# Potential of Indian Menthol Mint Oil in Production and Export: a Growth and Instability Analysis

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#### ABSTRACT

The present study is an attempt to examine the growth potential and instability in the area, production, productivity and export of menthol mint oil. The time-series data for the period of 2000-01 to 2017-18 has been analysed by using growth and instability models. The study revealed that compound growth rates (CGRs) of area, production, productivity, quantity and exported value have been shown positive growth trend and statistically highly significant. The instability indices have been measured in terms of adjusted co-efficient of variation and accounted to be 28.74, 28.96, 2.14, 32.03 and 63.39 percent respectively. From the results, growth rates and instability have been simultaneously associated with each other. Although, the productivity of menthol mint marginally accelerated in spite to realize the more stability followed by area, production and export quantity and value. The export of menthol mint oil witnessed a remarkable positive growth trend with low future trading risk.

Keywords: Production, Export, Growth potential and instability, Employment, Livelihood

# INTRODUCTION

Menthol mint (Mentha arvensis) is a short duration aromatic crop and it is well fitted between most empirical Rice-Wheat cropping systems of Indo-Gangetic plains. Due to this, farmers get additional income from deployed the same piece of land (Singh et al., 2019). India is the largest producer and prominent exporter of menthol mint oil in the world. In the last few years, India has emerged as an export hub for mentha oil and its derivatives. It has contributed around 80 percent to the total global menthol mint oil production and the contribution had been varied between 14.50Mt to 29.50Mt. Apart from India, China, Brazil and the United States are significantly contributed to the global menthol mint production [1-5].

In India, Uttar Pradesh alone accounts for 80-85% of Indian mint production and remaining 15-20% comes from Punjab, Bihar, M.P., Haryana, Himachal Pradesh etc. On commercial and large scale basis the menthol mint has been cultivated in Barabanki, Sambhal, Chandausi Ambedkar Nagar, Sitapur, Pratapgarh, Bareilly, Muradabad, Rampur and Lakhimpur districts of Uttar Pradesh. Recently the crop has been extended to the some other districts of U.P. viz., Rai Bareli, Lucknow and Hardoi districts (DoH, GoUP). In the global market of menthol mint oil, India is dominated with a floating range between 4.19Mt- 25.75Mt (38.05- 90.59%) annually of its stock to various countries. The major export destination of menthol mint oil from India includes countries like China, USA, Singapore, Germany, Japan, the Netherlands, UK, Paraguay, Hongkong, Argentina, Brazil and France etc. With increase in production and export of menthol mint oil, consumption demand of menthol mint oil is also rapidly increased in the international market. It creates billions of employment opportunity through its cultivation, value addition and marketing. Considering all these facts, the present study was focused to analyze the growth potential and instability of Indian menthol mint oil.

# MATERIALS AND METHODS

The study is merely based on time series data on multiple variables like area, production, productivity and export both in terms of physical and monitory value. The secondary data have been used and obtained from various publications issued by CSIR-Central Institute of Medicinal and Aromatic Plants, Directorate General of Commercial Intelligence and Statistics (DGCI&S) and Spices Board of India. The study had been

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focused for a period of last 18 years that is from 2000- 01 to 2017-18. In order to examine the trend of area, production and export behavior of menthol mint oil, both growth and instability indices had been estimated. To determine annual and compound growth both linear and exponential trend growth model and to access the instability in the area, production, productivity and export quantity and volume, the coefficients of variance technique and Cuddy-Della Vella index have been used.

# ESTIMATION OF GROWTH RATES

#### Annual Growth Rate Analysis

The annual trend or performance of production, consumption and export (quantity and value) was determined by using the equation as fallow.

# AGR= [(SV/ PV)-1]\*100

Where:

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

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

#### Compound Annual Growth Rate Analysis

The compound growth rate has been carried out to determine the growth trend in the area, production, productivity and export (quantity and value) by using an exponential form of equation and in modeling time trend. The exponential trend equation of following form has been used.

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

Where:

 $\underline{\chi} t$  = area, production, productivity and export both in terms of quantity and value in the year  $t_{\rm c}$ 

- $\beta o = intercept of the trend equation,$
- $\beta_{ij}$  = trend coefficient or (' $\beta_0$ ' and ' $\beta_{ij}$ ' are the parameter to be estimated)

ut = disturbance term/stochastic term in the year t

#### r= (eβi -1) ×100 or CAGR = (Anti log (βi)-1 ×100......(3)

Where:

r	=	compound	growth	rate	in	percent	per	annum,

- $\beta I =$  estimated coefficient from equation -2,
- E = euler's exponential constant (=2.71828).

#### Instability analysis

For analysis of instability in area, production, productivity and export (volume and value) of menthol mint oil. The coefficients of variation techniques and instability index or Cuddy-Della Vella index have been used in the following form:

$$Coefficient of Variation(C.V.) = \frac{Standard Deviation (\sigma) of X}{Mean (\mu) of X} \times 100$$

Here,

Standard Deviation of X has been calculated by using the formula

Standard Deviation(
$$\sigma$$
) of  $X \sqrt{\frac{1}{N}} \sum (X - \overline{X})^2$ 

Where:

- Xi = individual observation in time series data,
- $\overline{X}$  = arithmetic mean of X.

