOI: https://www.doi.org/10.22271/maths.2025.v10.i3a.2007

Abstract
Cotton one of the most significant crops in India's agricultural economy, supporting farmer livelihoods, industrial demand and export earnings. This study examines growth and instability in area, production, yield and exports using secondary data. Growth and instability in area, production, and yield were analyzed for three sub-periods: Period I (1992-93 to 2001-02), Period II (2002-03 to 2011-12) and Period III (2012-13 to 2021-22) along with the overall period (1992-93 to 2021-22). Export quantity and value were analyzed for 2013-14 to 2022-23. Data were analyzed using compound annual growth rate (CAGR) and the Cuddy-Della Valle Index (CDVI). At the national level, cotton showed significant growth in area (1.97%), production (5.23%) and yield (3.20%) during the overall study period. However, Period III showed negative growth rates in production (-0.61%) and yield (-1.51%). Instability was higher in production (44.22%) than in area (19.55%) and yield (25.26%) with states like Andhra Pradesh and Rajasthan experiencing high production instability. India's cotton exports to the world showed negative CAGR in quantity (-9.99%) and value (-4.67%) while Oman recorded the highest CAGR in import quantity (105.09%).

Keywords: Compound annual growth rate, cotton, export, instability

1. Introduction
Cotton, often referred to as 'White Gold' is not only a major cash crop but also a key raw material for textile industry which is one of the largest contributors to India's foreign exchange earnings, supports approximately 5.8 million farmers and 40–50 million individuals involved in trade and processing (MoT, 2023a) [7].

1.1 Cotton Cultivation
In the year 2022, China was the world's largest cotton producer accounting for 26.01 per cent of the world's total cotton production followed by India (21.52%) and the USA (12.16%). In terms of cultivated area, India led with 39.37 per cent of the global cotton growing area (FAOSTAT, 2023a) [5].
India cultivated 11.91 million hectares of cotton in 2021-22, producing 31.20 million bales. Gujarat emerged as the leading cotton producing state, cultivating 2.28 million hectares and producing 7.48 million bales with a yield of 557 kg/hectare. Maharashtra followed with 7.12 million bales from 3.95 million hectares while Telangana produced 6.07 million bales from 1.89 million hectares. Together, these states contributed approximately 67 per cent of India's cotton production from 51.4 per cent of the total cotton-cultivated area (MoT, 2023b) [8].

1.2 Cotton Exports
Despite being the second-largest producer, India ranked fourth in global cotton exports in 2022. The United States was the largest exporter of cotton with 3469.73 thousand tonnes followed by Brazil with 1816.34 thousand tonnes while India exported 513.54 thousand tonnes. In 2022, India exported only 3.43 per cent of its production due to high domestic consumption (FAOSTAT, 2023b) [6].

India's cotton exports are primarily directed to Bangladesh which remained the top destination in 2021 with exports of 638.22 thousand tonnes. However, exports to Bangladesh declined to 329.80 thousand tonnes in 2022. Vietnam is another key market for Indian cotton with consistent demand over the years (FAOSTAT, 2023b) [6].

2. Methodology

The secondary data were collected to analyse growth and instability in the area, production and yield for the 30 years period from 1992-93 to 2021-22 which was further divided into four periods: 1992-93 to 2001-02 (Period I), 2002-03 to 20011-12 (Period II), and 2012-13 to 2021-22 (Period III) and 1992-93 to 2021-22 (Period IV). Growth and instability of exports were studied for the period 2013-14 to 2022-23. The states were selected based on their average cotton production from 2018-19 to 2012-23. Ten major cotton export destination countries were selected based on the average export from 2018-19 to 2012-23. Data related to the area, production, yield, export quantity and export value of cotton were collected from the Centre for Monitoring Indian Economy (CMIE).

2.1 Compound annual growth rate

The compound growth rates of major cotton producing states were measured by fitting an exponential function for the variables *viz*., area, production and yield while India as a whole was considered to analyse the compound growth rate of export quantity and export values.

