The Organic Agri Export Conundrum: Growth and Opportunities in India

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Abstract**—** *India holds the sixth position globally in terms of organic agricultural area and ranks first in terms of the total number of producers in 2021 (FIBL & IFOAM Year Book 2023). The country has seen significant growth in organic cultivated area and production from 0.5 to 5.39 million hectare (Mha), and 1.3 million tones (MT) to 2.95 MT respectively, during 2012-13 to 2022-23. Madhya Pradesh, Maharashtra, and Rajasthan have the highest area and production share under organic farming in India. These three states have a combined share of over 60% of the total organic area and 70% of the total organic production in the country. Madhya Pradesh, in particular, has emerged as the leader in organic farming in India with the highest area (0.618 Mha) and production (1.26 MT) in 2021-22.*

In the wake of the current scenario of organic export from the country to major export destinations, an effort has been made through this paper to provide an in-depth analysis of the export of organic agricultural produce from India, examining trends, growth, and instability in the area and production. By leveraging secondary data from various governmental sources like the Agricultural and Processed Food Products Export Development Authority (APEDA) and the Ministry of Agriculture and Farmers Welfare (MoA&FW), the paper explores the potential of the organic sector to contribute to India's economic growth and agriculture sustainability, strengthening the nation's position as a key player in the global organic market. Time series data spanning the period 2012-2022 on area, production, and export of organic produce was utilized and the export of organic produce from India and major states was studied using CAGR, coefficients of variation (CV), and the Cuddy-Della Valle Index (CDVI) for instability.

Keywords— Organic, Export, Growth, Agri, Certification and CDVI.

I. INTRODUCTION

In the realm of agriculture, organic practices have emerged as a prominent force, championed for their holistic approach to maintaining sustainable food systems. As defined by the Food and Agriculture Organization/ World Health Organization (FAO/WHO) Codex Alimentarius Commission (1999), "organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, considering that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system. This global shift towards organic production has been further fueled by the COVID-19 pandemic, as consumers increasingly prioritize healthy and immunity-boosting foods, propelling the organic market to new heights.

According to the World Organic Agriculture (2023) report, the global organic agricultural land area reached 76.4 Mha in 2021, representing 1.6% of the world's total agricultural land. The major players i.e., Australia (35.69 Mha), Argentina (4.07 Mha), and France (2.78 Mha) possess almost 70% of the global organic area. China, Uruguay, India, Spain, United States, Italy, and Germany also possess remarkable areas of organic farming (Fig.1).

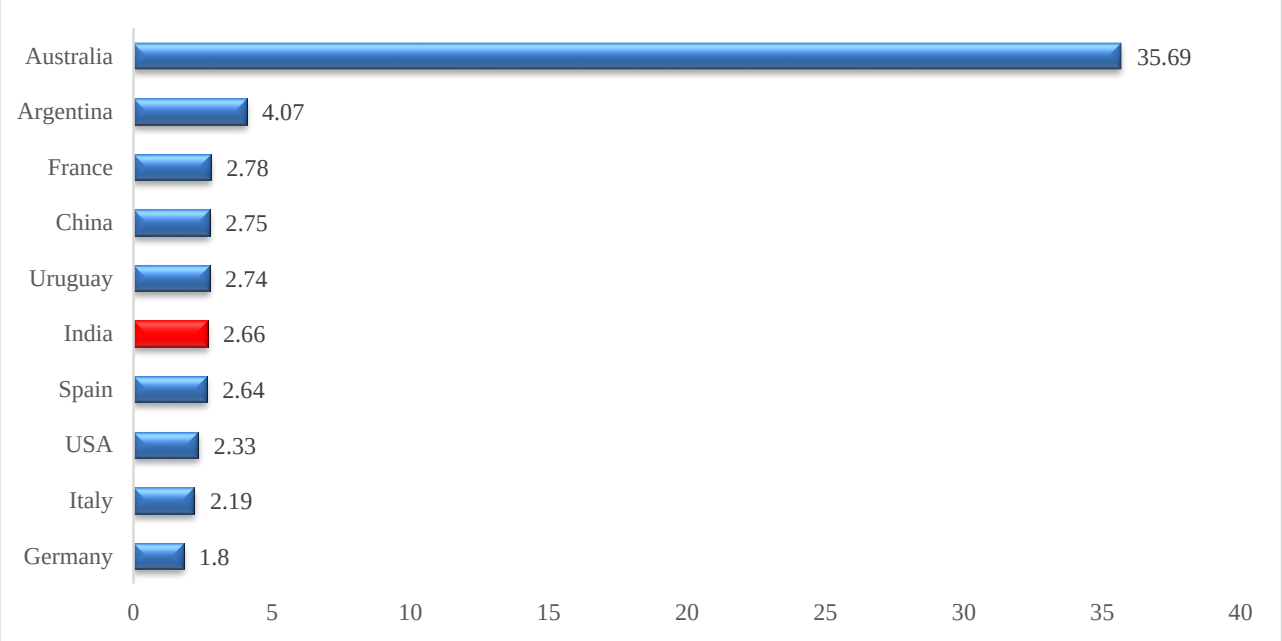

FIGURE 1: Country wise area under Organic Farming (Mha)
(Sources: WOA, 2023)

Globally, there were 3.7 million organic agri producers in 2021, with more than 91% in Asia, Africa, and Europe. India stands top among these countries, followed by Uganda and Ethiopia. With the highest number of certified organic farmers in the world, India has a vast potential to cater to the increasing global demand for organic food basket.

