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Assessment of Trade Performance and Growth Potential of Lemongrass Oil Export in India

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Abstract

The present study aimed to analyze the growth and potential of lemongrass oil exports over twenty years from 2003–04 to 2022–23 across India. The growth and potential of lemongrass oil were estimated based on secondary data of EXIM in quantity and value obtained from the Department of Commerce, Ministry of Commerce and Industry, Government of India for twenty years using statistical tools like the growth model and Cuddy-Della Valle index. Among the top ten countries or destinations of India's lemongrass oil export were the maximum shares (quantity and value) of importing countries i.e. USA followed by China PRP and Germany. The compound growth rate of the last twenty years both in quantity and value of lemongrass oil were analyzed 16.08 and 25.20% and the variation was 72.73% in quantity and 102.03% in value respectively, indicating the good potential and sustainable supply of Indian lemongrass oil in the world market. The continuously increasing domestic and global demand for lemongrass oil has good opportunities for earning foreign exchange and promotion in the Indian Aroma industry. The area under lemongrass cultivation provided employment opportunities for rural people especially agricultural workers and resource-poor people. It also offered a sustainable source of round-the-year income, better options for crop diversification, and utilization of marginal land.

Keywords: Descriptive statistics, export, growth rate, instability index

1. Introduction

Lemongrass is intentionally introduced in tropical and subtropical regions of the world for the essential oil extracted from its leaves and to be used as a culinary herb and has the potential to escape from cultivation. Lemongrass is a perennial, multi-cut aromatic grass cultivated with lemon-scented essential oil that is produced in large quantities (Vimala et al., 2022) in various parts of the world. Lemongrass is an herb, it's leaves and oil are used for the treatment of bowel spasms, chest pain, higher blood pressure, epilepsy, dysentery, cough, knee achy (rheumatism), flu, common cold, and tiredness (Spriha et al., 2021). The primary source of essential oil extracted from lemongrass is predominantly located in the plant's leaves, which contain up to 5% dry weight of essential oils. The main component, citral, gives the oil a unique lemon-like fragrance (Kaini et al., 2022). The oil smells like lemon (Barbosa et al., 2008) due to the presence of a high content of citral (citral 69%) composed of neral and geranial isomers in the oil (Hussain et al., 2011). The wide use of oil is due to the citral content that goes in perfumery, cosmetics, beverages, and flavouring of soft drinks (Joy et al., 2006, Thasrin and Anitha, 2013) and also used as starting material for the manufacture of vitamin-A through ionones (Majewska et al., 2019). Lemongrass is popularly used in herbal teas and other non-alcoholic beverages in baked food. The tea relieves anxiety, lowers blood cholesterol, and infections, boosts oral health and red blood cell levels, bloating etc.

At present time, In India, lemongrass is traditionally cultivated as a rained crop in Kerala state (Singh and Shivraj, 1999). Although, under semi-arid tropical conditions, it is grown as an irrigated crop in Karnataka, Tamil Nadu, West Bengal, Chhattisgarh, Odisha, Uttar Pradesh, Assam, Jharkhand, Bihar, Maharashtra, Madhya Pradesh and Rajasthan (Handa and Kaul, 2001) in about 4000 ha and the annual production is around 250 tonne. Since, 2017 CSIR-CIMAP introduced different aromatic crops like Palmarosa, Lemongrass, Tulsi, and Vetiver in the highly drought-prone area of the Bundelkhand region of Uttar Pradesh and Madhya Pradesh. Among these aromatic crops, Lemongrass emerges as the most profitable crop among the marginal landholding and resource-poor farmers. The annual world production of lemongrass oil is

around 1000 tonnes from an area of 16000 ha. (Gawali and Meshram, 2019). India is the largest producer in the world and about 80% of the produce is exported to more than 80 countries (Singh et al., 2022). The cultivation of lemon grass was redirected mainly to the western parts of India, but due to its properties and high market demand, it has gained popularity and is being preferred to grow by farmers of other states. Demand comes mostly from the following markets: food and beverage (35%), fragrances, cosmetics and aromatherapy (29%), household (16%), and pharmaceutical (15%) (Barbieri and Borsotto, 2018 and Falleh et al., 2020). As consumers have become increasingly conscious of the health benefits of essential oils, inclinations for foods and beverages containing these volatile oils as additives have developed. The essential oil of lemongrass from India is being exported to countries like Western Europe, the U.S.A., Japan, Belgium, Brazil, France, Germany, South Africa, Singapore, Spain, Switzerland, and the U.K., etc. (Sharma et al., 2022). The global essential oils market has also been led by the growth in demand for organic and natural hygienic products owing to increasing awareness of health problems among consumers.

