

Spanish Essential Oils*

Red thyme, lavandin, spike lavender, rosemary and more

Jordi Sort and Jordi Calonge, Ernesto Ventós S.A.

Essential oils are the artistic and romantic part of the fragrance and flavor industry. They are the origin of scent and taste; they are unique and cannot be completely imitated due to their extraordinary complexity. Today, there is a return to natural products for their intrinsic added value.

Spain's geographic location and terrain, as well as its particular ecology, make it an ideal place for growing, harvesting and distilling aromatic plants. More than 1,000 species, varieties and cultivars are grown in Spanish fields, 150 of which are endemic.

The rugged terrain of the peninsula and its variety of soils and climates (Euro-Siberian in the north and Mediterranean in the Levante region and the south) mean that tropical and alpine vegetation can exist within a short distance of each other. As a result, Spain is home to not just the most important species from Central European countries, but also those of the Mediterranean basin, Europe and North Africa.

Harvesting each of the aromatic plant species at the right time ensures the best possible yield and quality. Plants such as red thyme, lavandin, savory, marjoram, hyssop and spike lavender are harvested during the summer months. Cypress is unusual in that it can be harvested at any time, although preferably in winter.

Plants such as rosemary can be harvested twice, once in spring and again in autumn.

Once the plant material has been processed, the next step requiring special attention is distillation. But the real end point of the essential oil production process is reached when the oil meets the quality standards required under national and international law.

Many things have changed in the recent years due to globalization. Competition is stronger and every year requirements are more demanding. This is not only in terms of quality and price, but also in terms of regulation and legislation requirements that support the safety of products incorporating fragrances and flavors.

There are many endemic essential oils produced in Spain that have been analyzed, including cade, oregano, cistus and labdanum, sage, fennel, and rue oil. However, this article will concentrate on nine essential oils because of their significant production volumes and unique characteristics compared to other production origins.

Red Thyme Oil

This essential oil is distilled from the variety *Thymus zygis* L. (F-1), which is different from the plant, *Thymus vulgaris*, which is used for distillation in other production areas. The main difference between them is that *T. zygis* L. has a high thymol content. The different chemotypes coming from *T. vulgaris* have a high linalool or carvacrol content, but no thymol.

The plant mainly grows in the Mediterranean coast and southern Spain. The essential oil is primarily obtained from cultivated areas, which the authors will refer to in this article as "plantations" to differentiate them from production grown in the wild. Wild growing and harvesting is less important from year to year due to legal restrictions and environmental protections. Plantations give more stability and safety in terms of quality and availability.

