Menthol and Cornmint Oil from China

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The subject of menthol and cornmint oil from China and speculation about China's long-term plans to continue to supply these materials has gained some prominence in recent times because of the high prices prevailing in the market. This article looks at the current supply situation and draws some conclusions about the future availability of these products from China.

History

The cultivation of *Mentha arvensis* in China has a long history going back to the early 1800s. The cultivation area was small and occurred in Jiangsu province, where it was a secondary crop for the farmers who collected the leaves and made them into a non-prescription medicine.

The first large-scale commercial production of menthol/cornmint began in Shanghai in 1923. By the early 1980s, China was a significant exporter of these products. Today, mint cultivation is totally free from central control; farmers decide how much mint to plant. Buying mint from China on a forward basis is now difficult, if not impossible. (See **A Timeline on Menthol and Cornmint Oil from China** sidebar.)

Cultivation Areas

Cultivation of *Mentha arvensis* occurs in three provinces in China:

- Anhui (Taihe, Linguan and Bozhou)
- Jiangsu (Dongtai, Gaoyu and Haimen)
- Henan (Shangqiu and Yongchen)

The mint growing areas are within a three-to-five-hour drive from the major provincial cities of Hefei (Anhui), Nanjing (Jiangsu) and Zhengzhou (Henan).

Producing Crude Oil

Processing of mint to crude oil: In China, mint is planted in the winter months of December through February, depending on the weather, when the nights are long and cold and the days are dry. The farmer has basic tools and equipment. The fields are worked using farm animals and sometimes plows, but the roots usually are planted by hand.

The fields are irrigated weekly via irrigation channels throughout the growing period, which is 20–24 weeks. Phosphorous and urea fertilizers are used to improve the soil for crop growth.

As winter turns into spring and summer, the plant grows to about 24–30 inches high and is ripe for harvest. The most important factors for a good harvest are good roots, plenty of rain in the February–July period and very hot weather during the cutting time to bring out the oil in the leaves.

Harvesting begins at the end of July when the plant has flowered about 30-40%. A second cutting occurs at the end of October. The ratio of crude oil produced is approximately 65% and 35% for first and second cuttings, respectively. The percentage of oil in the leaves is greatest in the late morning and this is when the prudent farmer carries out most of the cutting. The crop then is left to dry in the fields for a day or so. This enhances distillation. A summary of the relevant factors concerning cultivation is given in Figure 1.

Mentha oil production process: Distillation of the *Mentha arvensis* usually is carried out by the farmers themselves using hydro-steam distillation units made of mild steel. A typical distillation unit consists of a tank, a condensation unit and a separator. Water is added in the

- Planting occurs: December - early February
- First cutting: end July 65-70%
- Second cutting: end October 30-35%
- Area under cultivation - 1996
  300,000 MU = 50,000 acres = 78 square miles
- Crude oil yield
  1985 - 15 kgs (33 lbs) per MU (2 cuts)
  1996 - 8-9 kgs (18.7 lbs) per MU (2 cuts)/55 kgs (120 lbs) per acre
- Crop is rotated each year
- 100 kg of mentha hay gives 1.5 kg of crude oil
- Estimate of crude oil product 1996 - 2,700 metric tons (MT)
- 100 MU = 6.7 hectares = 16.5 acres = 80,000 sq yards = 900 kgs crude oil

Figure 1. Relevant facts concerning *Mentha arvensis* cultivation

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A Timeline on Menthol and Cornmint Oil from China

1923	The first large-scale commercial production of menthol/cornmint started in Shanghai by the Yung Zeng Co. (Buddha brand). The *Mentha arvensis* plant was imported from Japan. With the help of Japanese technologists, Yung Zeng became the pioneer of the menthol refining industry in China.
1927	Xinhua Fragrance Factory started production (Polar Bear brand) in Shanghai.
1966	Nantong Menthol Factory was established but menthol production only started in 1971 (White Cat brand, Jiangsu province).
1978	A large increase in the cultivation area as the Chinese government made a drive to increase export earnings. China became a significant exporter in the early 1980s at the expense of Brazil.
1980–82	Processors started production at Huaguang (Huainan province), Changfeng and Fuyang (Anhui province).
1985	Chinese crude oil production peaked at approximately 15,000 metric tons (MT).
1988	Huai'an Menthol Factory started production (AE brand, Jiangsu province).
1990–91	Xinhua Fragrance Factory restructured and their equipment moved to a new site called Wangxing. Still produces Polar Bear brand.
1994	Shanghai Pu Fa Perfumery started production. A joint-venture factory between Shanghai Daily and Day Spring of Taiwan. China introduced a bid system for menthol exports; it caused confusion. There were contract defaults and the stranglehold of the traditional menthol exporters was broken.
1995–96	Mint cultivation is freed totally from central control. Farmers control how much mint to plant. Export corporations have credit lines markedly reduced. Buying from China on a forward basis becomes difficult if not impossible.

