Natural Product Supply Bulletin: Patchouli, Mexican Lime and the Crimean Conflict

An in-depth look at recent ingredient sourcing challenges and their outlooks.

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In the first of a series of occasional columns, Howarth et al. provide a review of key issues affecting the global supply of natural flavor and fragrance ingredients. –Editor in Chief

Market Spotlight

It is to be expected that when dealing with natural products in a global market there will be many factors influencing raw material availability, qualities and, of course, prices. Each year the industry is faced with a new set of challenges, and no matter how well one plans, no one can say with any certainty what those challenges will be next year. This never-ending cycle keeps everyone on their toes and makes the industry both challenging and interesting at the same time. The only weapon that suppliers and buyers have to fight this challenge is remaining knowledgeable and staying open-minded about the conditions that can affect both supply and demand.

Herein, the authors have created a few highlights on some of the products, markets, and economic and political issues influencing the supplies of some key raw materials. The authors have provided three examples of how the dynamics of a market can change quickly, and explore either why it happened during the past year or has happened once again in what can be considered a typical cycle of events.

Indonesia: Patchouli Oil (*Pogostemon cablin*)

Why is the patchouli market symbolic of the unusual cyclical trends in pricing facing the industry? It appears that there's never a dull moment when it comes to this product. As a key raw material in the perfumery world it is one product where every buyer needs to take extra care when planning and fixing prices for future formulation costs. Exploring some of the dynamics surrounding the supply of patchouli may uncover some details that will help explain these frequent movements in price, quality and availability.

Indonesia is the world's largest producer of patchouli, accounting for more than 80% of the global market. Patchouli is a perennial species that thrives in warm tropical climates. Current annual production volumes are around 1,000–1,200 mt, with market demand calculated to be about the same. Historically, Java and Sumatra have been thought of as the key growing regions for this oil, but today this is no longer the case and is in fact one of the contributing factors to current availability and quality issues.

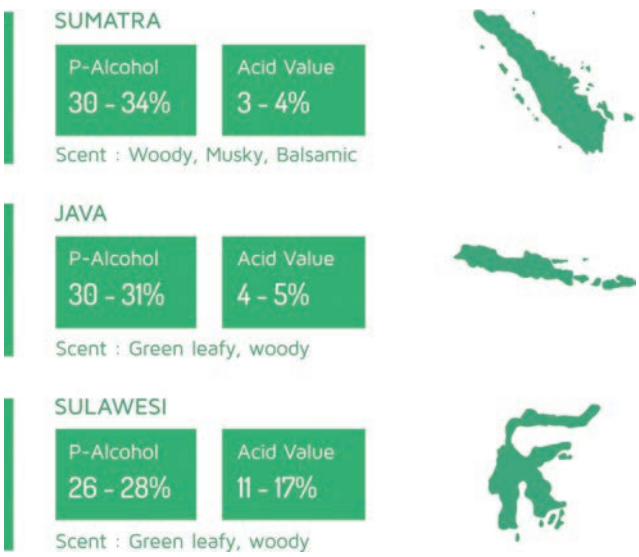
Not so many years ago, Java and Sumatra would have contributed around 90% of the raw materials used to make each kilo of patchouli oil. Today, the two regions represent only 20%, with Sulawesi now being the primary growing region. This evolution has happened in a relatively short period of time. At the turn of the millennium, 100% of patchouli leaves would have come from Sumatra in the west of Indonesia (**F-1**). By 2005, however, Sumatra was only responsible for 20% of all harvests, with Java now accounting for 80%. Again, this pattern lasted around five years. Since 2010, the balance has shifted to Sulawesi, with almost no raw materials coming from Java.

F-1. The three key patchouli growing areas in Indonesia; courtesy PT Van Aroma

There is a good reason for this evolution, one that will recur over time. Patchouli crops cannot be grown on the same patch of land for long periods as certain components and nutrients in the soil, which the plant needs, are depleted over time. Over a five-year period, what was once a good growing area will become a bad one, so plantations need to be moved to different areas, often to different islands. Over the past 15 years, Java and Sumatra have delivered good quality materials that yielded oils with low acid and high patchouli alcohol (PA) content. Unfortunately, this time the ecological shift has left the market with the major producing island (Sulawesi) providing below-typical-standard oil due to high acid values and low PA levels. This is why the industry is experiencing quality issues today.

Do you have a question or concern about other natural products that you would like to see discussed in future articles? Send all queries to the Editor in Chief at jallured@allured.com.