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

N = number of observation.

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 (r2) in cases where r2 was significant to obtain the instability index. The following formula was suggested by J.D.A. Cuddy and P.A. Della Valle in (1978) is called the Cuddy-Della Vella index [6-8].

Instability index = 
$$\frac{\sigma}{\overline{X}} \times 100 = \sqrt{(1 - r^2)}$$
  
Or  
Cuddy – Dell Valle Instability index (%) = C.V ×  $\sqrt{1 - R^2}$ 

Where,

C.V = Coefficient of Variation in per cent,

R2 = Coefficient of determination from a time trend regression adjusted for its degrees of freedom.

# **RESULTS AND DISCUSSION**

#### Annual and compound growth pattern in Area, Production and productivity

The growth rates and instability in area, production, productivity and export of menthol mint oil in India during 2000-01 to 2017-18 have been presented in table 1. It has revealed that the average area under menthol mint production in India for the last eighteen years i.e. from 2000-01 to 2017-18 is about 215.83 thousand hectares. It had also revealed that the maximum positive annual growth rate of the area has been found in the couple years of 2009-11. The reason behind it is that, during 2008 huge quantity of crop failed due untimely heavy rainfall resulting in the increase in price of menthol mint oil and majority of farmers extended their acreage under the menthol mint cultivation. The area of menthol mint has positively increased at a rate of 25.00 percent with highly statistically significant at 1.00% (<0.01) probability level. While

the highest negative annual growth rate of the area was observed (-) 13.85 percent in 2013-14, it is due to introduction of synthetic menthol mint oil in the market and price fall observed for naturally produced menthol mint oil resulting in the decrease the area of mint cultivation.

The result concludes that the price of menthol mint oil, availability of synthetic menthol mint oil in the market have inversely related to the farmers devoted their acreage under the menthol mint production. Table-1 indicates the annual and compound growth rates in the area, production and productivity of menthol mint oil in India. The average production of menthol mint oil in India for the last eighteen years i.e. from 2000-01 to 2017-18 is about 21.39 Mt. The highest production was recorded during the year 2017-18 is close to 29.50 Mt. The annual growth rate in the production of menthol mint oil has been found to be a huge decline during 2013-14 at the rate 13.00 percent due contraction of the area under menthol mint cultivation. The highest growth rate (25%) has observed during 2009-10 it may due to extend the demand of menthol mint oil in the major consumption sector. The compound growth rates of menthol mint oil production for the period of 2000-01 to 2017-18 were estimated and furnished in table1. The production of menthol mint oil has recorded a positive growth trend of 5.21 percent per annum with highly significant at 1.00 percent probability level. It implies that the production growth rate of menthol mint oil registering upward trend.

Over all, the country witnessed an increase in the productivity ranging between 93.33 to 100 kg ha-1 with corresponding fluctuation rates of (-) 3.23% to 7.14 percent. Next to area and production, the study estimated the annual and compound growth patterns in productivity and depicted in table 1, is evidently distinguished that the adoption and introduction of new production technology at farmer's field in order to increase production from deployed resources. The parallel expansion of area and production has come to a halt, vertical rise i.e. increasing productivity level it seemed to be an only reality to supplement production. The annual growth rates of productivity show a negative, positive and constant trend during the periods 2000-01 to 2017-18 at 1 %(P<0.01) probability level (Table1). Prior to the introduction and adoption of improved technology, marginally accelerate the yield in the country records as 0.20 percent compound growth.

**Table 1:** Annual, compound growth rates and instability of thearea, production and productivity of menthol mint during2000-01 to 2017-18.

Year	Area (In '000'ha. )	AGRs (%)	Product ion (In MT)	AGRs (%)	Product ivity (Kg.ha 1)	AGRs (%)
2000-01	155.00	0.00	14.50	0.00	093.55	0
2001-02	150.00	-3.23	14.00	-3.45	093.33	-0.23
2002-03	150.00	0.00	15.00	7.14	100.00	7.14

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2003-04	150.00	0.00	15.00	0.00	100.00	0.00
2004-05	160.00	6.67	16.00	6.67	100.00	0.00
2005-06	160.00	0.00	16.00	0.00	100.00	0.00
2006-07	170.00	6.25	17.00	6.25	100.00	0.00
2007-08	180.00	5.88	18.00	5.88	100.00	0.00
2008-09	160.00	-11.11	16.00	-11.11	100.00	0.00
2009-10	200.00	25.00	20.00	25.00	100.00	0.00
2010-11	250.00	25.00	25.00	25.00	100.00	0.00
2011-12	310.00	24.00	30.00	20.00	096.77	-3.23
2012-13	325.00	4.84	32.00	6.67	098.46	1.74
2013-14	280.00	-13.85	28.00	-12.50	100.00	1.56
2014-15	250.00	-10.71	25.00	-10.71	100.00	0.00
2015-16	260.00	4.00	26.00	4.00	100.00	0.00
2016-17	280.00	7.69	28.00	7.69	100.00	0.00
2017-18	295.00	5.36	29.50	5.36	100.00	0.00
CGRs (% p.a.)	5.00	-	5.21	-	0.20	-
Instabili ty index (%)	28.74	-	28.96	-	2.14	-