lower portion of the tank and the upper part is loaded with dry mentha hay. The two portions are separated by a metal partition that has holes in it. A heat source is provided to the lower portion by burning firewood or dried and spent mentha leaves. When the water starts boiling, the steam passes via the holes through the dried hay. The steam, which contains the oil, travels to the condensation unit that is submerged in cold water.

The steam condenses into a mixture of oil and water. Because the specific gravity of crude mentha oil is less than that of water, the oil floats on the water. The oil is removed from the upper outlet while water is drained from the lower. The spent mentha hay is taken out of the distillation unit after processing and then recycled as the heat source. The farmers store the crude mentha oil in 1, 5 and 10 kg drums.

Table I. The main processors of *Mentha arvensis* in China

Location	Year started	Processing capacity	1996 Actual throughput
Shanghai		**(MT)**	**(MT)**
Xin Hua	1923	2,400	1,500-1,800
Wanxing	1980		
Pu Fa	1994	700	300
Jiangsu			
Nantong	1971	2,000-3,000	500
Huai'an	1988	1,500	400-500
Anhui			
Huagong	1980	1,200	300
Changfeng	1980	800	300
Fuyang	1980s	800	200-300

Until recently, the Chinese farmers used to sell to the local cooperatives and state trading corporations because, as part of the centralized economy, they had no option. It is important to realize that today the farmers themselves control when they sell their crude oil and to whom. They can sell to any of the following entities:

- Small dealers. These dealers who visit the farmers to collect the crude in 100 kg lots and then sell it to the large dealers.
- Large dealers. These are private companies that have collection stations. The farmers take their crude oil to these stations.
- Cooperatives. These are state-owned and function like the larger dealers.

Processing

There are seven main processors of crude oil in China, whose methods of operation vary depending on ownership. Table I shows that, in 1996, all seven processors were running at well below their capacity, due to a lack of crude oil available from the 1996 crop. This had a direct bearing on their production costs.

An outline of one of the production methods used in China is given in Figure 2. The processors take in the mentha crude oil with 76-80% menthol content as the starting raw material. It is bulked, and quality control tests are done at this stage (chemical analysis, congealing point and GLC analysis). The crude then is heated to 50°C, filtered, dewatered and deep-frozen down to –5°C to –10°C. Menthol powder precipitates out from the Dementholized Cornmint Oil (DMO), which is then frozen a second time, down to –40°C, and precipitates out more menthol powder. The cornmint subsequently is distilled to give a DMO with 50% total menthol content. The menthol powder, after tests for optical rotation and solidification point, is added to the crude oil to give a free menthol content of 84–92%.

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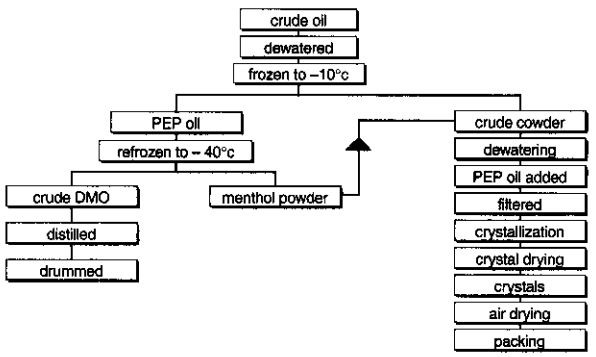

Figure 2. Processing of crude mentha oil

This crude oil then is filtered, seeded and crystallized in tanks for a period of 15 days with a gradual lowering of the temperature from 40°C to 10°C (approximately 2°C per day). The crystals are then dried for approximately two days and, in the process, reheated from 10°C to 40°C. The powder and crystal roots are removed by mechanical and centrifugal action, then dried at room temperature in a closed room. Quality control tests (melting point, color/oil content and crystal shape) are done to ensure the menthol meets brand specification. The menthol is then packed.

It should be mentioned at this point that there is a difference between menthol crystals processed from Indian crude oil and those processed from Chinese crude oil—mainly in taste and odor. This difference exists even when Indian crude oil is processed with Chinese equipment. The Chinese oils possess superior crystallizing ability. Menthol crystals made from Indian crude look like Chinese menthol crystals in color and size, but their taste and odor still are different.