F-2. Differences in patchouli alcohol and acid values from each patchouli growing region over the past 15 years



The simple chart in **F-2** illustrates the wide differences in PA and acid values from each growing region over the past 15 years.

Sulawesi plantations have been established in flatlands close to the sea, where the soil is naturally more acidic, but patchouli best grows on hill slopes at around 400–600 m above sea level. This improves the chances of good rainfall, which patchouli requires. The pressure on Sulawesi, given the market demands, has meant that farmers have resorted to harvesting younger plants, which typically mean lower PA and higher acid values. Over the past year, more plantations have been created to try and provide a better platform for growing patchouli in Sulawesi. It is hoped that these can be allowed to mature longer to improve the overall qualities from this region. That said, whilst the market continues to consume these inferior qualities, there is little encouragement for farmers to stop harvesting under the same conditions. It's hard to see the winner here—nature or the market, as it seems to be neither. The lack of forward-thinking by growers, along with the nature of market demands, have created today's problems, from which it will be hard to recover, certainly in the short term.

So, what constitutes a good soil? For patchouli, the pH needs to range from 5.5 to 7.5. The plants require a deep, well-drained, fertile, loamy soil, rich in humus and nutrients.

It is possible that in time the soil will replenish the nutrients needed to reestablish plantations in the same area, but attempts after five years were unsuccessful. There is no research to establish when past growing areas can return to patchouli production, but it seems that anything less than 10 years simply will not work.

There are differences in the odor profile of patchouli oil from different islands. Odor is always subjective and a constant battle between buyers and their internal QC teams, but an understanding of how nature can change may help convince perfumers and evaluators that sometimes internal standards also need to be updated.

If a company set its internal specifications before 2005, it may be finding it hard to meet the odor characteristics with today's fresh batches of patchouli oil. The first rule when it comes to odor is that patchouli gets better with age. This is key, because as the product matures the odor gets more round and loses some of those harsher green notes. One can achieve this through a simple process of aerating to start the oxidation process. Sometimes this "ageing" is done at origin before sampling. However, when one reviews the patchouli odor profiles of the different Indonesian regions, there is a clear variance between the Sumatra quality and those from Sulawesi and Java. The main odor characteristics of the three growing regions is below:

- Sulawesi: Green, leafy, woody
- Java: Green, leafy, woody
- Sumatra: Woody, musky, balsamic

As there is currently little material coming from Sumatra, replicating its profile can be difficult. As previously noted, this area also yields lower-acid and high-PA levels, making this quality not only a difficult option to source, but also the most expensive.

In the current cycle, the industry relies more on Sulawesi, and plans are afoot to create newer plantations in "virgin"growing areas within the region, but where will be the next region of Indonesia to provide this wonderful plant? Who is investigating and investing in this? Will time allow plantations to move back to Java and Sumatra? Maybe. This process never changes and as such will always create times of difficulty and other periods of consistency. The problem for the industry is that one cannot

Patchouli plantations on a typical hillside; patchouli best grows on hill slopes at around 400–600 m above sea level; courtesy of PT Van Aroma.

Patchouli plantations; courtesy of PT Van Aroma.

Typical patchouli transportation; courtesy of PT Van Aroma.

be certain as to what will be next. With supply and demand fairly balanced each year, any interruptions in supply or spikes in demand can disrupt the market for a matter of weeks or months, depending on the variance swing.

This past year was a typical example in which all these aspects came into play. The year started reasonably stable, but supplies slowed and quality dropped midway into the year, causing prices to spike. This increase continued for several months and only settled, but at higher levels, in the third quarter. The year ended with a slightly better balance in supply and demand, but prices remained firm, especially for those seeking a higher-quality material. The outlook for 2015–2016 is that supplies should remain stable, but this can always change quickly. If market prices remain fair, there is a better balance. If prices rise, then farmers plant more, possibly creating over-supply and making prices crash. This is a factor for many naturals in the flavor and fragrance markets and is a reminder that stability is always better than too many highs and lows.

Keeping all this in mind helps one appreciate that it is not simple to predict this product's future and that no matter how big or small the demands are, planning ahead to ensure the right quality and quantity is an important and strategic decision for businesses.

Essential Oils Impacted by the Crimean Annexation

Little was known internationally about this southern Ukrainian peninsula, which is situated to the west of Russia, before the start of 2014. However, it has become a focal point over the last year for all the wrong reasons.