2. Materials and Methods

The study has analyzed the trade of lemongrass oil exports during the last decade (2003–2023) and future prospects. The secondary data of EXIM in quantity (in thousand kg) and value (in Rs. lakh) was obtained from the Department of Commerce, Ministry of Commerce and Industry, Government of India, and relevant data available on different websites were also incorporated into the study. To determine annual and compound growth, linear and exponential as well as log-linear models were used to assess the instability in exports and imports in terms of quantity and value. To find out the coefficients of variation, techniques and the Cuddy-Della Vella index were worked out.

2.1. Descriptive statistics

To examine the nature of each year, these were subjected to obtain various statistics. Descriptive statistics were used to describe the basic features of the data in the study. They provided simple summaries of the sample and the measures. Together with simple graphic analysis, they formed the basis of virtually every quantitative analysis of data. Descriptive statistics were typically distinguished from inferential statistics. The statistical tools used to describe the above series were minimum, maximum, average, standard error, skewness, and kurtosis.

2.2. Estimation of growth rates

2.2.1. Annual growth rate analysis

Once the growth rate percentages for each period were calculated, they were added together and divided by the total number of the time periods, giving the AGR. The annual trend or performance of exports (quantity and value) was found with the help of the following formula:

$$AGR= [(EV/ BV)-1]\times100$$

Where:

AGR=Annual growth rate

EV=Ending value of production, consumption, and export for the year t

BV=Beginning value of production, consumption, and export for the year t

*100=Percent growth rate

2.2.2. Compound growth rate analysis

The compound growth rate was carried out to determine the growth trend in export (quantity and value) an exponential form of the equation and in modeling time trend. The exponential trend or log-linear was used. The exponential trend equation of the following form has been used.

$$Y_t=e\beta_0+\beta_i t_i+ ut \quad \ldots\ldots (1)$$

Where,

Y_t =Export (time series data) of lemongrass oil in both quantity and value in the year t,

β_0=Intercept

β_i=Trend/slope coefficient

ut=Error terms in the year t

Equation (1) has converted into the logarithmic form to facilitate the use of linear regression by taking the natural logarithms of both sides, we obtain;

$$\ln Y_t=\ln e\beta_0+t_i \ln \beta_i+ut \quad \ldots\ldots (2)$$

and are obtained by application of Ordinary Least Square (OLS) techniques. Equation (2) was estimated by using the OLS techniques. Then percent compound growth rate (r) is computed as follows:

$$r=(e-1)\times100$$

$$\text{or } r=(\text{Antilog of } \beta_i-1)\times100 \quad \ldots\ldots (3)$$

Where,

r=Compound growth rate in percent,

β_i=Estimated coefficient

e=Euler's exponential constant (2.71828)

2.3. *Instability analysis: coefficient of variation*

For the measurement of an index of instability and the Cuddy-Della Vale index or coefficient of variation in the export (volume and value) for the Lemongrass oil. If the less consistent export of oil i.e., it has a higher coefficient of variation among the Lemongrass oil export, the coefficient of variation is the ratio of standard deviation to the arithmetic means which is presented in percentages was calculated as following formula:

$$C.V.=\sigma/\mu\times100$$

Here,

The standard deviation of X has been calculated by using the formula

$$\sigma=\sqrt{(1/N)\sum X_i-\bar{X})^2}$$

Where:

C.V.=Coefficient of variation

(σ)=Standard Deviation of X

μ=Mean of X

X=individual observation in time series data

$\overline{X}$=arithmetic mean of X

$(X_i - \overline{X})$=deviation from the mean

N=Number of observations

The level of instability was also computed around the trend i.e. coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinants (R^2) in cases where R^2 was significant to obtain the instability index. The following formula suggested by J.D.A. Cuddy and P.A. Della Valle (1978) is called the Cuddy-Della Valle index.