1.1 Unlocking India's Potential as a Major Organic Produce Exporter:

India has carved a significant niche for itself in the global organic agriculture landscape. India holds the sixth position globally in terms of organic agricultural area and ranks first in terms of the total number of producers in 2021 (FIBL & IFOAM Year Book 2023). The country has seen significant growth in organic cultivated area and production from 0.5 to 5.39 Mha, and 1.3 MT to 2.95 MT respectively, from 2012-13 to 2022-23 (Fig. 3). As per the latest statistics of APEDA, India produced around 2.9 MT (2022-23) of certified organic products which include all varieties of food products namely oil seeds, fibre, sugar cane, cereals & millets, cotton, pulses, aromatic & medicinal plants, tea, coffee, fruits, spices, dry fruits, vegetables and processed foods, etc. The production is not limited to the edible sector but also produces organic cotton fiber, functional food products, etc. Madhya Pradesh, Maharashtra, and Rajasthan have the highest area and production share under organic farming in India. These three states have a combined share of over 60% of the total organic area and 70% of the total organic production in the country. Madhya Pradesh, in particular, has emerged as the leader in organic farming in India with the highest organic area (0.618 Mha) and production (1.263 MT) in 2021-22. This accounts for 38.19% of the total organic area and 42.8% of the total organic production in India (Fig. 2&3). The Madhya Pradesh government has taken several initiatives to promote organic farming and provide support to farmers to adopt organic practices. These include the establishment of organic farming clusters, subsidies on organic inputs, training programs for farmers, etc. Maharashtra is the second leading state with a share of 13.89% in the total area under organic, followed by Rajasthan (12.66%), Gujarat (5.05%), Sikkim (4.64%), and Odisha (4.50%) (Fig. 4).

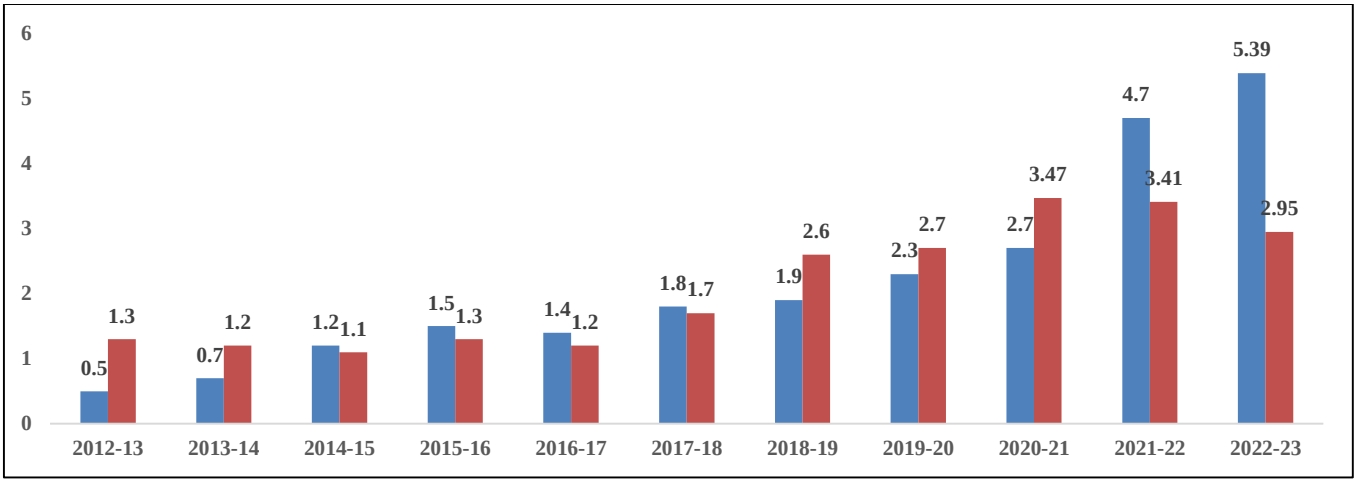

FIGURE 2: India's total certified organic cultivated area (Mha) and production (MT) (Source: APEDA)

