An Economical comparison Study between the Mint Oil Produced by Japanese Mint and that Produced by Spearmint in India and Egypt

1Shabbara M. Hany, 2Hussein M.S., 1Karima A. Mohamed and Haitham Bayoumy Ali Hassan

1Department of Agricultural Economics, National Research Centre, 33 El-Buhouth St., (former El-Tahrir St.) Dokki, Giza, Egypt. Postal Code: 12622.
2Medicinal and Aromatic Plants Researches Department, National Research Centre, 33 El-Buhouth St., (former El-Tahrir St.) Dokki, Giza, Egypt. Postal Code: 12622.

ABSTRACT

There is an increase in international demand for peppermint oil for its many uses. It is used in the manufacture of perfumes, cosmetics, pharmaceuticals and some other industries. Japanese mint contributes by more than half of the world's production of mint oil, followed by piperita oil and spearmint oil. Japanese mint oil contains a high percentage (reach to 92% of its content) of menthol, which is widely used in the pharmaceutical and flavor industries. India is the world's largest exporter of this oil and Uttar Pradesh is the largest producer in India. In Egypt, mint located in the fifth place of the list of Egyptian exports. The spearmint and piperita mint are grown widely for domestic consumption and export but mint oil is produced on a lesser scale and there is no production for Menthol crystals in Egypt. The present study was conducted in Rampur district of Uttar Pradesh in India and in Minya governorate in Egypt, with the objective to estimate the economic efficiency of mint oil produced by distillation of the Japanese mint plant in Rampur in India and the oil produced by Spearmint in the study area of Minya in Egypt. This study was relied on both descriptive and quantitative analysis plus using some statistical methods to economic efficiency measurements. Data was collected on random basis through personal interviews, structured questioners and group discussions with farmers in the study area in Minya governorate in 2016-2017. While the derivative data and Indian data were collected from publications and other governmental agencies. The current study materials consist of spearmint oil in Minya in Egypt; and Japanese mint (M. arvensis var. piperascens) oil in India. Results show that the value of the net return from the production of spearmint mint oil per acre over average total cost of its production per acre in Egypt is less than that value produced by Japanese mint oil in India. The study recommended to interest in the development of Japanese mint cultivation with a large economic area, to extract Menthol oil from it and export it to the United States and European countries due to the increasing demand from those countries for it.

Keywords: Oil, Japanese mint, Spearmint, India, Egypt, economic efficiency.

Introduction

The international demand has been increased nowadays toward natural products especially Medicinal and Aromatic plants. These plants are receiving considerable attention all over the world because of their vast untapped economic potential, especially in the use of herbal medicines (Kumar et al., 2008).

Genus Mentha is one of an important medicinal and aromatic plants. It is a member of Lamiaceae family, including about 30 species and numerous hybrids. This genus has many high value essential oil (EO) crops widely used in perfumery, cosmetic and pharmaceutical industries. It is used in medicinal preparations (ointments, itch-relieving creams, cough syrups, cough lozenges, tablets), as a flavoring agent in toothpastes, mouthwashes, confectionery, candies, chewing gums, beverages and cigarettes, and in the perfume industry (for lotions, soap and cologne). In South-East Asia, mints are mainly used to flavor food and for medicinal purposes. So, commercial mint oil production is developing as well (Do Tat Loi, 1995).
Leaves, whole plants and the oil extracted from *M. arvensis* are all reported as having medicinal properties. They are used as a carminative, stomachic, antispasmodic, stimulant, sedative, sudorific, emmenagogue, astringent (externally) and refrigerant (externally) all over the world and used also as insect stings e.g. rubefacient. (Bruneton, 1995)

World production of *Mentha* oil is produced mainly from Japanese mint (*M. arvensis* var. *piperascens* Maliv. ex Holmes). It contributes more than 50% of *Mentha* oil production while the peppermint oil production represent about 25% of the world production while the spearmint oil represent about 12.5% only (Kumar et al., 2008).