Instability index=$\sigma/X \times 100 = \sqrt{(1-R^2)}$
or
Cuddy-Dell Valle Instability index (%)=C.V.×$\sqrt{1-R^2}$
Where,

C.V=Coefficient of Variation in percent

R^2=Coefficient of determination from a time trend regression adjusted for its degrees of freedom.

3. Results and Discussion

3.1. Per se performance of Lemongrass oil export

The descriptive analysis such as mean, standard deviation, skewness, and kurtosis presented in Table 1. Table 1 shows that the value of oil export under lemongrass in whole India was increased from ₹ 142.14 lakh during 2002–03 to ₹ 10260.66 lakh during 2022–23. As a result, the total lemongrass oil export in India increased by nearly 7218.70% since 2002–03. The highest value of lemongrass oil export to different countries presented in table 1 showed a positive trend i.e. USA increased ₹ 23.97 lakh to ₹ 4361.07 lakh during the year 2003–23 followed by China P RP, Germany, Spain, France, UK, Canada, Australia, Singapore, and Thailand were increase respectively. When looking at the standard deviations of lemongrass oil export, India had the largest standard deviation at 3176.22. The positively skewed and platykurtic (Negative Kurtosis) form of the data for the U.K., France, Australia, and Singapore show that there was a minor shift in the favor of export of lemongrass oil during the early era and that it stayed nearly unchanged during the research period. The data for the USA, Germany, Spain, Canada, China P RP, and Thailand are leptokurtic (Positive Kurtosis) and positively skewed, indicating a relatively minor change in the export of lemongrass oil during the early era. The measure of central tendency, namely, mean>median>mode (positive skewness) and mean<median<mode (negative skewness) confirms the criterion, implying that the data were asymmetric in nature.

3.2. *Annual, compound growth rates and instability of export of Lemongrass oil*

The annual and compound growth rates of lemongrass oil exports both in quantity and value for the period of 2003–04 to 2022–23 were estimated and furnished in Table 2 and figure 1, 2 and 3. It could be seen that the quantity of exports in 2003–04 was 27.08 thousand kg and it reached a higher level of 432.42 thousand kg. in 2022–23. The value of exports in 2003–04 in ₹ 142.14 lakh which reached in 2022–23 Rs. 7534.70 lakhs. Lemongrass oil export in India was found about a quantity of 4928.81 thousand kg. and value of ₹ 60684.71 lakh in the last ten years i.e. from 2003–04 to 2022–23. Table 2 revealed that the both annual and compound growth rates and instability of export for lemongrass oil. The highest exports of lemongrass oil were found to be highest in both

Table 1: Descriptive statistics of the yearly export value of lemongrass (₹ in lakh) from 2003–23

Country	Minimum	Maximum	Mean	Standard deviation	Skewness	Kurtosis
U S A	23.97	4361.07	1251.54	1357.08	1.12	0.18
U K	27.29	515.15	245.21	182.75	0.26	-1.81
France	0	520.39	170.38	144.15	0.69	-0.00008
Germany	14.96	1063.18	216.51	252.84	2.32	6.18
Spain	0	610.10	145.96	181.23	1.54	1.76
Australia	2.62	244.23	104.85	87.22	0.46	-1.46
Canada	1.05	338.71	82.75	96.88	1.27	1.08
China P RP	0	1539.23	153.44	351.65	3.58	13.97
Singapore	2.36	169.36	57.73	53.64	0.78	-0.76
Thailand	0.97	86.67	24.77	23.97	1.12	0.79
Top 10 Countries	113.99	8027.55	2453.15	2493.79	0.97	-0.30
Others	26.23	2233.11	576.91	704.84	1.21	0.79
India	142.14	10260.66	3030.06	3176.22	1.02	-0.19

Table 2: Annual, compound growth rates and instability of export of Lemongrass oil during 2003–04 to 2022–23