Growth pattern of menthol mint oil export (quantity and value) from India

Menthol mint oil is an export oriented commodity as a major share of production is exported from the country. India is one of the largest exporters of menthol mint products in the global market and exports range about 90-91% (DGCI&S, 2017). The export of menthol mint products includes menthol mint oils, crystals and powder. The mentha product is the single largest product group in the export basket of spices export from India. The compound growth rates of mentha exports both in quantity and value for the period of 2000-01 to 2017-18 had been estimated and delivered in Table 1. It shows that the quantity of menthol mint oil export in 2000-01 was 4.19 Mt and it reached the higher level of 21.50 Mt in 2017-18. The export quantity of menthol mint oil has been found to be the highest i.e., 25.75 Mt in 2014-15. The least negative annual growth of menthol mint oil export was found in 2003-04 and jump as highest 30.52 percent during 2005-06. While the compound growth rate of 7.04 percent has been recorded as satisfactory and statistically significant at 1.00 percent probability level. The highest positive annual growth rate of the value of menthol mint oil export has been found to be 212.78 per cent in 2001-02 and highest negative has been found in 2003-04 i.e. (-) 32.83%.The compound growth of exported value of menthol mint oil

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recorded as high (16.19%) per annum and statistically significant at 1.00% (P<0.01). The area, production and export trend of menthol mint have been illustrated in Fig.1.

It can be summarized that the menthol mint oil is an export oriented commodity as most of the production is being exported. Due to natural calamity during 2008-2009 the huge cropped area of menthol mint was damaged and sharply decreased the production of menthol mint. Resulting, the sharp slump situation in menthol mint oil export from India was seen. In recent years, the mint products export from India is increasing over the years, which includes menthol flakes, crystal, mint oil. This can be mainly attributed to the growing demand for natural products of menthol mint in the country.

# Instability in Area, Production, productivity and export

Tables 1 and 2 gives the actual data of production, area and productivity and export volume and value of menthol mint oil in India between 2000-2001 to 2017-18 period. The calculated data of arithmetic mean, standard deviation and instability index or coefficients of variation are presented in both the tables. According to the data, the coefficient of variation of the area under menthol mint cultivation is found to be 28.74 percent, the coefficient of variation of production is 28.96 percent and coefficient of variation of productivity or yield per hectare is obtained as 2.14, the coefficient of variation of quantity of menthol mint oil export is 32.03 percent and value of export are 63.39 percent respectively.

Table 2: Annual, compound growth rates and instability ofmenthol mint oil export (volume & value) during 2000-01 to2017-18.

Year	Export (In MT)	AGRs (%)	Export to Producti on Ratio	Value (Rs. Crore)	AGR (%)
2000-01	04.19	0.00	0.29	154.98	0.00
2001-02	11.30	169.89	0.81	484.74	212.78
2002-03	13.59	20.31	0.91	565.58	16.68
2003-04	10.11	-25.60	0.67	379.91	-32.83
2004-05	11.14	10.22	0.70	502.18	32.18
2005-06	14.54	30.52	0.91	813.20	61.93
2006-07	17.64	21.30	1.04	1100.95	35.38
2007-08	21.10	19.60	1.17	1280.50	16.31
2008-09	20.50	-02.84	1.28	1420.25	10.91
2009-10	19.00	-07.32	0.95	1189.72	-16.23
2010-11	17.45	-08.16	0.70	1696.79	42.62

#### 2011-12 21.35 22.35 15.45 0.71 1958.86 2012-13 23.20 08.67 0.73 11.11 2176.54 2013-14 24.50 05.60 0.88 3430.42 57.61 2014-15 25.75 05.10 1.03 2689.25 -21.61 2015-16 23.25 -09.71 0.89 2581.30 -04.01 2016-17 22.30 2527.50 -02.08 -04.09 0.80 2017-18 21.50 -03.59 0.73 3228.36 27.73 CGRs (% 7.04 16.19 p.a.) Instability 32.03 63.39 index (%)

Figure 1: Area, production and export quantity of menthol mint in India.



# CONCLUSION

Despite being in good growth and stability in area under menthol mint cultivation, the productivity is slightly rise by 0.20 per cent. Therefore, India needs to adopt advance production and processing technologies. The highest growth rate of export value of mint oil over doubled compared with quantity of mint oil export. It implies the good potential and higher profit. The lowest instability indices for productivity, area, production and export indicating the low risk factors have been involved in its cultivation and export [9,10].

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