It can be concluded that the main quality difference between Chinese and Indian menthols relates to the quality of their respective crude oils, although the Chinese menthols still appear to have a superior crystallizing ability, as well. How critical are these differences? That has to be judged by application. Many consumers, in growing numbers, are willing to use Indian menthol. Others, especially those in the tobacco industry, do not yet wish to make this change.

Concerning dementholized cornmint oil, the main difference between Indian and Chinese product with l-menthol 37% is one of taste and odor and the percentages of isomenthone and menthone present. Indian DMO has 21-22% menthone and 11-11.5% isomenthone. Chinese DMO has 25% menthone and 7-8% isomenthone.

World Trade

The main difficulty in an analysis of production and export statistics is that there are no reliable statistics for production (as there are for mint from the U.S.). Figures have been gathered by talking with a wide range of people in China and India, from cooperatives and processors to state trading corporations. Another resource for the Chinese figures is a book published annually by Chinese Foreign Economic Relations and Trade. The statistics are shown in Tables II–IX, from which a number of observations can be made.

Table II. Crude mentha oil production (MT) in China and India (1984–1996)

Year	China	India
1984	5,150	500
1985	15,000	500
1986	7,500	850
1987	5,000	1,250
1988	4,000	2,500
1989	7,500	3,000
1990	6,000	4,000
1991	8,000	4,500
1992	4,000	5,000
1993	5,000	5,000
1994	4,500	5,000
1995	4,000	6,000
1996	2,800	8,000

Table III. Menthol exports (MT) from China and India (1984–1996)

Year	China	India
1984	2,250	100
1985	1,700	150
1986	2,450	200
1987	2,950	200
1988	2,750	475
1989	2,700	500
1990	1,800	600
1991	2,425	725
1992	2,100	775
1993	3,425	975
1994	3,425	1,200
1995	2,325	1,600
1996	2,500	1,975

Table IV. World menthol market in 1996

Country	MT
USA	2,000
Europe	2,000
Japan	700
S.E. Asia	1,200
India	2,000
China	1,000
S. America	500
East Europe	300
	9,700
Minus synthetic	(3,000)
Natural	6,700

Requires 12,000 MT crude oil

India's production of crude oil is growing steadily (Table II) and India has now surpassed China as the world's major supplier. The very low crop of crude oil in China in 1996 (2,800 MT) did lead to steeply rising prices in the fourth quarter of 1996 (Table VI), but the market under-estimated the production of crude in India. That brought

Table V. Market demand (MT) and production (MT) for natural menthol (1991–1996)

Year	Production	Market
1991	6,800	5,000
1992	4,950	5,050
1993	5,500	5,150
1994	5,200	5,300
1995	5,500	5,950
1996	5,700	6,700

Market growth: 5% per year

Table VI. Market price ($/kg) for menthol in China and India (1991–1997)

Year	China	India
1991 - Ist half	18	16
- 2nd half	16	12
1992 - 1	16	12
- 2	16	10
1993 - 1	10	9
- 2	10	9
1994 - 1	10	9
- 2	10	9
1995 - 1	22	20
- 2	16	14
1996 - 1	21	20
- 2	27	25
1997 - 1	79	65
- 2	45	25

Table VII. Cornmint oil exports (MT) from China and India (1984–1996)

Year	China	India
1984	1,600	0
1985	1,050	0
1986	1,300	0
1987	1,500	50
1988	1,500	125
1989	1,600	150
1990	1,100	150
1991	1,650	200
1992	850	200
1993	2,200	300
1994	2,650	300
1995	1,550	950
1996	1,750	750

Table VIII. World cornmint oil market in 1996

Country	MT
USA	350
Europe	1,750
Japan	100
S.E. Asia	300
India	300
China	300
S. America	900
Total	4,000

Table IX. Crude mentha oil exports (MT) from China and India (1984–1996)

Year	China	India
1984	875	0
1985	900	0
1986	1,150	0
1987	1,000	100
1988	650	300
1989	525	500
1990	375	600
1991	275	1,000
1992	200	1,100
1993	400	900
1994	575	600
1995	300	800
1996	300	1,800

prices back down to earth during the second quarter of 1997.

The apparent anomaly in 1996 between China's production of 2,800 metric tons (MT) of crude and their exports of 2,500 MT of menthol (Table III) can be explained by the fact that stock carryover from the previous crop made up the 1996 shortfall of menthol production. However, this apparently large export of menthol compared with crude oil crop size has seriously depleted China's stock of menthol in 1997. That is the reason why China has been unwilling to reduce price this year in the face of India's aggressive pricing.