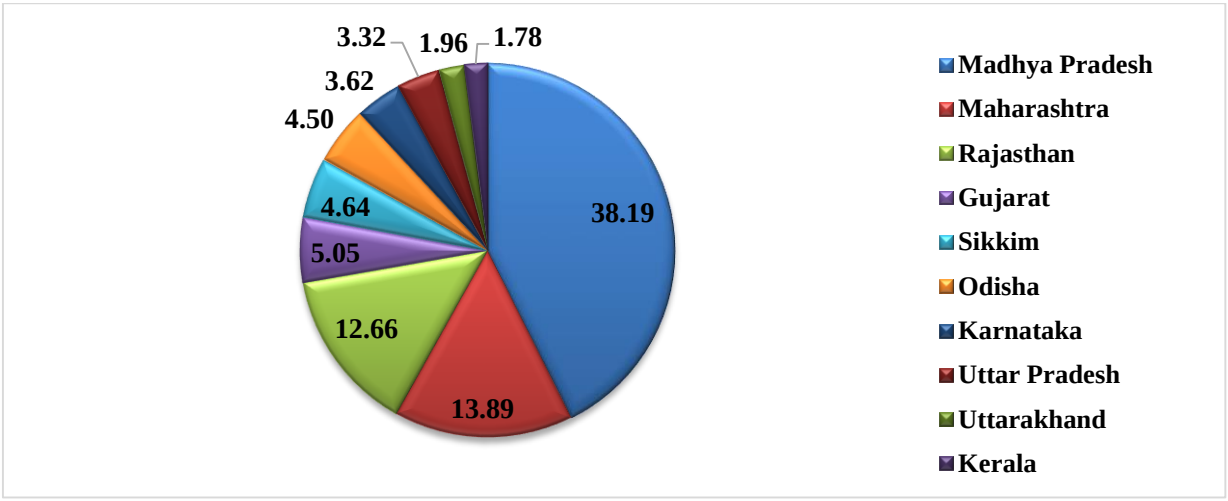

FIGURE 3: Percentage share of organic area in different states of India (2021-22) (Source: APEDA)

As far as organic production is concerned, Maharashtra and Rajasthan stand in second and third position after Madhya Pradesh with a production share of 19.7% and 11.2% respectively (Fig. 4). Even though there is a significant increase in the area under organic farming, the absolute quantity of organic produce remained same in 2021-22 from the previous year.

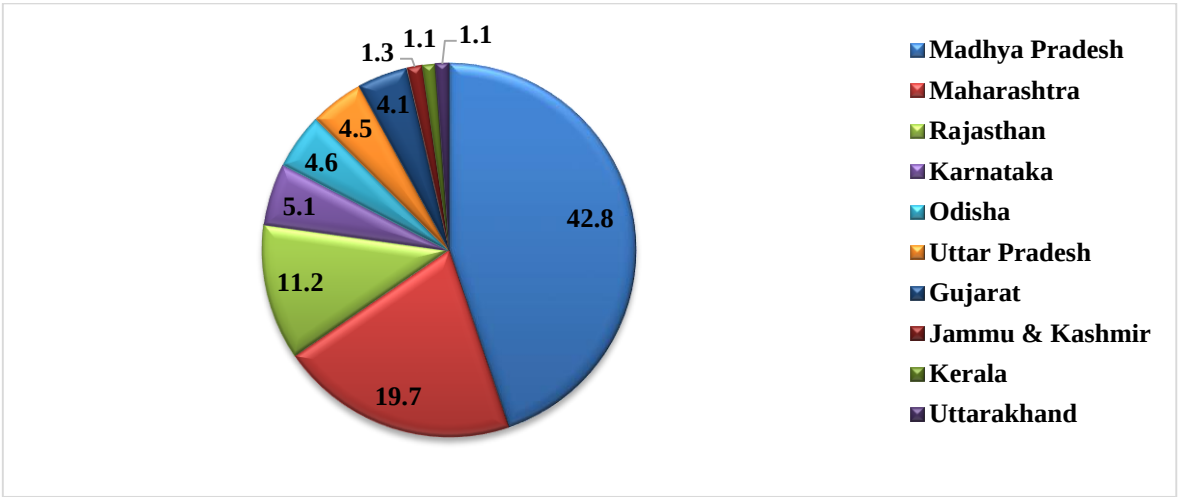

FIGURE 4: Percentage share of different states in organic agri production (2021-22) (Source: APEDA)

Processed food, oilseeds, and cereal & millet are the leaders among the commodities exported from the country. These three commodities have a combined share of about 87% of the total organic export. Processed food possessed the top position in total organic export with 61.09% share, followed by oilseeds (12.85%), cereal & millets (12.71%), and sugar (4.76%). Rest commodities contributed only 8.58% of total organic export (Table 1).

TABLE 1
COMMODITY WISE ORGANIC AGRI EXPORT-2021-22

Commodity name	Exported quantity (in tons)	% to total
Processed food	281190.452	61.09
Oil seeds	59168.419	12.85
Cereals & millets	58513.835	12.71
sugar	21932.591	4.76
Spices & condiments	7957.918	1.73
Tea	6060.466	1.32
Pulses	5433.505	1.18
Fodder	4972.904	1.08
Medicinal plant products	4072.861	0.88
Coffee	3916.192	0.85
Dry fruits	3433.509	0.75
Fresh fruits & vegetables	1580.125	0.34
Tuber products	922.138	0.2
Miscellaneous	730.847	0.16
Flowers	243.293	0.05
Essential oil	188.346	0.04
Oils & Oleoresins	2.999	0
Total	**460320.4**	**100**