$Y = a\, b^t U_t$

Where,

Y = Area (Million Hectares), Production (Million tonnes), Yield (Kg. /Hectare), Export quantity (Metric tonne), Export value (Lacs)
a = Intercept
b = Regression co-efficient
t = Time variable
U = Error term

The compound growth rate was obtained from the logarithmic form of the exponential equation as below

Log y = Log a + t Log b

The value of log b in equation (2) was computed using the formula

$$\text{Log b} = \frac{(\sum t \ \text{Log Y} - (\sum t . \sum \text{Log Y} / N))}{\sum t^2 - \left(\frac{\sum t^2}{N}\right)}$$

Where,

N=Number of years.

Then, the per cent compound growth rate (g) was calculated by using the relationship

g = {antilog of (logb)-1} x 100

Where,

G=Compound growth rate per annum in per cent.

Student‘t’ test was used to determine the significance of the growth rates obtained for which the following formulation was employed.

t = Log b/SE (Log b)

The calculated ‘t’ values, from equation (5), were compared with the table ‘t’ values and the significance was tested for 1 and 5 per cent probability levels.

2.2 Cuddy Della Valle index

Instability for area, production, yield, export quantity and export value were calculated using the coefficient of variation and Cuddy Della Valle Index.

Cuddy Della Valle Index was calculated as follows:

Coefficient of variation (CV) = $\frac{\text{Standard deviation}}{\text{Mean}}$

Cuddy Della Valle Index = CV × $\sqrt{1 - \bar{R}^2}$
Where, CV= Coefficient of variation ($\sigma/\bar{X}$)
$\bar{R}^2$= Adjusted coefficient of multiple determination.

3. Result and discussion

3.1 Growth Rates in Cotton Area, Production and Yield

Table 1 represents compound growth rates of area, production and yield of major cotton producing states as well India as whole for overall period of 1992-93 to 2021-22 which were further divided into three different sub periods.

It is observed from table that cotton at whole India level during the overall study period showed a significant growth in area (1.97%), production (5.23%) and yield (3.20%). Area under cotton cultivation during period I (1992-93 to 2001-01) was observed to grown at 2.07 per annum while production and yield showed negative growth rates of-1.56 and-3.55 per cent respectively. During Period II (2002-03 to 2011-12) significant growth in area (4.89%), production (13.84%) and yield (8.53%) was observed. During period III (2012-13 to 2021-22), growth in area was merely 0.92 percent while production and yield shown negative growth rate-0.61 and-1.51 per cent respectively. Comparatively, period II observed as more progressive phase in terms of growth in area, production and yield than period I and period III.

During Period-I (1992-93 to 2001-01), compound growth rates of area for cotton crop were found positive in most states except Karnataka (-1.07%) and Punjab (-2.77%). The highest positive and significant growth rate was observed in Gujarat (4.99%) followed by Andhra Pradesh (4.17%) and Maharashtra (2.77%). However, growth rate of production during Period-I showed a negative growth in most states. Highest negative growth was observed in Punjab (-8.27%) followed by Rajasthan (-7.58%). Only Andhra Pradesh (3.66%) and Maharashtra (0.75%) maintained positive production growth during this period.

During Period-II (2002-03 to 2011-12) growth rate of area increased significantly in most states with Andhra Pradesh showing highest growth (17.79%) followed by Gujarat (6.93%) and Maharashtra (4.53%). In case of production Gujarat showed highest growth (17.77%) followed by Karnataka (16.31%) and Madhya Pradesh (16.16%). In terms of yield growth rate Karnataka showed highest increase (11.96%) followed by Madhya Pradesh (13.80%) and Gujarat (10.45%).

