Research Paper

Export Performance of Palmarosa oil in India: A Growth and Instability Analysis

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ABSTRACT

The present study attempts to examine the annual and compound growth rate in the export of Palmarosa oil. The time-series data for a period of 2000-20 was analyzed by using a growth model. Quantitative analysis was used to perform descriptive statistics, linear and exponential, and quantum change estimation using exclusively secondary data. The results revealed that the compound growth rate (CGR's) of export of Palmarosa oil was statistically significant at a 1 percent probability level. The quantity export compound growth rate was 22.33 percent per annum, and exported value was 39.17 percent per annum. The maximum and positive to negative annual growth rate of the export of Palmarosa oil during the entire study period and instability have been directly related to each other. Though, Palmarosa oil export achieved more stable values followed by quantity. The top three countries USA, France, and Spain, recorded significant imports (quantity and value) of Palmarosa oil from India. The result also reveals that the most significant change in quantity export increase was more prominent in Spain, and value export increased in Australia during 2019-20 over the previous year.

HIGHLIGHTS:

◉ The share of palmarosa oil export to total export is continuously rising year by year.
◉ India is also a major supplier to the international market of palmarosa oil.

Keywords: Palmarosa, growth and instability, quantum change

Palmarosa is a tropical perennial grass cultivated for its oil that smells like rose fragrance and is obtained from the floral shoots and above-ground parts of crop. It is cultivated both as irrigated and un-irrigated (rain-fed) crop in several tropical and subtropical parts of India. Palmarosa in India is commercially cultivated in different states like Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, and Uttar Pradesh. CSIR- Central Institute of Medicinal and Aromatic Plants (CIMAP) has developed yielding varieties and agro-technologies and, through its extensive technology dissemination program, introduced this crop in various parts of the country, especially in the Kutch and Saurashtra region of Gujarat during the

last 5-6 years. Due to these efforts of the institute now Gujarat is the largest cultivar state of Palmarosa in India.

Globally, India has a significant producer and exporter of Palmarosa oil. The major export destination of Palmarosa oil from India includes countries like USA, France, Germany, Spain, UK, Belgium, Australia, Singapore, Vietnam, Thailand, etc. It is a less caring and risky crop and less affected by domestic and wild animals, insect-pests, and natural phenomena (drought and high wind

How to cite this article: Choudhri, H.P.S., Verma, D.K., Bhise, R.N., Sharma, R.S., Srivastava, R.K. and Kumar, S. (2022). Export Performance of Palmarosa oil in India: A Growth and Instability Analysis. *Economic Affairs*, **67**(02): 43-48.

velocity, etc.). It can grow in poor sandy loam to heavy fertile soils.

The essential oil of Palmarosa, which contains the chemical compound geraniol, is valuable for its scent and a number of traditional medicinal and household uses. Palmarosa oil is used for flavoring food, beverages, perfumery, cosmetic and pharmaceutical products and against the action of various bacteria, fungi, and microorganisms (Rajeswara *et al.* 2009). Palmarosa oil is extensively used in mosquito repellents, an effective insect repellent for stored grain and beans (Duke *et al.* 1993 and Kumar *et al.* 2007).

METHODOLOGY

The present study is merely based on secondary sources of data. The secondary data has been collected from the official website of Department of Ministry of Commerce and Industry, Government of India. To examine the nature of change, the growth in export of Palmarosa oil from 2000-01 to 2019-20, the annual compound growth rate is a comparatively simple metric; it is the mean annual growth rate of export over a specific period. The exponential regression model, coefficient of variance, and Cuddy-Della Vela instability index, quantum change of the following form were used.

Estimation of growth rates

Annual Growth Rate Analysis

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

$$AGR = [(EV/BV) - 1] * 100$$

Where:

AGR = Annual Growth Rate

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

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

*100 = Percent growth rate

Compound Growth Rate Analysis

The compound growth rate has been 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 were used. The exponential trend equation of the following form has been used.

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

Where,

Y_t = export (time series data) of Palmarosa 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 been converted into the logarithmic form to facilitate the use of linear regression by taking the natural logarithms of both sides, we obtain;

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

β_0 and β_i are obtained by application of Ordinary Least Square (OLS) techniques. Equation (2) was estimated by using the OLS techniques. Then percent compound growth a rate (*r*) has computed as follows:

$$r = (e \beta_i - 1) \times 100$$

$$\text{or } r = (\text{Antilog of } \beta_i - 1) \times 100 \qquad \ldots(3)$$

Where,

r = compound growth rate in percent,

β_i = estimated coefficient

e = Euler's exponential constant (2.71828)

Instability analysis: Coefficient of variation

To measure the index of instability and Cuddy-Della Vale index or the coefficient of variation in the export (quantity and value) for the Palmarosa oil. If the less consistent of export of oil i.e., it has a higher coefficient of variation among the Palmarosa oil export, coefficient of variation is the ratio of

standard deviation to the arithmetic means, which is presented in percentages was calculated as the following formula:

$$C.V. = \frac{\sigma}{\mu} \times 100$$

Here,

Standard Deviation of X has been calculated by using the formula:

$$\sigma = \sqrt{\frac{1}{N} \Sigma (X_i - \underline{X})^2}$$

Where:

$C.V.$ = Coefficient of variation

Σ = Standard Deviation of X

μ = Mean of X

X = individual observation in time series data,

$\underline{X}$ = arithmetic mean of X.