Caught up in a myriad of geopolitical issues and warfare, this territory has unilaterally declared its independence from Ukraine and acceded to Russia under the banner of the Republic of Crimea. This status has been recognized by Russia, Cuba, Nicaragua, Syria and Venezuela only. Depending on which side of the political fence one is on, Crimea is now either an "occupied zone" or part of the Russian Federation. Whether this distinction is an important fact to many of us or not, supplies in the region have certainly been disrupted as a result of these developments, and is another factor no one could have foreseen heading into 2014.

Many will not appreciate that this territory of 27,000 km^2 (about the size of Massachusetts and a little smaller than Belgium) had a prosperous history in manufacturing essential oils during the Soviet era. Crimea, up until the beginning of 1990, was producing as much as 40 mt per annum of lavender oil (*Lavandula angustifolia*) and processing as much as 1,000 mt of rose petals per day at the height of the season. Crimea, along with other Soviet-based manufacturers, would produce around 1,000 mt of coriander seed oil each year, which is over 10 times that of today.

The perfumery and cosmetics markets within the Soviet Union were significant, but after the collapse of the Union of Soviet Socialist Republics in 1991, the essential oil market in Crimea disappeared almost overnight. After the Soviet Union collapsed, new smaller businesses were formed. Despite the markets being decimated, the growing conditions in Crimea were still very favorable to all types of agriculture. A rich and fertile soil, good summers and good spring rains ensured nature could still provide an interesting platform for new businesses to emerge.

Twenty years on, and whether the industry realized this before now (or this last season), Crimea has once again begun to play an important role in the flavor and fragrance markets. Despite not producing the same range or volumes as in Soviet times, the industry can usually rely on Crimea to contribute around 30% of the Russian coriander seed oil output. Crimea is also the only notable source of "Russian" lavender oil and the largest contributor to clary sage oil and clary sage concrete from Russia (used for its sclareol content to produce products

*Crimean sage (*Salvia officinalis*) plantation; courtesy of Irina Eidelman.*

Crimean Lavandula angustifolia *plantation in early season; courtesy of Irina Eidelman.*

Crimea's modest Rosa damascena *x* centifolia *collections; courtesy of Irina Eidelman.*

like ambroxide). Average yields from the past five years imply Crimea's output of coriander seed oil to be 30 mt, lavender oil 8 mt, clary sage oil 6 mt and clary sage concrete 25 mt. In addition, Crimea produces products including sage oil (*Salvia officinalis*), artemesia oil (*Artemisia vulgaris*) and rose oil (*Rosa damascena* x *centifolia*).

The impact of the annexation in February 2014 has caused many problems for Crimean-based businesses and for the market itself. Businesses in the territory have had to re-establish themselves as companies trading within the Russian Federation, which comes with many internal challenges. For many, new banks, insurance, customs and regulations mean starting all over again. New borders have ensured that logistically goods can no longer move freely over the Ukrainian mainland, isolating Crimea as an island. The only real way to ship goods now is by a small ferry service to the Russian mainland. Then there are political sanctions imposed by the United States and the European Union that are directly impacting Crimean exporters.

The EU sanctions (EU692 Article 2) clearly state that it shall be prohibited: "(a) to import into the European Union goods originating in Crimea or Sevastopol; (b) to provide, directly or indirectly, financing or financial assistance as well as insurance and reinsurance related to the import of the goods referred to in point (a)."

If Europe is not accepting goods "directly" from Crimea, then it is reasonable to consider that there could be other options available to those who are creative, manipulative or have the financial power to make things happen; however, this is not going to be an easy process. Any new process is sure to be met with unexpected obstacles or heavy financial implications, so it is difficult to see short-term solutions. Any solution also needs to consider the buyer. Assuming the goods leave Crimea and physically arrive at their EU destination, can companies be confident to store and insure goods knowing they could be in breach of this particular EU sanction? Avoiding the EU as a client is another option, but with each new challenge there are only a couple of clear answers—time delays and inflating costs.

Alongside all of this, it is still relevant to mention the environmental effects on the 2014 crops and the mixed year for oil yields. Coriander seeds blossomed well, but increased demand from food markets in Asia meant that fewer than expected seeds were further processed into oil. Floral plants like lavender and clary sage faced an intense period of hot weather prior to harvesting, significantly damaging the flowers and therefore the oil yields. Other products grown in Ukraine and processed in Crimea, like artemisia, also suffered as it was not viable to harvest or transport the raw materials for processing.