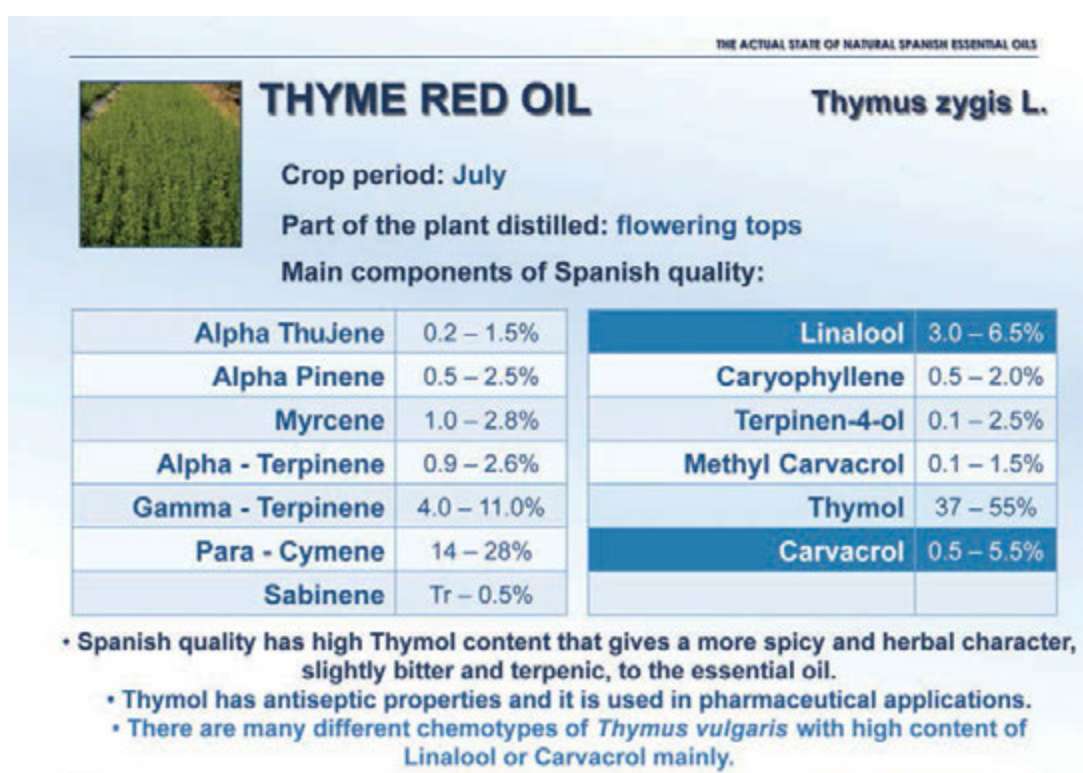
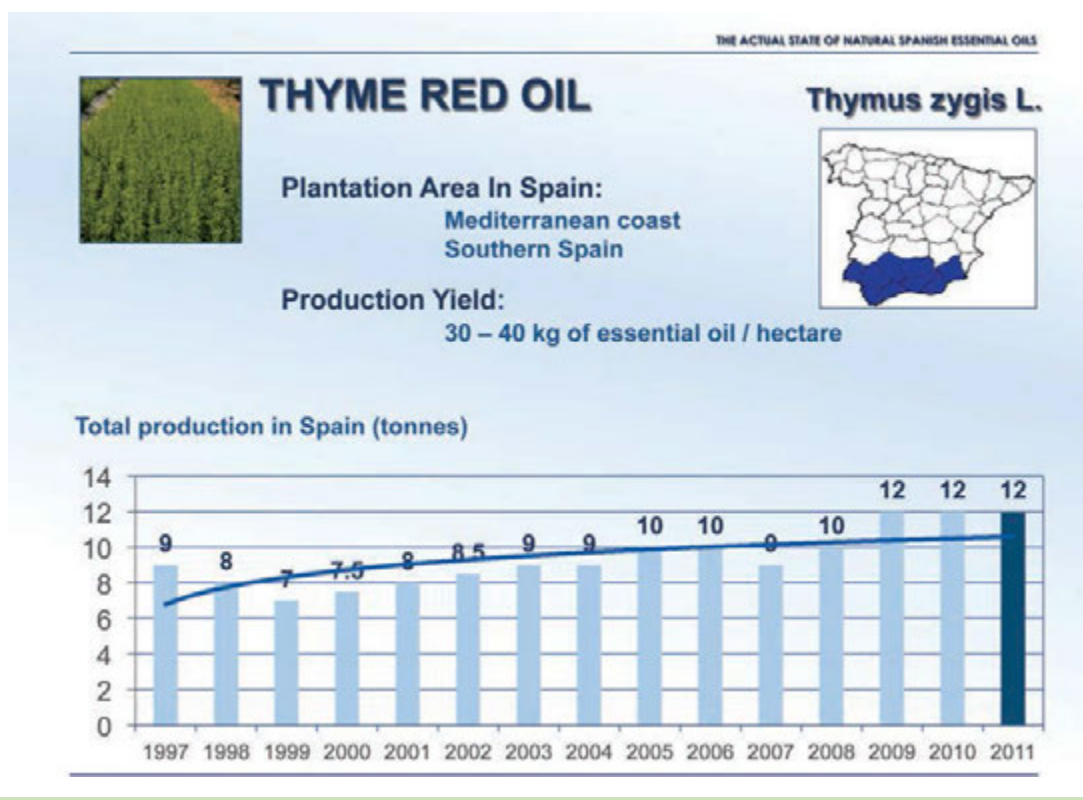
The crop is harvested in July. The production yield for thyme red oil is 30–40 kg/ha or in other terms 0.6–0.8% (kg of essential oil per kg of plant distilled). Production decreased in the late 1990s, but it has slowly been growing since then, reaching a stable production of 12 MT per year. There is still a chance to increase this amount. The essential oil's usage has increased by 400% in recent years due to its specific composition and the decreasing price of the oil so that today it has reached a stable situation.