$(X–\underline{X})$ = deviation from the mean,

N = number of observations.

The level of instability is also computed around the trend i.e., coefficient of variation is 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 used by Devi *et al.* (2021).

$$Instability\ index = \frac{\sigma}{\underline{X}} \times 100 = \sqrt{(1 - R^2)}$$

or

Cuddy-Dell Valle Instability index (%) $= C.V. \times \sqrt{1 - R^2}$

Where,

$C.V.$ = Coefficient of Variation in percent,

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

Quantum Change

The quantum change has carried out the change of trend in export of Palmarosa oil from current year to based year. The quantum changes have been used in the following form:

Quantum change = Current year – Based year

RESULTS AND DISCUSSION

Per se performance of Palmarosa oil export

The *per se* performance of Palmarosa oil export has presented in Table 1. The quantity of oil exported under Palmarosa in India has increased from 0.00 in 2000-01 to 54.77 thousand kilograms in 2019-20, while the value has increased from ₹ 0.00 to ₹ 1408.07 lakh in the same year. The average quantity of Palmarosa oil exported during the period was 33.06 thousand kilograms, whereas, in value, it was ₹ 648.88 lakhs and the Platykurtic nature followed by negative skewness (-0.610) in quantity and kurtosis (-0.86) indicate that there has been a steady change in the quantity and value of Palmarosa oil export taken place during the later phase. In contrast, leptokurtic in nature in quantity and value having positive kurtosis (0.31) and skewness (0.76) reveals that, starting from the initial years of the period under the investigation, a continuous effort was there to increase the value exported of Palmarosa oil. Thus, the combined effect of expansion quantity and value has resulted in a brighter picture of Palmarosa oil export in India.

Table 1: *Per se* performance of Palmarosa oil exports during 2000-20

Descriptive Analysis	Quantity (000' Kg.)	Value (in ₹ Lakh)
Mean	33.06	648.880
Standard Error	4.24	128.11
Standard Deviation	18.97	572.93
Kurtosis	-0.86	0.31
Skewness	-0.61	0.76
Range	57.17	2089.38
Minimum	0.00	0.00
Maximum	57.17	2089.38

Annual, compound growth rates and instability of export of Palmarosa oil

Annual growth rates of export of Palmarosa oil

Table 2 revealed that the export of Palmarosa oil in India had been estimated at 661.29 thousand kg. with a value of ₹ 12977.61 lakh in the last twenty

years, i.e., from 2000-01 to 2019-20. The quantity exported of Palmarosa oil has been highest (57.17 thousand kg) in 2008-09, whereas the value was highest (₹ 2089.38 lakh) in 2018-19 due to the higher price of the palmarosa oil compared to 2008-09. It is also revealed that the maximum and positive to negative annual growth rate of the export of Palmarosa oil. The highest percentage increase in annual growth rate has been observed 3006.90 percent in quantity and 2391.08 percent increase in value during the year 2003-04.

Compound growth rates of export of Palmarosa oil

The compound growth rate of quantity exported has been estimated as 22.33 percent, found satisfactory and statistically significant at 1.00 percent level of probability. In comparison, the compound growth rate in terms of value of Palmarosa oil exported has been recorded as 39.17 percent statistically significant at 1.00 ($p<0.01$).

Instability of export of Palmarosa oil

The data also revealed that between 2000-01 to 2019-2020, India exported both quantity and value of Palmarosa oil. The calculated mean, standard deviation, and instability index or coefficient of variation are presented in table 2. According to data coefficient of variation of both quantity and value exported has been recorded as 55.92 percent and 86.06 percent, respectively.

It is concluded from the table 2 that Palmarosa oil export from India seems stable in the last decade except for some depletion in quantity and value in one or two years; this is due to the increase in internal consumption or price fluctuations in oil price.

Table 2: Annual, compound growth rates and instability of export of Palmarosa oil during 2000-01 to 2019-20

Sl. No.	Year	Quantity (000' Kg.)	AGR's	Value (in ₹ Lakh)	AGR's
1	2000-01	0.00	0.00	0.00	0.00
2	2001-02	0.18	0.00	1.34	0.00
3	2002-03	0.58	222.22	4.37	226.12
4	2003-04	18.02	3006.90	108.86	2391.08
5	2004-05	12.51	-30.58	67.78	-37.74
6	2005-06	20.58	64.51	118.95	75.49
7	2006-07	21.12	2.62	183.52	54.28
8	2007-08	40.94	93.84	332.37	81.11
9	2008-09	57.17	39.64	539.72	62.39
10	2009-10	43.96	-23.11	459.58	-14.85
11	2010-11	37.06	-15.70	643.23	39.96
12	2011-12	47.41	27.93	1135.13	76.47
13	2012-13	46.44	-2.05	1085.46	-4.38
14	2013-14	52.05	12.08	1104.8	1.78
15	2014-15	33.34	-35.95	753.26	-31.82
16	2015-16	43.6	30.77	926.92	23.05
17	2016-17	37.61	-13.74	814.08	-12.17
18	2017-18	38.42	2.15	1200.79	47.50
19	2018-19	55.53	44.53	2089.38	74.00
20	2019-20	54.77	-1.37	1408.07	-32.61
CGR's (% p.a.)		22.33	—	39.17	—
Instability index (%)		55.92	—	86.06	—

Source: Department of Ministry of Commerce and Industry, Government of India.