One can see that these are not excuses for increased prices; they are in fact consequences of today's geopolitical reality. The industry needs to accept that the essential oil market is highly influenced by climatic conditions, demands from other markets and political developments. Sadly, Crimea has met with all these challenges in one year. This past year will be a period to be forgotten for many businesses in Crimea. One hopes it doesn't mean Crimea will be forgotten as a key source of raw materials in the future.

Mexico: Lime Oil (*Citrus aurantifolia*)

Mexico's lime production suffered terribly in 2014. There are many possible factors behind this, with the main reasons being plant disease and other climatic conditions. However, one can throw into this mix a possible new factor. According to many reports the supply of lime is also influenced by drug cartels. Other theories lay the blame at the feet of Florida, which no longer produces lime, therefore putting so much pressure on the Mexican production.

Mexican lime production; courtesy of Citrojugo SA, Mexico.

Mexican lime harvesting; courtesy of Citrojugo SA, Mexico.

Mexico is the second largest producer of limes in the world, behind India. However, Mexico processes more fruits for oil-making and so is the largest oil producer.

The crop started late in the Colima and Michoacán states due to unusual weather patterns. Rains in November and December 2013 removed the blossoms in many areas and, in reality, Michoacán was the only major producing state this year, but with yields around 40% lower than usual. These sorts of season-to-season weather events can be usual across all natural products.

Unfortunately, Colima was one of the worst states suffering from the greening, or huanglongbing (HLB), disease. Citrus greening is a disease common to citrus plants and is transmitted by insects. Historically, it is more commonly found in China and Africa, but was first discovered in Mexico in 2009. This bacterium grows quicker in hot temperatures and will ultimately kill a plant/tree where the fruit is growing. In the meantime, the plant/tree will bear multiple seasons of small fruits, many unsuitable for processing. There is no cure for greening, so the disease is hard to control once a region is infected.

When Florida suffered from a similar disease after the 1992 Hurricane Andrew (reported at that time as canker), the state took some dramatic action and destroyed almost all of its lime plantations. Florida forced growers to kill any trees within 1,900 ft of an affected tree, almost ensuring no lime tree was left standing. In the 1980s, Florida would have supplied around 50% of the domestic US market with fresh limes. Hence, some historians are still pointing the finger at Florida as an influence on today's troubles. Today, almost 100% of limes in the United States come from Mexico.

An interesting thought here is that if Florida felt it had to take this sort of action to eradicate canker, what will Mexico's long-term solution be to avoid the continuing shortages caused by this HLB disease?

Meanwhile, if tree disease and unusual weather patterns are not bad enough, there are also widespread reports that some drug cartels have been trying to capitalize on the high prices.

In some parts of Mexico, the cost of limes has risen as much as 600%, and nationally the average price for a kilo of limes rose 147% between December 2013 and February 2014.

Sadly, as with any high-priced products, the door opened to corruption and exploitation. While growers are used to dealing with climatic issues, the move by some of Mexico's drug cartels has caused new problems for which protective measures are needed. Some lime growers on the Pacific coast state of Veracruz have taken to guarding their trees at night, and truckers are now travelling with escorts following a hijacking in which armed bandits made off with almost $50,000 worth of the prized fruit, according to a March 30, 2014, New York Times report.

Many producers are being forced to pull limes early from the trees, which means smaller fruits and less oil, so criminal gangs do not steal the fruits and capitalize on the high prices themselves.

Whatever the core problems, 2014 was more than challenging for the lime markets in Mexico. It is hoped that 2015 will bring slightly better conditions, but until a strong challenger in the global market for lime oil production arrives, the industry is dependent on Mexico as a source, despite the various conditions affecting the country.

Mexican limes; courtesy of Citrojugo SA, Mexico.

Summary

These three short topics have covered a wide variety of issues, which can influence the flavor and fragrance markets and the availability of raw materials: political, economic, weather, disease, ecological and even some more extreme influences such as the drug cartels of Mexico.

In addition, there are many other factors to consider, like simple supply and demand issues. Many problems can be created by other industries, since many important raw materials in the natural product market are simple by-products of other industries.

Whatever the reasons, the industry needs to stay informed. Today it will be one thing, tomorrow another. All one can do is remain vigilant, stay informed, and trust and work with the supply chain.

In future editions, the authors will focus on other products and markets and analyze other interesting facts affecting the marketplace.

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