Mint oil is obtained from the flowering tops of Japanese mint; leaves can contain over 5%, but at least 0.8% V/w of essential oil on a moisture-free basis according to the Chinese Pharmacopoeia. Japanese mint oil can contain as much as 92.5% menthol. Very slow cooling of the essential oil (e.g. from 35°C to 5°C at 2°C/day) induces part of the menthol to crystallize. Japanese mint popularly known as menthol mint is a source of natural menthol which is widely used in pharmaceutical and flavour industries. Kumar and Bhatt (1999) found mint oil effective as a bio insecticide against *Amritodus atkinsoni* and *Scirtothrips angiferae*.

In India, Uttar Pradesh is the largest *Mentha* producing state in the country contributing 80 to 90% of total production. *Mentha* oil prices have shown strength more than 20% in last two months (Kumar, 2017). Generally, *Mentha* cuttings are sown in the month of December and harvested during March-April. The end product i.e. *Mentha* oil is extracted from the mint leaves by processing and steam distillation. *Mentha* oil arrives in market in the month of June and July. Once *Mentha* is planted; it can be cut twice and even thrice in a crop season. It can be grown frequently, while spearmint mint can only be grown for three repeated years.

Consumption of natural menthol has increased significantly in India over a period of time. However, in other major consuming countries of Europe and USA, menthol consumption has remained almost stagnant. Strong industrial growth in India over last two decades and increasing consumption of tobacco products has pushed up the domestic consumption of menthol (Karvy 2011).

*Mentha* plays a very significant role in the agricultural economy of a few areas of India. The crop is economically significant not only for its contribution to the livelihood to the thousands of farmers but also for its highly diversified industrial uses. High value diversification in agriculture is seen as one of the means by which farmers can increase their income.

Although *Mentha* species are recorded to be cultivated by the ancient Egyptians, Egyptian flora includes few mint species such as *Mentha pulegium*, *M. microphylla*, and *M. longifolia* (Tackholm, 1974) and only two species are widely cultivated for local consumption and export viz. *M. spicata* L. (=*M. viridis*) known as spearmint, and *M. piperita* L. known as peppermint, Egypt never produce Menthol Crystals. So for the natural Oil production Crystals are imported mainly from China. and the pure Menthol crystals crystallized from (*Mentaarvensis*) are imported mainly from USA.

Mint is one of the most important herbs traditionally produced in Egypt for hundreds of years. The area cultivated with mint in 1999 exceeded 1100 feddan (4200 m²) and produced about 6000 tons of herb. Mint is located in the fifth place in the list of Egyptian exports of herbs and the quantities exported vary from year to year for the requirement in the exports of peppermint to be completely free of pesticide slates. The Egyptian mint has a good reputation in the Europe and USA, Germany, UK and Spain are the major markets.

Egypt Spearmint plants produce a commercially valuable essential oils, viz. spearmint oil. Its extracted from aerial parts of *Menthas picata* L.. Spearmint oil has antimicrobial property. This essential oil is used in toothpaste as a flavoring ingredient. In addition, spearmint oil is also used in chewing gum and medicines.

The specific objective of the study is to make a comparable economic study between the mint oil produced by distillation of the Japanese mint plant in Rampur, Uttar Pradesh state in India and the oil produced by Spearmint in the study area of Minya in Egypt with a statement of the economic efficiency of each of them.
Study area
To achieve the goal of the study, two areas were selected for study: Minya governorate in Egypt, for its distinguished production of Spearmint oil, and Rampur Uttar Pradesh in India for its distinguished production of Menthol oil. Minya governorate lies at 28°10´N- 30°7´E, 50-180 meters above sea level and most of its soil is heavy mud while Rampur Uttar pradesh, lies at 28°48´ N 79°05´ E, about 192-166 meter above sea level and most its soil is loamy to silty. The average annual Minya temperature is about 16.5°C, and the hottest month is July, with an average temperature of 28.3°C and the coldest month is January with an average temperature of 11.8°C (https://ar.climatr-data.org/location/478410/) while in Rampur the average temperatures are about 26.2°C, 31.7°C and 17.1°C respectively (https://www.accuweather.com › daily-weather-forecast).

Method and data sources:
This study was conducted during 2016-2017. The search was relied on both descriptive and quantitative analysis plus using some statistical methods to economic efficiency measurements. Data was collected on random basis through personal interviews, structured questioners and group discussions with farmers in the study area in Minya governorate in 2017. While the derivative data and Indian data were collected from publications and other governmental agencies. The current study materials consist of Spearmint oil in Minya in Egypt; and Japanese mint \((M. \text{ arvensis \ var. \ piperascens})\) oil in India.