Source: APEDA

1.2 Government Initiatives to Bolster India's Organic Produce Exports:

The Government of India has actively fostered organic agriculture through dedicated schemes like the Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development in North East Region (MOVCDNER) since 2015-16 to cater to the needs of domestic and export markets respectively. Both the schemes stress end-to-end support to organic farmers i.e., from production to certification and marketing. Post-harvest management support including processing, packaging, and marketing is made integral part of these schemes to encourage organic farmers. Under PKVY, a unique quick certification program “Large Area Certification” (LAC) was launched to harness the potential areas such as areas in hills, tribal districts, deserts, and rainfed areas in India that continue to remain free from chemical input usage. The government is also implementing its Large Area Certification program to transform “Traditional Organic Areas” into certified organic production hubs. In addition, Organic cultivation on either side of River Ganga and Large Area Certification have also been introduced under PKVY to increase acreage under organic cultivation using organic manure / bio-fertilizers. Organic Farming has also been supported under other schemes viz. Rashtriya Krishi Vikas Yojana (RKVY) and Mission for Integrated Development of Horticulture (MIDH), Network Project on Organic Farming under the Indian Council of Agricultural Research (ICAR). Natural Farming is promoted in India as Bharatiya Prakritik Krishi Paddhati (BPKP) under the centrally sponsored scheme PKVY. India is all set to launch a National Mission on Natural Farming to promote the adoption and upscaling of these practices across

the country. As per the MoA&FW, more than 1 Mha area (i.e., 10,05,623 ha) is under natural farming and more than 1.6 million (i.e. 16,78,693) farmers are practicing this (GoI, 2023).

1.3 Organic Certification:

In India, organic certification can be obtained either from the National Program for Organic Production (NPOP) or through the Participatory Guarantee System-India (PGS). However, certification for export is mandated through NPOP only. The NPOP is the central regulatory system for organic agriculture in India, established by the APEDA under the Ministry of Commerce and Industry in 2001. This program was originally meant for exporters and requires adherence to stringent standards. The NPOP is based on the International Federation of Organic Agriculture Movements (IFOAM) standards and includes rules for the accreditation of certification authorities, guidelines for certifying growers, and rules for the use of India's organic label. Mainly the Organic certification is carried out by a third-party inspection agency under the NPOP's purview, and the government maintains the "India Organic" national seal, which is used by exporters, processors, and manufacturers.

In NPOP, the exporter can get a certificate, valid for one year, from one of the 28 third-party certification agencies accredited by the APEDA. The other option is the Participatory Guarantee System-India (PGS), under which a group of farmers come together and vouch for each other's produce.

The NPOP and PGS both are process-based certification systems. They look at the processes and practices of farming and food processing. Testing of food for pesticide residues is a limited part of the scheme. NPOP is far more expensive than PGS and therefore, preferred by big farmers, companies, and exporters.

The organic agriculture sector has experienced significant growth, supported by government initiatives and increasing consumer demand. However, there are areas where further improvement can enhance the organic food processing industry and boost exports. Efforts are undertaken to refine certification systems to better accommodate small and marginal farmers, ensuring they receive adequate support. While multiple certificates are currently necessary for exports to various countries following the cessation of the equivalence agreement with the US certification system, this presents an opportunity to streamline processes and enhance compliance standards. Additionally, initiatives are being developed to improve traceability within the certification and export system, addressing a key challenge and further strengthening the organic food industry's global competitiveness. In 2013, India embarked on a journey to enhance its processed food exports by reevaluating its unilateral equivalence arrangement with the European Union (EU), a pivotal market for Indian organic exports. Concurrently, consumer surveys in India revealed a robust preference for organic food among consumers, underscoring a growing awareness and appreciation for healthier dietary choices. Moreover, consumer survey highlighted an evolving consumer sentiment, where concerns about the quality of organic products are being addressed through increased transparency, stringent quality control measures, and heightened vigilance against adulteration and fraudulent practices. (Ramesh and Divya, 2015; Sharma et al. 2016).

Recognizing the current landscape of organic exports from India this paper delves into a comprehensive analysis of the nation's organic agricultural produce exports; examining trends, growth patterns, and any instabilities observed in area, production, and export volumes of organic agri produce.

II. METHODOLOGY

By leveraging secondary data from various governmental sources like APEDA and the MoA&FW, the paper explores the potential of the organic sector to contribute to India's economic development and agriculture sustainability. Time series data spanning the period 2012-2022 on area, production, and export of organic produce was utilized and the export of organic produce from India and major states was studied using CAGR, coefficients of variation (CV), and the Cuddy-Della Valle Index (CDVI) for instability.

2.1 Compound Annual Growth Rate (CAGR) Analysis:

CAGR is used to assess trends in organic produce area, production, and exports from India. This analysis leverages an exponential growth function to calculate the CAGR. Time-series data encompassing the chosen period will be fitted to this exponential trend equation. Subsequently, by solving the resulting equation, the CAGR for each metric (area, production, and

exports) is precisely determined. This approach provides a clear and concise understanding of the annual growth rate experienced within the organic produce sector over the specified timeframe.

The exponential trend equation used in this case is of the following form:

$$Y_t = ab_t \quad (1)$$

Where, Y_t = Parameters of land-utilization and cropping pattern

a = constant

t = time variable with an annual frequency (Year = 1, 2…, n)

b = coefficient that shows the rate of change

Converting eq. 1 into a semi log exponential form:

$$\log (Y_t) = a + tb \quad (2)$$

Eq. 1 can also be written as:

$$Y_t = Y_o (1+r)^t \quad (3)$$

Taking log on both sides:

$$\log (Y_t) = \log (Y_o) + t \log (1+r) \quad (4)$$

Comparing eq. 2 and eq. 4, we get:

$a = \log (Y_o)$

$b = \log (1+r)$

The Compound Annual Growth Rate can be calculated by using the following method:

$b = \log (1+r)$

Antilog (b) = 1+r

Antilog (b) – 1 = r

i.e. r = Antilog (b) -1

When this value of r is multiplied by 100, it gives the percentage compound annual growth rate as per the formula.