While again in Period-III (2012-13 to 2021-22) revealed declining trend of growth rates. Area under cotton showed

negative growth in cotton-growing states like Punjab (-7.66%) Andhra Pradesh (-1.40%) and Gujarat (-1.04%). However, Rajasthan emerged with significant growth in area (8.31%). Production growth rates during this period were negative in several major states with Punjab showing the decline in growth with (-8.40%) followed by Gujarat (-3.51%). Yield growth rates were also negative in many states with Haryana showing highest decline (-5.20%) followed by Madhya Pradesh (-4.06%).

In the overall period (1992-93 to 2021-22), Odisha showed highest growth rates in both area (12.12%) and production (16.45%). Gujarat showed significant growth in area (2.96%), production (6.80%) and yield (3.73%) during the overall period while Maharashtra maintained steady growth with 1.94, 5.87 and 3.85 per cent growth in area, production and yield respectively over the study period. Punjab, however showed negative growth in both area (-3.20%) and production (-0.96%) over the entire period.

However, despite Rajasthan showed the highest positive growth in area and production during Period-III, its total production and area under cotton cultivation remained significantly lower than those of top-producing states. For example, in 2021-22, Rajasthan cultivated cotton across 755.9 thousand hectares and produced 2481 thousand bales. In contrast, Gujarat's cultivation area was more than double (2,283 thousand hectares) with a production output over three times higher (7509.3 thousand bales). Similarly, during the overall study period, Odisha showed the highest compound annual growth rate in area with 193.1 thousand hectares under cultivation in 2021-22 and produced 625.9 thousand bales in the same year. This highlights that while some states demonstrated high growth rates their overall contribution to national production remained relatively small.

During the period from 2002-03 to 2011-12 cotton production in India experienced a significant annual growth rate of 13.84 per cent. This growth was primarily driven by a productivity increase of 8.53 per cent per annum and a notable expansion in the cultivated area which grew by 4.89 per cent annually. Introduction of Bt cotton cultivation in 2003-04 and government's technology mission on cotton were key contributors to this continuous rise in annual cotton production.

Similar findings were noted by Pavithra *et al.* (2022) [9] who observed significant growth in area, production and yield in major cotton-producing states, including Gujarat, Maharashtra, Andhra Pradesh and Madhya Pradesh, during Period II (1999-2000 to 2008-09). They attributed the growth in Gujarat primarily to widespread adoption of Bt cotton. They also noted that yield improvements played a crucial role in boosting cotton production across India throughout the study period contributing significantly to production increases in nearly all cotton-growing states. However, during Period III (2009-10 to 2018-19), they reported negative growth in area, production and yield in Gujarat, Andhra Pradesh and Madhya Pradesh. Similarly, Devegowda *et al.* (2023) [3] observed positive growth rates in area, production and yield of cotton in India during Period VI (2001-2010). However, they noted negative growth rates in production and yield during Period VII (2011-2020), highlighting that yield enhancement was the primary driver of cotton production improvements in India compared to area expansion. Wani *et al.* (2023) [14] also reported a considerable decline in cotton production and yield during the fifth sub-period (2011-2012 to 2020-2021).

Shwetha *et al.* (2020) [10] found that in Punjab growth rates in both area and production of cotton were negative during Period II (2002-03 to 2019-2020). They attributed this decline to frequent crop losses caused by pest attacks such as pink bollworm and whitefly which discouraged farmers from expanding cotton acreage. They noted that assured minimum support prices for crops like rice and wheat led farmers to shift their focus toward these more secure alternatives. Chaudhari *et al.* (2023) [2] reported crop damage due to pink bollworm infestation in the Banas kantha district of Gujarat.

3.2 Instability Analysis in Cotton Area, Production and Yield

The instability indices for area, production and yield of cotton across India and its major cotton-producing states are presented in Table 2.