The Spanish quality of the essential oil distilled from the flowering tops of the variety *T. zygis* L. has its own ISO (International Organization for Standardization) specification. It also complies with the requirements to be used in pharmaceutical applications. This usage is due to thymol, the main component that has antiseptic properties (F-2). The high thymol content is specific to the



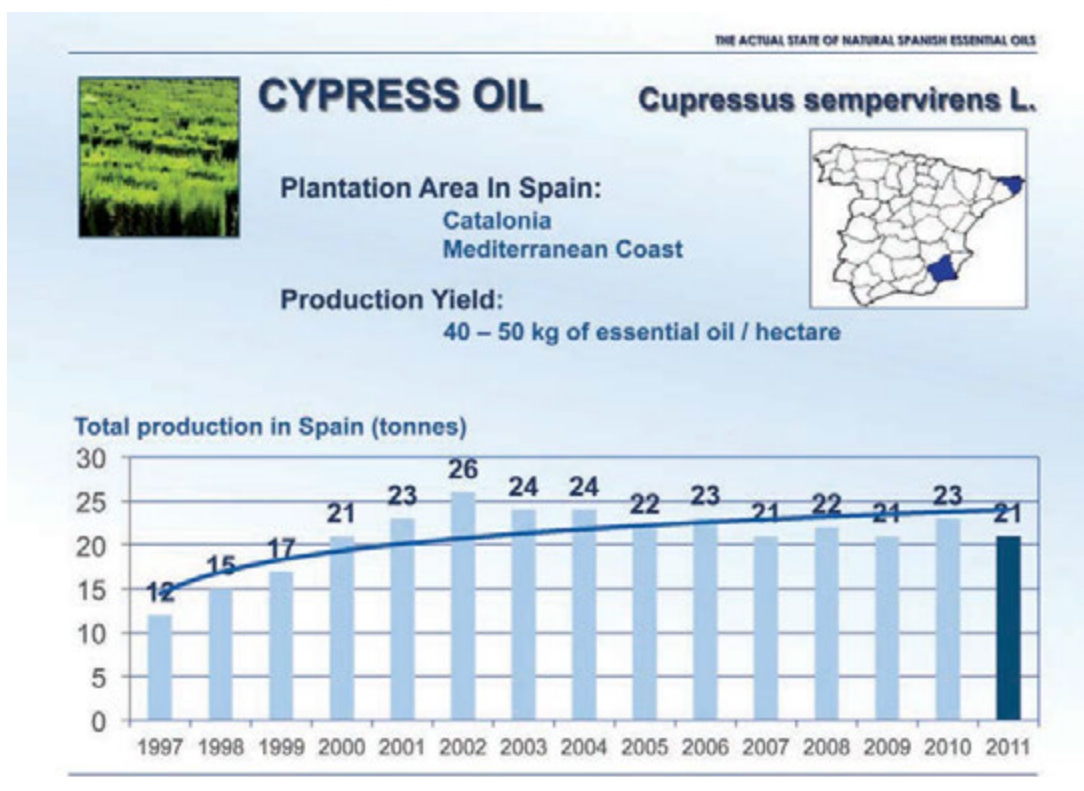
Red thyme

* This article is adapted from a presentation at the International Federation of Essential Oil and Aroma Trades in Barcelona, Spain, November 2011; www.ifeat.org.



