

# Introduction

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Peppermint, which is obtained from *Mentha x piperita* L. got its name because it was originally described as having a pepper-like taste and was similar in appearance to spearmint. It was first found naturally occurring by Dr. Eales in the county of Hertfordshire (N. of London) and later by Mr. Dale in Essex (S.E. of London) in the 1690s (Raii, 1696). According to Dony (1969), it is understandable why peppermint was not discovered until the seventeenth century because it is a very rare plant that has been found only a few times on waste land in Hertfordshire. Because of its unique aroma and the fact that it contained an essential oil, peppermint was being grown commercially in the vicinity of Mitcham, Surrey county (S. of London) by 1750 (Landing 1969).

The actual date in which peppermint was introduced into the United States is unknown; however, by the 1790s commercial cultivation of peppermint and subsequent peppermint oil production had commenced in the vicinity of Lanesborough and Pitsfield (Massachusetts). Once a market for peppermint oil (albeit small) had been established, peppermint cultivation and oil production in western Massachusetts started to grow (Landing, 1969). Between the early 1800s and 1850s, peppermint cultivation and oil production gradually moved away from Massachusetts, initially into New York State and then to the Midwestern states of Ohio and Michigan (Landing, 1969). By the mid-1800s American peppermint oil had become big business where it had not only achieved national attention but an international market was beginning to take off primarily as the result of an American merchant entrepreneur Hiram G. Hotchkiss (New York State). A second player entered the peppermint oil business in the 1870s when Albert M. Todd and his brother Oliver H. Todd determined that the quality of peppermint oil could be enhanced if the crude distilled oil was rectified. Also, the Todd brothers were concerned that peppermint oil adulteration with a range of substances had become a common enough practice that industry-wide standards had to be developed as an international market for the oil was starting to grow. By 1875, Albert M. Todd bought out his brother and the A.M. Todd Co. was established (Landing, 1969).

Peppermint was successfully introduced into the mucklands (organic soils) of Michigan and Indiana which helped in the growth of the Michigan-based peppermint oil business. By the early 1900s peppermint cultivation and oil production had become a relatively big business with A.M. Todd monopolizing it. Because of the

better growing conditions such as more sunlight, warmer temperatures and longer seasons in the farwestern United States combined with the reduced incidence of *Verticillium* wilt, peppermint cultivation moved west to Oregon (1909) and then to Washington (1917) (Landing, 1969).

Since then, peppermint oil production in the United States has grown from 96.6 metric tonnes in 1927 to a high of 4,819 tonnes in 1997 (Lawrence 2000). Currently, the market for U.S. peppermint oil has stabilized to ca. 3,000 tonnes. It is readily understandable why the bulk of U.S. production takes place in the far western states. If we examine the average oil yield for the two decades 1970-1990, we see the following:

Midwest:	39.3 kg/ha
Madras valley (OR):	63.5 kg/ha
Idaho:	70.9 kg/ha
Willamette Valley (OR):	72.2 kg/ha
Yakima Valley (WA):	86.7 kg/ha

Peppermint oil (CAS No. 8006-90-4; EINECS No. 308-770-2) is produced in the United States and other parts of the world primarily by steam distillation, although in India much of the peppermint oil is produced by a process known as steam and water distillation (Lawrence 1995). Steam distillation is a process in which steam that is produced from a satellite steam generator (boiler) is passed through the plant material (chopped and partially dried peppermint plants in the U.S.). The oil is volatilized from the plant material, condensed along with the water and separated from the water in a so-called receiver by flotation. Because the steam is generated in a satellite boiler, the plant material does not come in contact with heat greater than 100°C.

At one time in the United States, the still into which the plant material was loaded was a fixed vessel which meant that the harvested plant material had to be transported to the still where it was loaded, a process which was time consuming.

The United States became the world leader in peppermint oil because of the mechanization of the whole process starting with the cutting (swathing) of the peppermint plants in the field after which the cut herbage is left in a windrow in situ for 12-72 hours to allow it to wilt. Reduction of the moisture content has the benefit of reducing the distillation time thereby reducing any oil component decomposition such as polymerization and/or hydrolysis that could take place if the plant material was distilled fresh.

In the U.S., the optimum time to harvest peppermint is at the onset of flowering which, although does not maximize the oil content, oil produced from plants harvested at that stage are known to possess a commercially higher quality oil. Once the partially dried plant material in the windrow has lost sufficient moisture it is picked up and chopped into pieces 0.6-1.9 cm using a silage chopper. The chopped herbage is then blown into a prefabricated trailer (tub) which is, in fact, the mobile

still vessel. These tubs which are of a variety of sizes and designs are fitted with a series of evenly distributed perforated sparge pipes that run lengthwise inside the bottom of the tub. They are connected to a steam inlet manifold mounted on the outside of the tub at the opposite end to the opening (a gasketed door at the top of one end of the tub) through which the chopped herbage is blown. As the silage chopper and tub are pulled through the field of windrows of wilted herbage, the tub fills up, and the chopped herbage packs down from the constant vibration.