CAGR = (Antilog of (b)-1*100)

2.2 Cuddy Della Valle Instability Index (CDVI):

Cuddy and Valle (1978) created the CDVI to measure the instability in time series data that is characterized by trends. The coefficient of variation (CV) was calculated using the expression to investigate the stability of processed vegetable exports. The Cuddy Della Valle Index is used to measure the instability in this study. The CDVI de-trends the given series first, indicating the direction of instability. The use of the CV as a measure of instability in time series data has significant drawbacks. If the time series data show any trend, the variation assessed by CV can be overstated, i.e., if CV is used to quantify instability, the region with expanding output at a constant rate will score high in instability. In contrast, the CDVI uses the coefficient of determination to de-trend the coefficient of variation.

The CV is a statistical measure of data points' dispersion around the mean in a data series, and a useful statistic for assessing the degree of variation between two data series, even if the means are radically different. It indicates the ratio of the standard deviation to the mean.

$$\text{Coefficient of Variation (CV)} = \frac{\text{Standard Deviation (SD)}}{\text{Mean}} \times 100 \quad (5)$$

The CV (%) was calculated to determine the extent of fluctuation in processed vegetable exports in terms of quantity and value over time. The instability index was also calculated to look at the volatility of processed vegetable exports from the country in terms of quantity and value over time using the following formula:

$$\text{Instability Index (I)} = \text{CV} \times \sqrt{1 - \text{Adjusted } R^2} \quad (6)$$

Where,

CV = Coefficient of Variation

Adj R^2 = Coefficient of determination

The ranges of CDVI (Sihmar, 2014) are given as follows:

Low instability = between 0 and 15

Medium instability = greater than 15 and lower than 30

High instability = greater than 30

III. RESULTS AND DISCUSSION

India has a long history of organic farming practices, with a large number of farmers engaged in traditional organic farming methods. However, the country's formal organic agriculture sector has been growing in recent years, with increasing domestic and international demand.

India's organic agriproduct exports increased from 0.286 MT worth 327 Million USD in 2014-15 to 0.888 MT worth 1041 Million USD in 2020-21. India's organic exports have continuously shown positive growth with constant increase in exports till 2020-21. In 2021-22 it remained at 0.46 MT with a value of 772 million USD (i.e., Rs. 5249 Crores), registering a decline of 51% from the previous year (Fig. 5).

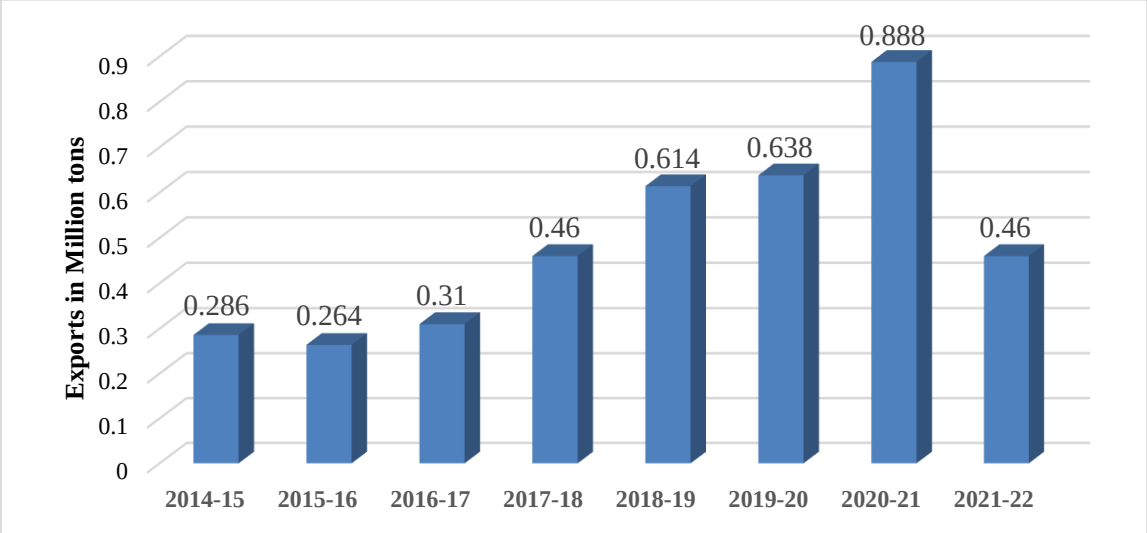

FIGURE 5: Export of India's Organic Agri Produce (MT)
(Source: APEDA)

Overall, the country has seen a significant growth in organic export, with a magnitude of 0.065 MT/ha/year with a CAGR of 15.14% from 2014 to 2022.