During period I (1992-93 to 2001-02), instability index for cotton area ranged from 3.71 to 19.77. Madhya Pradesh showed highest stability in area (3.71) while Odisha showed highest instability (19.77). In terms of production, highest instability was observed in Gujarat (36.90) and least value of instability index of 11.7 observed in Andhra Pradesh. In terms of yield highest instability was observed in Odisha with index of 32.53 and lowest in Karnataka with index of 12.36.

During Period II (2002-03 to 2011-12), Maharashtra and Madhya Pradesh maintained low area instability with index of 5.24 and 3.64 respectively suggesting consistent cultivation practices while highest instability in terms of area (38.46) and production (41.52) observed in Andhra Pradesh. Lowest instability in yield (11.04) was observed in Odisha.

Table 1: Compound annual growth rates in area, production and yield of cotton in India and major producing states (% / annum)

Sr. No.	State Name	Period-I (1992-93 to 2001-01) CAGR			Period-II (2002-03 to-2011-12) CAGR			Period-III (2012-13 to 2021-22) CAGR			Overall (1992-93 to 2021-22) CAGR		
		A	P	Y	A	P	Y	A	P	Y	A	P	Y
1	Maharashtra	2.77**	0.75**	-1.96**	4.53**	13.83**	8.90**	0.98**	0.25**	-0.73**	1.94**	5.87**	3.85**
2	Gujarat	4.99**	-1.36*	10.45*	6.93**	17.77**	10.45**	-1.04**	-3.51**	-2.50**	2.96**	6.80*	3.73**
3	Telangana	-	-	-	-	-	-	2.52**	1.85**	-0.66**	-	-	-
4	Rajasthan	0.97**	-7.58*	-8.46*	0.24**	10.89**	10.62**	8.31**	10.44**	1.97**	0.35**	3.85*	3.48**
5	Karnataka	-1.07**	-1.98**	-0.92**	3.88**	16.31**	11.96**	2.78**	3.11**	0.32**	0.65**	4.21*	3.54**
6	Andhra Pradesh	4.17**	3.66**	-0.49**	17.79	8.96*	5.91**	-1.40**	-1.02**	0.38**	-1.24	1.32**	3.11**
7	Haryana	2.26**	-3.06**	-5.20**	-0.24**	6.43**	6.69**	2.26**	-3.06*	-5.20*	0.49**	2.03**	1.54**
8	Madhya Pradesh	0.88**	-0.10**	-1.83**	2.08**	16.16**	13.80**	0.81**	-3.28**	-4.06**	0.83**	7.36**	6.49**
9	Punjab	-2.77**	-8.24*	-5.63*	1.80**	5.46**	3.59**	-7.66**	-8.40*	-0.80**	-3.20**	-0.96*	2.31**
10	Odisha	36.51**	41.60*	3.72*	10.82**	16.88**	5.48**	5.49**	7.20**	1.62**	12.12**	16.45*	3.86**
11	All India	2.07**	-1.56**	-3.55**	4.89**	13.84**	8.53**	0.92**	-0.61**	-1.51**	1.97**	5.23**	3.20**

Note: 1. CGR-Compound Growth Rate 2. A-Area, P-Production and Y-Yield 3, * and ** indicate significance at 5% and 1% levels, respectively

Table 2: Instability analysis in area, production and yield of cotton in India and major producing states (% / annum)