Year	Quantity ('000' Kg)	AGR	Value (₹ in Million)	AGR
2003–04	27.08	0.00	14.21	0.00
2004–05	36.18	33.60	15.63	9.97
2005–06	67.49	86.54	31.42	100.99
2006–07	71.44	5.85	39.62	26.11
2007–08	81.47	14.04	43.94	10.90
2008–09	137.44	68.70	86.37	96.57
2009–10	106.96	-22.18	58.26	-32.55
2010–11	127.38	19.09	78.29	34.39
2011–12	153.04	20.14	101.55	29.71
2012–13	165.94	8.43	122.43	20.57
2013–14	182.72	10.11	163.93	33.90
2014–15	231.71	26.81	229.86	40.22
2015–16	293.81	26.80	328.53	42.93
2016–17	345.41	17.56	400.26	21.83
2017–18	388.33	12.43	499.21	24.72
2018–19	462.71	19.15	757.12	51.66
2019–20	410.64	-11.25	499.29	-34.05
2020–21	596.52	45.27	819.02	64.04
2021–22	610.12	2.28	1026.07	25.28
2022–23	432.42	-29.13	753.47	-26.57
CGR's (% p.a.)	16.08		25.20	
Instability index (%)	72.73		102.03	

Source: Ministry of Commerce and Industry, Government of India

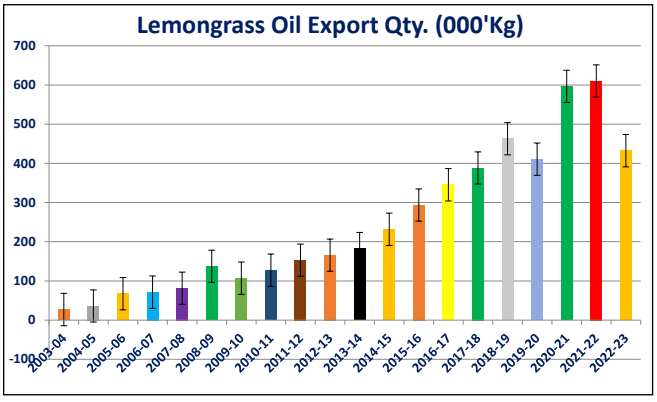

Figure 1: Quantity of lemongrass oil export in the last 20 years from India

quantity and value in 2021–22, 610.12 thousand kg and in case of value Rs. 10260.66 lakh respectively. It also observed that annual growth rates show the maximum and positive to

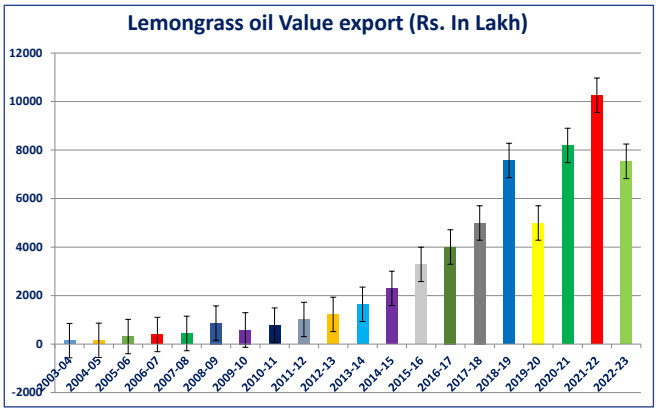

Figure 2: Value of lemongrass oil export in the last 20 years from India

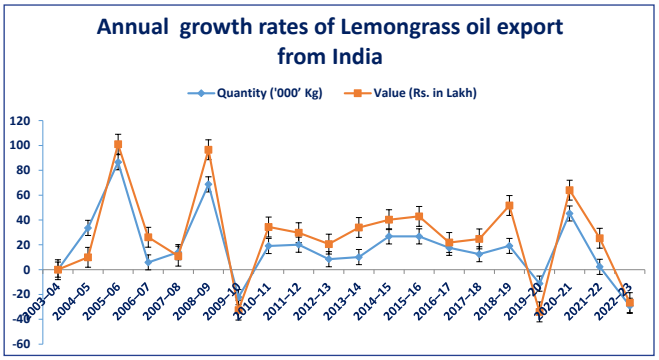

Figure 3: Annual growths in quantity and value of lemongrass oil export in the last 20 years from India

negative trend in the export of lemongrass oil. The highest percentage increase in annual growth rate was observed in quantity (86.54%) and value of oil export (100.99%) increase in 2005–06. The compound growth rate of quantity and value exported was estimated which be 16.08% and 28.20% respectively found satisfactory significant at 1% (p<0.01) level of probability. The instability index or coefficient of variation of lemongrass oil export of quantity and values were observed as 72.73% and 102.03% respectively over the study period.