Both primary and secondary data were used for the study. Secondary data used on Japanese mint in India were collected from published reports, journals, magazines, ICAR websites and other sources. Primary data with regard to cost and return and marketing aspects on Spearmint oil were collected through personal interview from growing farmers in Minya.

Results and Discussion:

Average productivity, costs, total and net revenue per acre of Spearmint oil in Minya government, Egypt:

The field study of Minya governorate in the Arab Republic of Egypt shows that:
- The acre of Spearmint produces about 68 kilos of oil per year and the price of a kilo of oil was about 420 pounds, thus: the total revenue of the production of Spearmint acres in Minya= 68 x 420 = 28560 Egyptian pounds
- The acre produces about 7 tons of Spearmint plant per year. Also, the cost of an acre of Spearmint amounted to about 4636 Egyptian pounds, where the cost of distilling and extracting oil from the country mint plant amounted to about 1545 pounds in addition to 3091 pounds, the cost of planting and producing acres of Spearmint. Thus, the average total production cost per acre of Spearmint oil = 1545 + 3091 = 4636 L.E.
- Net revenue = the value of total revenue from the production of Spearmint oil - the average cost per acre of its production = 28560 - 4636 = 23924 L.E.
- The cost of producing one kilo of Spearmint oil in Minya = Average production costs per acre ÷ Average production of an acre of Spearmint oil = 4636/68= 68.2 L.E.

Average productivity, costs, total and net revenue of an acre of Japanese mint oil in Rampur Province, India:

A study in Rampur Province (Harshika et al., 2017) mentioned that:
- A Japanese mint acre in Rampur Province in India, produces about 113.4 kilos of oil per acre (after conversion from hectares per acre). As the price of a kilo of Japanese oil is about 336.014 L.E. / kilo, so: total return per acre for the production of Japanese mint oil = 113.4 x 336.14 = 38104 L.E.
- The cost of distillation and oil extraction operations from the Japanese mint were about 2332 Egyptian pounds, in addition to 3178 L.E. as costs for the production of an acre of Japanese mint plant, thus:

- The average costs of total production of an acre of Japanese mint oil = 2332 + 3178 = 5510 L.E.

- Net revenue per acre of Japanese mint oil = the total revenue from the production of Japanese mint oil per acre - the average cost of its production = 38104 - 5510 = 32594 L.E./acre

- The cost of producing a kilo of Japanese mint oil in the Rampur region in India was:

Average production costs per acre of Japanese peppermint oil = average productivity per acre of Japanese peppermint oil = = 5510/ 113.4 = 48.6 L.E.

Table 1: Measures of economic efficiency for the production of mint oil produced by Spearmint in Egypt and Japanese mint in India

| State          | Minya¹ | Rampur² |
|----------------|--------|---------|
| Total return per acre in pounds | 28560  | 3814    |
| Net return per acre in pounds   | 23924  | 32594   |
| Average production costs per acre in pounds | 4636   | 5510    |
| Average productivity per acre (per kilo) | 68     | 113.4   |
| Agricultural Price (pound/kilo)  | 420    | 336.014 |
| Cost of a kilo of oil (in pounds) | 68.2   | 48.6    |
| the total return produced value (in pounds) per acre / the total return produced (in pounds) per acre | 6      | 7       |
| Average total cost per acre (in pounds) / value of net return per acre (pound) | 5      | 6       |

¹from a Questionnaire made in the study area in Minya province in Egypt in 2017
² Harshika et al. (2017).

The economic efficiency is an important tool for economic analysis that can judge the efficiency of the production unit in the use of available resources, so it was necessary to make some measures that were used to measure the economic efficiency of the mint oil produced by Spearmint in Egypt and Japanese mint in India:

1- Average productivity of the mint oil per acre, which is one of the most effective measure of the component of the land (about 68 Kg. spearmint oil /acre in Egypt) and (about 113.4 Kg. Japanese mint oil/acre in India)

2- Average of production costs per acre (4636L.G. for spearmint oil /acre in Egypt) and (5510 L.G. for Japanese mint/acre in India).