The largest export destination for Indian Organic Agri produce is United States and EU, which together account for over three-quarters of the total export volume and value. Other significant export destinations include Canada, Great Britain, Turkey, Switzerland, Vietnam, Ecuador, Korea Republic, and Australia, etc. India export 86.42% share of its organic export to United States, EU, and Canada of which the highest 40.48% exported to United States followed by EU (37.10%), Canada (8.84%), Switzerland (1.10%), and Australia (0.34%) (Table 2).

TABLE 2
MAJOR ORGANIC EXPORT DESTINATIONS FOR INDIA (TONS)

Country	2017-18	2018-19	2019-20	2020-21	2021-22
United States	223854	334112	376070	500936	186339
	-48.50%	-54.40%	-58.85%	-56.40%	-40.48%
European Union (EU)	129546	155253	175674	267076	170762
	-28%	-25.30%	-27.50%	-30.10%	-37.10%
Canada	82133	101942	64225	69142	40677
	-17.80%	-16.60%	-10.05%	-7.80%	-8.84%
Switzerland	8925	6199	5192	3924	5142
	-1.93%	-1.01%	-0.81%	-0.44%	-1.10%
Australia	2690	2130	2357	2923	1574
	-0.57%	-0.35%	-0.37%	-0.33%	-0.34%
Total Export	**458339**	**614089**	**638998**	**888179**	**460320**

(Figure in parenthesis is percentage to total export) Source: APEDA

In 2017-18, Madhya Pradesh possessed the highest, 51.5% share of exports of organic agri produce, followed by Gujarat (14.3%), New Delhi (13.9%), and Maharashtra (7%). Rajasthan, Daman & Diu, Karnataka, Haryana, Uttar Pradesh, and Andhra Pradesh also contributed with a small share in India's organic export basket, ranging from 0.5% to 2.6%. The percentage share of organic exports increased for all the states during 2017 to 2021 except, New Delhi, Andhra Pradesh, and Gujarat where the same has been decreased by more or less similar quantity during the period. However, in 2021-22, there was a drastic decline in the percentage share of exports for Madhya Pradesh, which dropped to 38.3%. This was accompanied by an increase in the percentage share of exports of Maharashtra, Gujarat, and New Delhi, although their share remained lower than that of Madhya Pradesh (Table 3).

TABLE 3
STATE-WISE EXPORT OF ORGANIC PRODUCE IN INDIA DURING 2017 TO 2022 (X000 TONS)

State	2017-18	2018-19	2019-20	2020-21	2021-22
Madhya Pradesh	237 (51.5%)	314(51%)	351 (54.9%)	500 (56.3%)	176 (38.3%)
Maharashtra	32 (7%)	75 (12.26%)	73 (11.4%)	126 (14.2%)	85.5 (18.6%)
Gujarat	66 (14.3%)	64.9 (10.50%)	58 (9.1%)	65.5 (7.4%)	60 (13%)
Haryana	4.7 (1%)	26.67 (4.83%)	31 (4.9%)	38.9 (4.4%)	29.1 (6.3%)
New Delhi	64 (13.9%)	40.15 (6.50%)	20.7 (3.2%)	31.7 (3.6%)	24.8 (5.4%)
Karnataka	6.7 (1.5%)	11.89 (1.94%)	21.8 (3.4%)	17.4 (2%)	22.1 (4.8%)
Daman & Diu	10 (2.2%)	25.50 (4.16%)	36.2 (5.7%)	42.4 (4.8%)	16.5 (3.6%)
Rajasthan	12 (2.6%)	23.27 (3.78%)	14.5 (2.3%)	24.7 (2.8%)	9.1 (2%)
Andhra Pradesh	2.48 (0.5%)	3.73 (0.60%)	2.3 (0.4%)	1.83 (0.2%)	2.7 (0.6%)
Uttar Pradesh	2.43 (0.5%)	4.66 (0.76%)	5.2 (0.8%)	12.14 (1.4%)	6.9 (1.5%)
Total Export	460	614	639	888	460

Figure in parenthesis is percentage to total (Source: APEDA)

The reason behind this deceleration might be a sizeable reduction in the production of organic agri produce in some states like Maharashtra and Karnataka due to heavy rainfall, cyclones, and COVID-19 pandemic.

3.1 Trend, Growth, and Instability in Organic Area and Production in Major States (2017 -2022):

Area: The growth and instability of area under organic farming in major states have been analyzed from 2017 to 2022 and found that, over the years, the absolute area under organic farming increased in all the major States and the country as well (Table 4).

TABLE 4

TREND, GROWTH, CHANGES, AND INSTABILITY IN ORGANIC AREA OF MAJOR STATES

State	Base year (2017)	Current year 2022	Absolute Change	Relative Change (%)	CAGR (%) (P-Value)	Instability
Madhya Pradesh	328420	618,080	289660	88.2	17.56** -0.0003	2.15
Maharashtra	108029	224,787	116758	108.08	19.65** -0.0028	10.54
Rajasthan	76002	204,871	128869	169.56	27.89** -0.0077	6.79
Gujarat	49298	81,701	32403	65.73	12.68** -0.012	7.05
Sikkim	74094	75,168	1074	1.45	0.42 -0.2	0.81
Odisha	61981	72,758	10777	17.39	3.95 -0.212	7.46
Karnataka	24669	58,613	33944	137.6	19.72 -0.165	28.32
Uttar Pradesh	39406	53,701	14295	36.28	8.23** -0.007	3.32
Uttarakhand	19746	31,739	11993	60.74	15.06** -0.013	8.92
Kerala	17523	28,743	11220	64.03	13.63** -0.0005	3.75
Total	884875	1,618,464	733589	82.9	16.36** -0.0003	3.24