Once the tub is filled, it is disconnected from the silage chopper and transported to the distillation site where the boiler, condensers and receiving cans are found. At this time in the field, another tub is connected to the silage chopper and the process of collection and chopping of the herbage is resumed. While this is in progress, the tub at the still site has the door through which the plant material was blown closed and sealed, a flexible pipe vapor tube connects the tub to the condenser at one end of the tub, and the steam line from the boiler is connected to the inlet manifold at the other end.

The condenser can either be a single tube or multi-tubular in a vertical or horizontal configuration. Once the steam has released the oil in vapor form, it along with the water vapor pass into the water cooled condenser and the condensed liquid mixture is separated in the receiving can because the oil, which is not water miscible, is lighter than water and therefore can be separated by flotation. According to Denny and Lawrence (2007), if the chopped herbage has been sufficiently dried, the optimum distillation ratio should be 25:1 v/v water to oil.

As the standard peppermint cultivar grown in the United States which is known as “Black Mitcham” was found to be susceptible to *Verticillium wilt* (*Verticillium dahliae*), in the mid-1960s, Murray commenced a mutation-breeding program which led to the development and introduction of two wilt-resistant cultivars: ‘Todd’s Mitcham’ and ‘Murray Mitcham’ (Murray, 1969; Murray and Todd, 1972). Even though ‘Black Mitcham’ is known to be more susceptible to wilt, it is still preferred by the growers because of its higher oil yield than the wilt-resistant cultivars.

Most of the peppermint grown around the world started as selections of what was originally known as “Mitcham.” However, there are now numerous peppermint cultivars available to be grown in different geographical regions. A summary of the known cultivars can be seen as follows:

- Bulgaria: ‘Bulgaro-Mitcham,’ ‘Tunja,’ ‘Sofia,’ ‘Zephir,’ ‘No. 101,’ and ‘Kliment 63’
- France: ‘Maine et Loire,’ ‘Hungarian,’ Auvergne and Milly-la-Fôret
- India: ‘Kukrail,’ ‘Tushar,’ ‘Pranjal’ and ‘CIM-Madhuras’
- Italy: ‘Italo-Mitcham’
- Japan: ‘Kasano’ and ‘JMM-3’
- Romania: ‘Columna’ and ‘Cordial’
- Serbia (and former Yugoslavia): ‘Feldioava,’ ‘Multimentha’ ‘Nana ZA,’ and ‘Tetraploid’

The development of peppermint cultivars in the former USSR did not necessarily follow the selection process; most of the cultivars were created by hybridization of *M. piperita* with other *Mentha* species such as *M. canadensis* L., *M. spicata* L., *M. longifolia* (L.) L. etc. As a result, a number of polyploidal cultivars were created and disseminated throughout the Soviet block countries. The main polyploidal cultivars created are as follows:

‘Prilukskaya-6,’ ‘Prilukskaya-6-3,’ ‘Prilukskaya-324,’ ‘Prilukskaya 541,’ ‘Krasrodarskaya-2,’ ‘Kubanskaya-6,’ ‘Kubanskaya 541,’ ‘Polyhybrida-7,’ ‘Lekarstvenaya-I,’ ‘Prilukchanka,’ ‘Chernigovska,’ ‘Simpferoloskaya,’ ‘Vniiek,” and ‘Reznikova.’ It should be noted that the two Kubanskaya cultivars are selections of two Prilukskaya cultivars.

It would be remiss if the subject of peppermint oil adulteration is not addressed, albeit briefly. Over the years, peppermint oil has been standardized with blends of oils originating from the same botanical source from various geographical origins. The most commonly encountered blends were those of N. American peppermint oil blended with the less expensive Indian oil. However, in addition to legitimately labeled oils, standardization often included the use of oils or fractions of oils from botanical sources other than *M. piperita*. The most common of these is the addition of dementholized cornmint oil (ex. *M. canadensis*), which is now a permitted flavor material in the United States (Smith et al. 2005), or fractions therefrom with N. American peppermint oil. Such an adulteration requires the use of a variety of analytical techniques such as component ratios, chiral analysis and even more sophisticated gas chromatography-isotope ratio mass spectrometry to determine the genuineness of a peppermint oil (Lawrence, 2007).

The purpose of this treatise on peppermint oil is to summarize the published data on commercial peppermint cultivation and oil composition. The text is divided into two sections. The first is a brief summary of the oil cultivation regions in the United States and the compositional data on U.S. peppermint oil since 1960 to date. The second section is devoted to a summary of the same type of information on peppermint oil production and compositional data of countries that are or were at one time producers of commercial qualities of oil. Finally, a list of peppermint oil suppliers from around the world can be seen in the Appendix of the introduction.

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