3.3. *Growth and variation of lemongrass oil exported from India to the top 10 countries*

The table 3 revealed that the growth and variation of lemongrass oil exported (quantity in 000' kg and value in Rs. lakh) for the period 2003–04 to 2022–23. Over the twenty-year highest export of lemongrass oil was found in 2021–22 i.e. quantity 610.12 thousand kg and value ₹ 10260.66 lakhs i.e. the total lemongrass oil export in India was increased by nearly 7218.70% since 2002–03. The major top ten destinations of lemongrass oil export quantity and percent share is presented in table 3 and furnished in figure 4 from India i.e. USA, UK, France, Germany, Spain, Australia, Canada, China RP, Singapore, and Thailand. The country-wise highest growth performance in quantity and value of lemongrass oil was observed that China P RP (28.41%), Canada (26.78%) Spain (21.00%) accounted the highest growth rates followed by

Table 3: Compound growth rates and instability of export quantity of Lemongrass oil in India during 2003–04 to 2022–23 (In thousand kgs.)

Year	USA	UK	France	Ger-many	Spain	Austra-lia	Canada	China P RP	Singa-pore	Thai-land	Top 10 Countries	Others
2003–04	5.03	7.34	0.54	6.36	1.08	1.76	0.4	0	0.37	0.5	23.38	3.7
2004–05	13.4	6.8	0	3.21	0	1.6	0.04	0	1.96	0.63	27.64	8.54
2005–06	24.42	18.76	1.98	4.82	1.19	3.52	0.8	0	3.96	0.22	59.67	7.82
2006–07	25.15	12.06	5.64	5.25	0	5.04	0.6	0.09	2.76	0.6	57.19	14.25
2007–08	31.59	12.47	3.78	11.3	3.06	5.78	0.4	0.4	2.92	2.52	74.22	7.25
2008–09	66.11	20.39	6.89	16.32	3.9	7.14	2.3	0.25	4.28	1.96	129.54	7.9
2009–10	42.21	15.51	13.03	10.5	4.07	5.19	1.18	1.01	1.41	0	94.11	12.85
2010–11	42.67	23.75	15.88	13.98	4.03	5.39	2.93	2.73	0.41	0.61	112.38	15
2011–12	69.23	12.09	15.5	16.16	7.84	7.15	2.04	0.91	2.78	2.65	136.35	16.69
2012–13	64.16	18.77	17.09	18.65	4.28	6.5	5.39	0.75	3.44	1.25	140.28	25.66
2013–14	71.31	17.48	21.53	16.59	10.95	6.74	3.78	1.48	3.79	2.81	156.46	26.26
2014–15	92.46	37.74	16.64	17.75	9.94	9.93	8.24	2.37	4.3	2.26	201.63	30.08
2015–16	131.26	35.17	24.14	11.85	12.9	10.91	11.39	3.69	3.75	4.57	249.63	44.18
2016–17	144.33	41.29	22.08	17.08	21.02	18.34	8.52	9.8	7.85	2.59	292.9	52.51
2017–18	188.2	31.85	17.95	22.85	19.39	11.21	11.17	18.18	9.5	2.39	332.69	55.64
2018–19	196.01	31.91	21.32	3.56	38.6	14.44	12.36	16.63	8.61	4.23	347.67	115.04
2019–20	146.07	37.55	25.51	21.63	20.15	18.82	8.71	2.23	9.52	3.22	293.41	117.23
2020–21	272.71	36.56	20.18	44.33	27.26	13.74	23.36	21.93	13.76	0.67	474.5	122.05
2021–22	243.41	28.94	26.84	56.42	33.67	12.09	8.02	27.9	9.8	1.64	448.73	161.39
2022–23	113.14	27.21	17.44	23.16	12.43	12.61	11.41	99.79	3.5	2.25	322.94	109.48
Average	99.14	23.68	14.70	17.90	11.79	8.90	6.15	10.51	4.93	1.88	198.77	47.68
Growth (% p.a.)	17.30	7.87	17.13	9.28	21.00	10.84	26.78	28.41	11.80	8.45	15.21	20.49
Variation (%)	76.82	45.12	56.95	74.94	94.67	54.88	94.15	210.10	208.50	67.76	67.66	100.20