***** Significant at 1 percent; Source: Author's calculation***

The maximum increase in area under organic farming was observed in Rajasthan (169.56%), followed by Karnataka (137.60%), Maharashtra (108.08%), Madhya Pradesh (88.20%), Gujarat (65.73%), Kerala (64.03%), Uttarakhand (60.74%), Uttar Pradesh (36.28%), Odisha (17.39%), and Sikkim (1.45%) respectively. As far as the growth of area under organic farming is concerned, the Compound Annual Growth Rate (CAGR) of the same was found highly significant and positive in all the major states during the period from 2017 to 2022. The maximum growth in CAGR was observed in Rajasthan (27.89%) followed by Karnataka (19.72%), Maharashtra (19.65%), Madhya Pradesh (17.56%), Uttarakhand (15.06%), Kerala (13.63%), Gujarat (12.68%), Uttar Pradesh (8.23%), Odisha (3.95%), and Sikkim (0.42%) during the reference period. The growth of area under organic farming in the country was found highly significant and positive during the period.

The fluctuation was found through CDVI and observed that the fluctuation in areas under organic farming was recorded as very low in all the major states except in Karnataka, where the instability was observed medium as the CDVI value was found 28.32. This indicates that the persistence of volatility may be higher in Karnataka than in other states. In the rest of the states, the CDVI value ranged from 0.81 (Sikkim) to 10.54 (Maharashtra) indicating the lowest instability over the period of five years. Low instability in area under organic farming in major states shows that the farmers are moving towards organic farming in these states.

Production: The absolute quantity of organic agri-produce increased in the country and all the major states during the reference period. At the country level, organic production was increased by 77.28 % during the reference period. Among the States, Karnataka had the highest increase (510.65%) in organic production, followed by Maharashtra (437.97%), Rajasthan (336.70%), Madhya Pradesh (284.56%), Uttar Pradesh (234.50%), Jammu & Kashmir (185.63%), Gujarat (147.79%), Odisha (119.42%), Kerala (82.42%) and Uttarakhand (60.64%) in the current year over the base year (Table 5).

TABLE 5

TREND, GROWTH, CHANGES, AND INSTABILITY IN ORGANIC AGRICULTURE PRODUCTION IN MAJOR STATES

State	Base year	Current year	Absolute Change	Relative Change (%)	CAGR (%) (P-Value)	Instability
Madhya Pradesh	328420	1262967	934547	284.56	37.59*	12.14
					-0.028	
Maharashtra	108029	581164	473135	437.97	38.16	53.02
					-0.312	
Rajasthan	76002	331901	255899	336.7	42.13**	10.2
					-0.0012	
Karnataka	24669	150641	125972	510.65	43.2	83.24
					-0.373	
Odisha	61981	135999	74018	119.42	21.38*	12.44
					-0.03	
Uttar Pradesh	39406	131813	92407	234.5	30.54	35.59
					-0.19	
Gujarat	49298	122155	72857	147.79	26.48**	11.92
					-0.0058	
Jammu & Kashmir	13528		25113	185.63	25.75	22.98
		38641			-0.1	
Kerala	17523	31965	14442	82.42	13.8	11.23
					-0.058	
Uttarakhand	19746	31720	11974	60.64	15.06	25.85
					-0.181	
Total	1664549	2950920	1286371	77.28	14.63	13.51
					-0.074	

Note: *Significant at 5percent; ** Significant at 1 percent; source: Author's estimation

All the major states and the country showed an increasing trend of growth rates in production during the period. Among the states, the highest CAGR was seen in Rajasthan (42.13%) and Gujarat (26.48%) which was significant at 1% level. Whereas, the growth of organic production in Madhya Pradesh (37.59%) and Odisha (21.38%) was positive and significant at 5% level. The rest of the states showed not significant growth of organic production and the same was highest in Karnataka (43.20%), followed by Maharashtra (38.16%), Uttar Pradesh (30.54%), Jammu & Kashmir (25.75%), Uttarakhand (15.06%) and Kerala (13.80%). The production in Uttar Pradesh, Karnataka, and Maharashtra showed quite high fluctuation over the reference period with CDVI values ranging from 35.59 to 83.24. Uttarakhand (25.85) and Jammu & Kashmir (22.98) showed medium fluctuation in organic production. In Odisha, Madhya Pradesh, Gujarat, Rajasthan, and Kerala, the fluctuation in organic production was minimal during the reference period with CDVI values ranging from 10.20 to 12.44.