Sr. No.	State Name	Period-I (1992-93 to 2001-01) CDVI			Period-II (2002-03 to-2011-12) CDVI			Period-III (2012-13 to 2021-22) CDVI			Overall (1992-93 to 2021-22) CDVI		
		A	P	Y	A	P	Y	A	P	Y	A	P	Y
1	Maharashtra	5.95	22.19	20.63	5.24	17.70	17.39	5.27	20.33	23.37	8.50	24.43	24.51
2	Gujarat	5.33	36.90	28.04	5.92	22.71	20.79	6.70	12.97	12.51	12.20	41.04	30.27
3	Telangana							12.09	23.73	17.35			
4	Rajasthan	12.95	28.99	23.65	16.47	23.66	20.87	10.09	18.55	9.38	26.03	45.25	27.64
5	Karnataka	9.59	13.77	12.36	14.52	18.27	12.69	19.39	25.57	17.58	23.67	40.46	23.47
6	Andhra Pradesh	11.86	11.71	13.53	38.46	41.52	15.74	14.57	25.58	18.66	41.43	40.65	18.03
7	Haryana	8.16	19.10	21.48	11.98	16.72	12.73	8.15	26.15	26.51	11.69	26.32	29.27
8	Madhya Pradesh	3.71	18.43	16.72	3.64	25.62	24.19	6.60	15.63	12.48	8.16	29.89	29.81
9	Punjab	15.22	31.24	28.43	9.25	19.23	13.45	9.36	26.89	23.51	16.34	36.84	26.33
10	Odisha	19.77	28.88	32.53	16.19	23.89	11.04	4.10	15.20	12.07	27.38	31.58	20.30
11	All India	6.24	11.67	6.79	4.86	11.79	11.75	5.72	8.40	8.49	19.55	44.22	25.26

Note: 1. CDVI-Cuddy Della Valle Index (%), 2. A-Area, P-Production and Y-Yield

During period III (2012-13 to 2021-22), lowest instability in production (4.10) and yield (12.07) was observed in Odisha. In terms of production lowest instability observed in Gujarat with index of 12.97, down from 36.90 in period I. Gujarat also improved yield stability reducing instability index from 28.04 in Period-I to 12.51 in Period-III.

During overall period (1992-93 to 2021-22), highest instability in area was observed in Andhra Pradesh (41.43) followed by Karnataka (23.67) while Rajasthan showed highest production instability (45.25) among all states during this time. At national level, cotton showed moderate instability in area (19.55) but higher instability in production (44.22) and yield (25.26).

3.3 Growth and Instability in Indian Cotton Exports

Analysis of Indian cotton exports from 2013-14 to 2022-23, based on Compound Annual Growth Rate (CAGR) and Coefficient of Variation in Instability (CDVI) is presented in Table 3. It is observed from table that Oman experienced substantial growth in both quantity (105.09%) and value (169.15%), it also exhibited high instability with values of 86.11 for quantity and 91.62 for value. This high CAGR in Oman's imports of Indian cotton is attributed to its active development of textile and apparel manufacturing sector as part of its Vision 2040 economic diversification strategy. Omani government's efforts to promote non-oil industries, including textiles, have increased demand for cotton imports with India emerging as a preferred supplier. Oman's duty-free trade zones such as Salalah Free Zone and Sohar Free Zone have attracted investments in textile manufacturing, creating a steady demand for raw cotton (FAO, 2019) [4].

Germany also demonstrated positive growth with 2.59 per cent increase in quantity and an 8.94 per cent rise in value alongside moderate instability levels of 41.56 and 38.97, respectively. In contrast, countries like Malaysia and China experienced declines in growth rates. Malaysia saw a significant drop of-33.77 per cent in quantity and-33.90 per cent in value coupled with high instability levels of 106.05 and 113.55, respectively. Similarly, China recorded-21.63 per cent decline in quantity and a-17.66 per cent decrease in value. Thailand also showed negative CAGR (-19.57%) in quantity and-15.44 per cent decline in value.

A notable negative CAGR of-21.63 per cent was observed in Indian cotton exports to China. This decline was particularly observed during 2014-15, 2015-16, 2017-18, 2019-20 and 2021-22. Sharp year on year decline in exports to China during 2014-15 (-56.76%) and 2015-16 (-68.29%) was primarily driven by China's cotton stockpiling policy and subsequent adjustments. Between 2011 and 2013, China implemented temporary stockpiling program to support domestic farmers which led to accumulation of unprecedented cotton reserves (over 8,000 million kg by 2014). This policy reduced China's reliance on imported cotton, including from India. By 2014, the stockpiling policy became unsustainable and China started reducing its stockpiles. Additionally, China imposed restrictions on import quotas, discouraging direct cotton imports and prioritizing domestic stocks. These measures significantly reduced India's cotton exports to China during this period (BS, 2015) [1].