Changes in the Domestic Supply Chain

Centralized planned economy: When China started to export menthol in significant quantities at the end of the 1970s and throughout the 1980s, the trade export system was centralized in Beijing. Sales of menthol and cornmint were made by Beijing Native H.O. on a forward contract basis. Up to two years forward was not unusual.

How was Beijing able to do this? The answer lies in the fact that a planned economy existed in China at that time. Beijing decided how much menthol and cornmint it wanted to export each year after investigating the market conditions.

Beijing advised their provincial trading branches in the producing areas how much crude oil they needed in order to meet their targets on menthol and cornmint sales. The provincial branches then advised the cooperatives in the mint producing areas what quantities of crude oil they would purchase in the next year. The local counties in these producing areas then decided how much mint acreage needed to be cultivated to make the quantities of crude oil required. The farmers then were given instructions as to how much mint needed to be planted and, finally, they produced the required amount of crude mint oil.

The State Trading Corporations (STCs) were then allocated money from Beijing to buy the crude oil from the cooperatives. The STCs borrowed money from their local banks to buy the entire crop from the cooperatives in the growing areas. There was no financing pressure on the STCs to repay this loan.

The STCs then got the crude oil processed in the processing factories (outlined earlier) and stored the menthol and cornmint in warehouses in the Shanghai area. Thus, a few months after harvesting, the entire crude oil crop moved into the hands of the trading corporations as crude and was processed against orders. Beijing then signed forward contracts with foreign buyers, usually on a long-term forward basis. These sales contracts were then allocated by Beijing to the STCs for execution and shipment.

In trading terms, it was as if there was only one P&L trading book that was being controlled from Beijing, even though the STCs in the provinces executed the contracts.

Free market economy: The centralized economy gradually has changed since 1989, and the position today is much different. Currently the farmers themselves decide how much acreage they wish to plant. This depends on what they can get for other crops such as wheat, rice, cotton, soya bean, corn, sweet potato or rape seed.

Meanwhile, Beijing's influence has declined markedly, and the trading corporations in Jiangsu, Anhui, Shanghai, Jiangxi and Henan have had their credit lines significantly reduced. Thus they no longer can buy the large quantities of crude oil from the new crop as they used to do.

In the last few years, the chain has developed a new link; that is, the private trading company or "middlemen" as they are sometimes called. The middlemen, some of whom have become very rich in recent years as a result of speculation, can now purchase crude oil direct from the farmers and get it processed themselves into menthol/cornmint for sale either to the domestic market or STCs.

Thus the traditional STCs have lost their power to offer forward because they are unable to finance large pre-purchases of crude oil. They operate more on a back-to-back basis. They buy a little, sell a little. If they do offer forward on a short basis and the market moves up, they are unable to take the losses. The result is contractual default. This happened on a widespread basis during 1994–1995 and caused problems for foreign buyers.

Having learned their lesson from the changing situation in China, the STCs no longer offer forward to any great extent. However, our customers in Europe and the USA still expect us to do so, because this is what has always been done, without realizing the big changes in the domestic supply chain in China. The only way this is possible is if companies like ourselves buy on a spot or one-month forward basis from China then sell forward building in a finance cost. This means holding large stock levels in Europe and the USA and requires large amounts of cash. Not everyone is willing or able to meet these requirements.

Future Supply from China

The following points seem clear about the future supply of menthol and cornmint oil from China:

1. China will continue to produce crude mentha oil and its derivatives in the short term.
2. Within five years, 3,000 tons of crude mentha oil will be needed to satisfy domestic demand in China.
3. The prices for alternative cash crops and the level of government subsidies to farmers will have a great bearing on the acreage of mint planted in China.
4. If India adopts an aggressive pricing policy, it is quite possible that Chinese exports will be reduced in the coming years. The growing domestic demand will absorb the quantities available.
5. It is possible that China may withdraw from the export market in five to ten years if the domestic market experiences strong growth.
6. The world will not wish to depend on India as its only source if recent years' experiences are anything to go by. China will continue to get orders from consumers who prefer the still-superior quality and those who wish to dual-source in order to be prudent.

I close with a few other factors to consider. Apart from China and India, where will new supply come from? Will we find ways to increase our capacity for producing synthetic menthol? Will we invent new processes to manufacture menthol? Where—perhaps in Vietnam or North Korea—will we find new sources of natural menthol?

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