Comparison of quantity and value of Palmarosa oil export in a different country from India

Table 3 presents the country-wise export of Palmarosa oil (quantity and value) for 2019-20. USA (36.26 percent) was the leading country in the quantity of Palmarosa oil imported from India 2019-20, followed by France (26.51 percent) and Spain (7.92 percent). These countries have contributed 70.69 percent share in total Palmarosa oil export from India during 2019-20. The Palmarosa oil export in terms of value was highest in USA (39.48 percent) followed by France has (26.58 percent) and Spain (6.50 percent). It is concluded that USA, France, and Spain are the major export destination of Palmarosa oil from India.

Quantum change in Palmarosa oil export during 2018-19 to 2019-20

Quantum change in quantity and value during 2019-20 over 2018-19 is presented in Table 3. The quantity exported increased more in Spain and Australia, estimated at 1.21 thousand and 0.23 thousand kilograms, respectively, while it fell more in the United States, estimated at (-)4.99 thousand kilograms. The rationale could be a shift to alternative aromatic crop oils with higher profit margins.

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Table 3: Comparison of quantity and value of Palmarosa oil export to different countries from India during 2019-20

Sl. No.	Country	Quantity (000' kg.)	% share	Value (in ₹ Lakh)	% share
1	USA	19.86	36.26	555.85	39.48
2	UK	2.24	4.09	23.89	1.70
3	France	14.52	26.51	374.32	26.58
4	Germany	0.89	1.62	19.98	1.42
5	Spain	4.34	7.92	91.49	6.50
6	Australia	0.88	1.61	27.52	1.95
7	Singapore	0.31	0.57	11.85	0.84
8	Netherland	0.36	0.66	8.91	0.63
9	Switzerland	0.38	0.69	13.19	0.94
10	Other	10.99	20.07	281.07	19.96
11	Total	54.77	100.00	1408.07	100.00

Source: Department of Ministry of Commerce and Industry, Government of India.

Table 4: Quantum change in quantity ('000 kg.) and value (in lakh) of Palmarosa oil during 2019-2020

Sl. No.	Country	2018-19		2019-20		Quantum change in	
		Quantity	Value	Quantity	Value	Quantity	Value
1	USA	24.85	938.44	19.86	555.85	-4.99	-382.59
2	UK	2.10	76.12	2.24	23.89	0.14	-52.23
3	France	17.22	650.26	14.52	374.32	-2.7	-275.94
4	Germany	2.91	107.55	0.89	19.98	-2.02	-87.57
5	Spain	3.13	111.75	4.34	91.49	1.21	-20.26
6	Australia	0.65	23.55	0.88	27.52	0.23	3.97
7	Singapore	0.53	21.40	0.31	11.85	-0.22	-9.55
8	Netherland	0.60	20.80	0.36	8.91	-0.24	-11.89
9	Switzerland	0.61	22.72	0.38	13.19	-0.23	-9.53
10	Other	2.93	116.78	10.99	281.07	8.06	164.29

Source: Department of Ministry of Commerce and Industry, Government of India.

Change in exported value of Palmarosa oil during 2019-20 over the previous year indicates that the majority of the country has increased exported value in Australia. The increase in Australia's exported quantity is due to more oil exports. It is also evident from the table 4 that, excluding the USA, UK, France, Germany, Spain, Singapore, the Netherland, and Switzerland rest of the country registered decreased export value in 2019-20 over the previous year due to the decrease in the price of Palmarosa oil.

CONCLUSION

The research revealed that the country's export of Palmarosa oil increased from 2000-01 to 2019-20 and significant growth in quantity. The growth rate and instability have been directly related to each other. It was found that export in quantity and value of Palmarosa oil compound growth rate observed as 22.33 percent and 39.17 percent, respectively. Instability analysis showed that both the quantity and value observed as 55.92 percent and 86.06 percent. It is found that more variations in growth followed by in value and quantity exported respectively. Though, Palmarosa oil export achieved more stable values followed by quantity. The top three countries, i.e., USA, France, and Spain, have recorded more shares in the export of Palmarosa oil (quantity & value) from India. The most significant quantum change in export quantity was observed in Spain, followed by Australia & UK, and the highest export value was recorded in Australia. Stability and increase in export of Palmarosa oil will open up a new avenue for crop diversification and Aroma entrepreneurship in the country.

ACKNOWLEDGMENTS

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