The year on year decline in Indian cotton exports to China in 2017-18 (-53.94%) was largely due to increased competition from Vietnam and tariff disadvantages faced by Indian exporters. Vietnam emerged as a major competitor benefiting from zero import duties on its cotton yarn exports to China while Indian exports faced tariffs of 3.5 per cent to 5 per cent. This made Vietnamese yarn more cost-competitive in the Chinese market. Furthermore, China's shift in yarn production to Vietnam, driven by rising labour costs, significantly reduced India's market share in China (TOI, 2018) [11]. In 2022-23, the decline in Indian cotton exports to China was driven by China's focus on domestic cotton production, particularly from the Xinjiang region and its emphasis on self-sufficiency. This reduced China's reliance on imported cotton, including from India (USDA, 2024) [13].

Bangladesh showed a marginal decline in quantity (-0.56%) but achieved a positive growth rate in value (6.17%) despite instability levels of 33.03 for quantity and 42.43 for value. Belgium experienced a slight decrease in quantity (-0.88%) but positive growth rate in value (4.01%). Taiwan recorded minimal growth with a 0.16 per cent increase in quantity and 0.61 per cent rise in value.

When considering India's total cotton exports to the world there was a negative growth rate in quantity (-9.99%) and value (-4.67%) with instability levels of 30.79 for quantity and 37.92 for value. In 2019-20, Indian cotton exports were heavily impacted by the COVID-19 pandemic which disrupted global trade and supply chains. Lockdowns and restrictions in India and major importing countries led to delays, cancellations and reduced cotton consumption. Textile and spinning operations were halted due to factory closures, labour shortages and decreased consumer spending. Logistics and transportation disruptions further exacerbated the situation, causing backlogs and uncertainty in delivery times. Market volatility also led to the cancellation of many orders as international buyers postponed new purchases of cotton and textiles from India (USDA, 2020) [12].

Table 3: Compound annual growth rates (CAGR) and instability in quantity and value of Indian cotton exports to major destinations

Sr. No.	Countries	(2013-14 to 2022-23)			
		Quantity		Value	
		CAGR (%)	CDVI	CAGR (%)	CDVI
1	Bangladesh	-0.56*	33.03	6.17**	42.43
2	China	-21.63	84.72	-17.66	90.63
3	Vietnam	-4.67	40.34	-1.95	46.60
4	Indonesia	-5.37	41.07	-0.27	49.91
5	Taiwan	0.16*	37.72	0.61*	35.88
6	Germany	2.59*	41.56	8.94*	38.97
7	Belgium	-0.88*	29.15	4.01*	31.63
8	Thailand	-19.57	37.38	-15.44	41.18
9	Malaysia	-37.77	106.05	-33.90	113.55
10	Oman	105.09	86.11	169.15	91.62
11	World	-9.99	30.79	-4.67*	37.92

Note: * and ** indicate significance at 5% and 1% levels, respectively.

4. Conclusion

The study reveals that cotton exhibited positive growth in area, production and yield at the national level during the overall study period with Gujarat and Maharashtra emerging as key contributors. The adoption of Bt cotton during Period II played a significant role in driving growth, particularly in production and yield. However, growth rates declined in Period III with production instability remaining high in states like Andhra Pradesh and Rajasthan. This underscores the need to develop and promote high-yielding, pest-resistant varieties to enhance productivity and resilience.