3.2 Growth and Instability in Export of Organic Produces to Major Export Destinations (2017 -2022):

The results reveal that over the period, the absolute quantity of export of organic produce to all the major export destinations has decreased except for the EU, experiencing an acceleration of 31.82% per annum during the period. The export to Canada showed the highest decline (50.47%), followed by Switzerland (42.39%), Australia (41.49%), and the United States (16.76%) respectively. As far as the growth of export of organic produce is concerned, CAGR of export to the United States (0.38%) and EU (11.57%) was found positive but not significant whereas, the same was found negative and highly significant to Canada (16.42%) and Switzerland (14.44%). The CAGR of the export of organic produce to Australia was found negative and not significant (7.28%). The CAGR of total organic agri export from India was found positive but not significant during the reference period (Table 7). The CDVI was analyzed to know the fluctuation in exports and the result indicated that the instability of the quantity exported from the country was at a medium level for all the export destinations except the United States. The export to the United States showed high instability over the reference period as the CDVI value is found to be 44.42 (Table6).

TABLE 6
TREND, GROWTH, CHANGES, AND INSTABILITY IN EXPORT OF ORGANIC PRODUCE TO MAJOR EXPORT DESTINATIONS (2017-2022)

Country	Base Year	Current year	Absolute change (MT)	Relative change (%)	CAGR (%) (P-Value)	Instability
USA	223854	186339	-37515	-16.76	0.38 -0.98	44.42
EU	129546	170762	41216	31.82	11.57 -0.236	27.95
Canada	82133	40677	-41456	-50.47	-16.42 -0.082	21.47
Switzerland	8925	5142	-3783	-42.39	-14.44 -0.093	20.92
Australia	2690	1574	-1116	-41.49	-7.28 -0.396	23.28
Total Export	458339	460320	1981	0.43	3.85 -0.725	32.12

Source: Author's estimation

The results further reveal that the absolute quantity of export of organic produce increased in all the major exporting states during the reference period. The highest increase in the export of organic produce was found in New Delhi (108.08%), followed by Karnataka (96.38%), Haryana (91.47%), Uttar Pradesh (71.34%), Maharashtra (68.33%), Daman & Diu (24.89%), Madhya Pradesh (19.33%), Rajasthan (17.35%), Gujarat (9.54%), and Andhra Pradesh (8.44%) during the period. The absolute quantity of total export was more or less stagnant during the period under study (Table 7).

As far as the growth of export of organic produce is concerned, the CAGR of export was found positive and not significant in five major states while in the rest of the five States, it was negative and insignificant. Among the major exporting states, Haryana showed the highest positive but not significant growth rate of 47.95% per annum followed by Uttar Pradesh (35.59%), Karnataka (31.89%), Maharashtra (28.20%), and Daman & Diu (16.30%). Whereas, New Delhi, Andhra Pradesh, Rajasthan,

Gujarat, and Madhya Pradesh showed negative and not significant growth rates with 19.20, 5.28, 4.82, 1.79, and 1.29% per annum during the period. The CAGR of total export was found positive but not significant during the period (Table 8).

TABLE 7
TREND, GROWTH, CHANGES, AND INSTABILITY IN EXPORT OF ORGANIC PRODUCE FROM MAJOR EXPORT STATES (2017 – 2022)

State	Base Year	Current year	Absolute Change (MT)	Relative Change (%)	CAGR (%) (P-Value)	Instability
Madhya Pradesh	237	176	61	19.33	-1.29 -0.93	45
Maharashtra	32	85.5	54	68.33	28.2 -0.116	33.08
Gujarat	66	60	6	9.54	-1.79 -0.402	5.79
Haryana	4.7	29.1	24	91.47	47.95 -0.174	39.27
New Delhi	64	24.8	39	108.08	-19.2 -0.131	32.79
Karnataka	6.7	22.1	15	96.38	31.89 -0.055	24.06
Daman & Diu	10	16.5	7	24.89	16.3 -0.499	55.48
Rajasthan	12	9.1	3	17.35	-4.82 -0.769	47.61
Andhra Pradesh	2.48	2.7	0	8.44	-5.28 -0.587	29.45
Uttar Pradesh	2.43	6.9	4	71.34	35.59 -0.088	47.32
Total	460	460	0	0	3.76 -0.73	32.07

Source: Based on Authors' estimation

The CDVI was analyzed to know the fluctuation in export and the result showed that the highest fluctuation was found in Daman & Diu, Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana, Maharashtra, and New Delhi with a CDVI value of 55.48, 47.61, 47.32, 45.00, 39.27, 33.08, and 32.79 respectively during the period. The fluctuation of the quantity exported was found low and medium in Gujarat and Karnataka with an instability value of 5.79 and 24.06 respectively. In all the states, the instability of Daman & Diu was quite higher than the others, which indicates that the persistence of volatility may be higher as compared to other states (Table 7).

IV. CONCLUSION AND WAY FORWARD

Despite holding the highest number of organic farmers globally and experiencing rising global demand for organic produce, India's organic export share remains below 1%, which shows the global market is enough space for untapped potential and opportunities of Indian organic produces. To solidify the position in global market, we can leverage technologies to enhance traceability throughout the organic value chain. Establish organic agri export facilitation centers in the state having more area under organic but less export. To further enhance and capitalize on the immense potential of the organic export sector, India must prioritize strengthening its certification processes while exploring additional strategies. Furthermore, fostering collaboration with Krishi Vigyan Kendras (KVKs) and agricultural universities can significantly leverage their existing infrastructure, expertise, and research capabilities within the organic certification process. Use of satellite imagery, AI based analytics and digital tracking might be helpful for addressing the issues of traceability of production, stocks and wastage.

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