3- Total revenue and net revenue per acre (28560&23924L.G respectively for spearmint oil /acre in Egypt) and (38104& 32594 L.G. respectively for Japanese mint/acre in India).

4- Total revenue related to the average production costs per acre Where : The value of total revenue from the production of spearmint oil /acre in Egypt over the average of total costs used for this production = 28560/4636 = 6.16 And the value of total revenue from the production of Japanese mint oil /acre in India over The average of total costs used for this production = 38104/5510 = 6.9.

5- The value of the net revenue on the average costs of production per acer, which reflects the economic efficiency of the productive unit (acre). Where : The net revenue per acer of the production of spearmint oil in Egypt over the average total costs of its production = 23924/4636 = 5.16 And the net revenue per acer of the production of Japanese mint oil in India over the average total costs of its production = 32594/5510 = 5.9

6- Unit cost (kilo oil from Spearmint plant in Egypt) = 4636/ 68 = 68.2 L.E. while: unit cost (kilo oil from Japanese mint plant in India) = 5510/ 113.4 = 48.6 L.E.

7- Agricultural price (pound/kilo) of the production of Spearmint oil in Egypt = 420 L.E. while: Agricultural price of the production of Japanese mint oil in India = 336.014L.E. Thus, it is clear that the economic efficiency of the production unit (acre) of Japanese mint oil in India is relatively high in comparable with that of the production of Spearmint oil in
Egypt for a number of factors, the most important is: The average productivity of the Japanese mint oil production in India is high compared to the productivity of Spearmint oil production in Egypt (about 167%, from the spearmint oil production in Egypt).

Recommendations
- Interest in the development of Japanese mint cultivation, with a large economic area in Egypt, to extract Menthol oil and export it to the United States and European countries for the increasing demand from those countries to it.
- Focus on extracting menthol from Japanese mint and using it in industrial products such as medicins, perfumes, cosmetics, sweets, soap, food and toothpaste to make an added value to mint oil which can be exported abroad and/or stop importing the imported counterpart and provide difficult currency for Egypt.
- Make guidance leaflets carried out by the Ministry of Agriculture for agricultural studies in different provinces, in an attempt to convince the Egyptian farmer to plant Japanese mint in the provinces with climate ± near that of Rampur district in Uttar Pradesh, India and having black mud soil, which is the provinces of Minya, Beni-Suef and Fayoum.
- Make television programs about the Japanese mint during the periods of the event about the Egyptian agriculture. That, to show the extent of the high net return that can raise the standard of living of the Egyptian farmer as a result of his cultivation of Japanese mint.

References:
Bruneton, J., 1995. Pharmacognosy, phytochemistry, medicinal plants. Lavoisier Publishing, Paris, France. pp. 431-437.
Do Tat Loi, 1995. Medicinal plants and drugs of Vietnam. Science and Technics Publishing House, Hanoi., pp. 747-750.
Harshika C., P.S. Badal, V. Singh and R. Osti, 2017. Economics of Menthol Mint Cultivation in India: Shifting from Traditional Farming to Income Based Farming Indian Journal of Economics and Development Volume 13 -1: 769- 773
https://www.accuweather.com › daily-weather-forecast
https://ar.climatr-data.org/location/478410/
Karvy., 2011. Mentha oil seasonal report. Culled from www.karvycomtrade.com
Kumar J. M., 2017. Global demand lifts mentha oil prices. Outlook bullish.
Kumar P., MadanM.Dey and Nagesh K. Barik, 2008. Farm economics of Genetically Improved Carp Strainsin Major Asian Countries and Carp Seed Price Policy Model. Agricultural Economics Research Review, 21. pp395-406
Kumar., S., R.I., Bhatt, 1999. Field evaluation of plant leaf extracts, oil and neem products against mango hopper (Amritodusatikinsoni Lethierry) and thrips (Scirtothrips mangiferae Hood). Allelopathy 6(2) pp.271-276.
Land Survey Authority of Egypt, 1990. Topographic maps of scale 1: 50,000.
Tackholm, V., 1974. Students' Flora of Egypt. Cairo Universiy.
Visuttipitakul, S., E.J. Britten, and S. Chaimongkol, 1990. Comparative oil production of varieties of Japanese mint, spearmint and peppermint at low and medium elevations in the tropics. Thai Journal of Agricultural Science 23(3): 233-241.