Source: Ministry of Commerce and Industry, Government of India

USA (17.30%), France (17.13%), Singapore (11.80%), Australia (10.84%), Germany (9.28%), Thailand (8.45%) and U.K. (7.87%) per annum respectively. In the same progression, the variation of lemongrass oil export value of the top ten countries is also exceeded. The result given in the table 3 showed that the variation of lemongrass oil export analyzed the highest variation, China RP (210.10%) followed by Singapore (208.50%) and Spain (94.67%).

The data presented in Table 4 and figure 5 reveals that growth, variation and percent share of lemongrass oil value exchange from India for the study period. The study showed that lemongrass oil export value growth has maximum in China P RP with 46.22% followed by Spain Canada, France, USA, Singapore, Australia, Germany, Thailand, and the U.K. observed as 35.91, 35.13, 28.64, 27.31, 22.21, 20.11, 19.77, 19.36 and 16.42% respectively. The calculated mean, standard

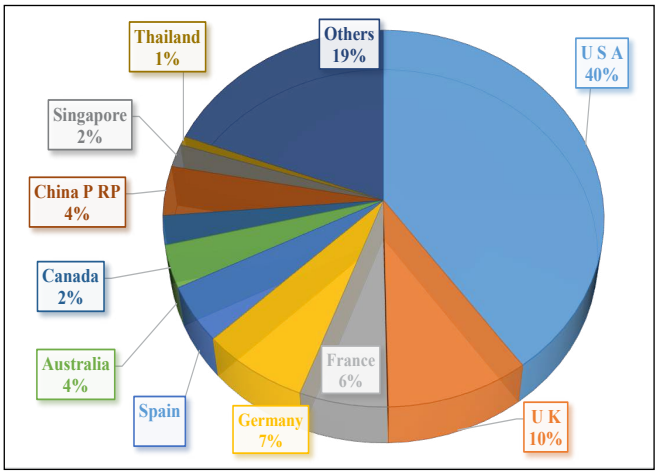

Figure 4: % Share of lemongrass oil export (Quantity-000' Kg)

Table 4: Compound growth rates and instability of value export of Lemongrass oil in India from 2003–04 to 2022–23 (In ₹ Lakh)