India's total cotton exports to the world showed a negative growth rate in both quantity and value during the study period. The COVID-19 pandemic worsened challenges in 2019-20, disrupting supply chains and textile operations, leading to delays, cancellations and reduced consumption. Oman recorded the highest growth in imports of Indian cotton driven by its Vision 2040 economic strategy and duty-free trade zones. Exports to China showed negative growth rate due to its stockpiling policy and competition from Vietnam. Among India's export destinations Malaysia showed the highest instability. Thus, efforts to diversify export markets, improve cost competitiveness and invest in logistics and storage infrastructure could mitigate external shocks and enhance India's competitiveness in the global cotton market.

5. References

1. BS. India's cotton exports to China plunge 56.7% in 2014-15, Business Standard, 2015, Available from: https://www.business-standard.com/article/pti-stories/india-s-cotton-exports-to-china-plunge-56-7-in-2014-15-115072200810_1.html. Accessed on 7th January, 2025.
2. Chaudhari DK, Panickar BK, Chadaragi MK. Survey and seasonal incidence of pink bollworm Pectinophora gossypiella (Sounders) in Bt cotton growing areas of North Gujarat. Biol Forum. 2023;15(9):682-686.
3. Devegowda SR, Yadav A, Nagaveni M, Kushwaha S. Sowing seeds of prosperity: Uncovering the calculated growth, instability and decomposition of cotton in India. Eco Env & Cons. 2023;36(3):283-286.
4. FAO. Manufacturing for wellbeing: the sultanate of Oman's manufacturing Strategy 2040. Food and Agriculture Organization of the United Nations, 2019, Available from: https://faolex.fao.org/docs/pdf/oma214503E.pdf. Accessed on 20th December, 2023.
5. FAOSTAT. Production-Crops and livestock products. Food and Agriculture Organization of the United Nations, 2023a, Available from: https://www.fao.org/faostat/en/#data/QCL. Accessed on 20th December, 2023.
6. FAOSTAT. Trade-Crops and livestock products. Food and Agriculture Organization of the United Nations, 2023b, Available from, https://www.fao.org/faostat/en/#data/TCL. Accessed on 20th December, 2023.
7. MoT. Annual report 2022-23. Ministry of Textiles, Govt. of India, 2023a, Accessed on 20th December, 2023. Available from: https://texmin.nic.in/sites/default/files/English%20Final%20MOT%20Annual%20Report%202022-23%20%28English%29_0.pdf.
8. MoT. State-wise/year-wise area, production and yield in India as per cocpc. Ministry of Textiles, Govt. of India, 2023b, Accessed on 20th Dec, 2023, Available from: https://texmin.nic.in/sites/default/files/statewise%20year-wise%20area%2c%20production%20and%20yield%20in%20india%20as%20per%20cocpc_0.pdf
9. Pavithra S, Mishra RR, Bhaviskar PP, Gaware UP, Kumari K, Ahmad N. Growth performance and decomposition analysis of major cotton growing states of India. Int J Env & Climate Change. 2022;12(9):1-10.
10. Shwetha MN, Devi S, Lavanya T, Suhasini K, Meena A. Growth in area, production, and productivity of cotton crop in India: A state-wise analysis. Int J Env & Climate Change. 2022;12(11):51-57.
11. TOI. Cotton yarn exports hit by fall in Chinese demand. Times of India, 2018, Accessed on 7th January, 2025, Available from: https://timesofindia.indiatimes.com/business/india-business/cotton-yarn-exports-hit-by-fall-in-chinese-demand/articleshow/64671884.cms
12. USDA. Cotton and products annual. United States Department of Agriculture, 2020, Accessed on 7th January, 2025, Available from: https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Cotton+and+Products+Annual_New+Delhi_India_04-01-2020.
13. USDA. Cotton and products annual. United States Department of Agriculture, 2024, Accessed on 7th January, 2025, Available from: https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Cotton+and+Products+Annual_Beijing_China++People%27s+Republic+of_CH2024-0053
14. Wani BK, Kaspate RN, Memane SR. Growth and instability in area, production and productivity of major cash crops in India. Eco Env & Cons. 2024;30(2):858-864.