Year	USA	UK	France	Germany	Spain	Australia	Canada	China P RP	Singapore	Thailand	Top 10 Countries	Others
2003–04	23.97	34.68	2.92	30.63	5.15	11.6	1.95	0.00	2.32	2.69	115.91	26.23
2004–05	57.81	27.29	0.00	14.96	0.00	7.87	1.05	0.00	2.32	2.69	113.99	42.32
2005–06	114.14	84.04	10.22	24.75	3.14	18.1	2.42	0.00	17.23	0.97	275.01	39.15
2006–07	136.84	66.2	34.7	28.71	0.00	29.85	3.19	0.72	14.57	2.56	317.34	78.84
2007–08	164.97	64.65	19.67	63.81	15.5	38.15	2.18	2.24	16.73	12.69	400.59	38.77
2008–09	405.98	124.54	44.74	102.36	23.36	53.21	15.94	1.95	31.6	5.99	809.67	54.00
2009–10	220.2	83.38	74.30	57.91	26.30	2.62	7.53	5.73	10.04	4.72	492.73	89.83
2010–11	246.3	150.84	89.87	88.11	25.62	40.97	16.75	16.09	2.57	5.00	682.12	100.77
2011–12	428.64	78.91	100.29	113.18	46.8	56.62	14.54	8.81	22.24	21.97	892.00	123.45
2012–13	469.88	132.77	130.06	136.5	31.16	51.12	36.3	8.10	33.61	10.40	1039.9	184.39
2013–14	629.52	142.6	184	141.44	92.37	72.48	29.56	16.37	42.64	39.72	1390.7	248.58
2014–15	914.89	349.73	167.08	167.53	94.39	109.87	76.14	27.79	47.58	22.43	1977.43	302.88
2015–16	1452.91	358.75	282.7	129.38	132.57	127.27	135.29	46.10	50.59	65.87	2781.43	438.77
2016–17	1720.38	437.01	261.49	191.99	227.31	212.95	103.22	111.22	98.18	38.06	3401.81	600.83
2017–18	2463.28	401.18	259.81	301.66	231.05	153.58	142.92	216.29	111.16	40.18	4321.11	670.99
2018–19	3282.54	509.04	374.19	369.56	610.1	244.23	225.41	259.54	138.49	86.67	6099.77	1471.46
2019–20	1797.82	425.8	303.27	255.92	206.11	225.85	124.22	36.79	125.9	50.92	3552.6	1440.32
2020–21	3885.83	471.06	255.88	618.08	352.57	186.15	338.71	281.35	169.36	11.94	6570.93	1619.3
2021–22	4361.07	515.15	520.39	1063.18	554.65	217.96	139.81	490.56	138.7	26.08	8027.55	2233.11
2022–23	2253.77	446.7	292.07	430.46	240.96	236.55	237.94	1539.23	78.82	43.92	5800.42	1734.28
Average	1251.54	245.22	170.38	216.51	145.96	104.85	82.75	153.44	57.73	24.77	2453.15	576.91
Growth (% p.a.)	27.31	16.42	28.64	19.77	35.91	20.11	35.13	46.22	22.21	19.36	24.73	27.87
Variation (%)	105.68	72.64	82.46	113.82	121.02	81.07	114.12	446.75	90.56	94.32	99.08	119.08

Source: Ministry of Commerce and Industry, Government of India

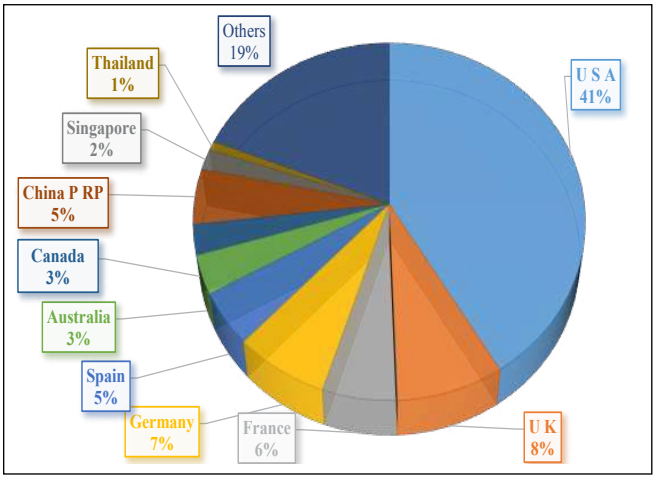

Figure 5: % Share of lemongrass oil export (Value- in Lakh Rs.)

deviation, and instability index or variation of lemongrass oil value exported over the period were highest observed for China RP (446.75%) followed by Spain (121.02%) and Canada (114.12%) respectively.

It was concluded from table 3 and 4 that Lemongrass oil export from India to different countries seems stable from the last decade except for some depletion in quantity and value in a few years, this is due to the increase in internal consumption or price fluctuations in oil price in the international market. This trend showed that the quality of lemongrass oil produced was used in different countries as raw material for the fragrance and flavor industry. It also indicates that sustainably supply the quality lemongrass oil maintained by India and produced by farmers in different states.

4. Conclusion

The compound growth rates in both quantity and value were found high and positive to significant, indicating good potential and profit for Indian lemongrass oil. The export of lemongrass oil has the potential to earn foreign exchange, while at the same time acting as a good source of income and employment for farmers through the utilization of uncultivated land and preventing the migration of resource-poor farmers or agricultural laborers in the villages.

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