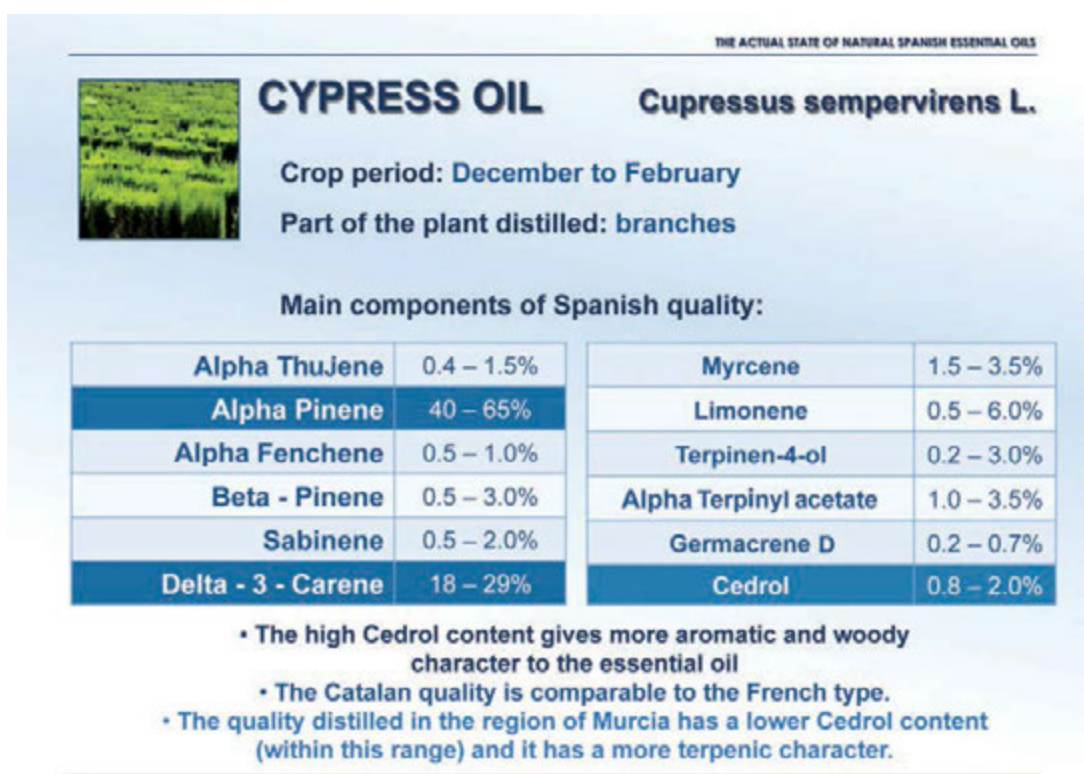
Cypress oil

F-3



Key components of cypress oil

F-4



Spanish quality. The antiseptic properties of red thyme were well-known in the past, as seen from its use in infusions or poultices to cure wounds.

The other important components of red thyme oil are: α -thujene, α -pinene, myrcene, α -terpinene, γ -terpinene, p-cymene, sabinene, linalool, β -caryophyllene, terpinen-4-ol, methyl ether carvacrol and carvacrol. There are different chemotypes of *T. vulgaris* with high carvacrol, linalool or terpinen-4-ol content.

Spanish red thyme oil is spicier, slightly bitter and less terpenic than other types of thyme oil, and its main use, apart from the pharmaceutical applications, is in flavors for dressings and meat sauces.

Cypress Oil

This essential oil is distilled from fresh branches of the *Cupressus sempervirens* L. Cypress trees are used on the southern Mediterranean coast (Murcia region) to protect citrus plantations against the wind. They are used as windbreak fences for the fields to avoid fruit loss from wind damage. These cypress trees, which are regularly pruned, yield branches that become the raw material for the distillation of the essential oil. This particular raw material origin gives a regular and stable production of this essential oil. Cypress trees are very common in Mediterranean landscapes. In Catalonia, the essential oil is obtained from plantations as there is no citrus production in this area. As it is a very windy area, with a strong northern wind called *Tramuntana*, the trees have been used to create natural walls.

Production yield of this oil is 40–50 kg/ha or, in other terms, 0.8–1.5% kg of essential oil per kg of plant material (F-3). There is not yet an ISO specification for cypress oil because its usage has increased only a small amount recently. Today there is a stable production of about 23 MT of material per year. It is possible to distill the material throughout the year, but it is best to do so in winter when it is the time for pruning.

The main components of the essential oil are α -pinene and δ -3-carene, but its composition also includes α -thujene, α -fenchene, β -pinene, sabinene, myrcene, limonene, terpinen-4-ol, α -terpinyl acetate, germacrene D and cedrol (F-4). Cedrol content differs somewhat in the Catalan quality—which is very similar to the French quality coming from the geographically close Provence

region—from the southern Mediterranean quality. The Catalan quality has higher cedrol content, which gives the essential oil a more aromatic and woody character. It is less balsamic and has fewer burned notes and is more delicate and coniferous. The Southern Mediterranean quality has less cedrol content and has a more terpenic character with more burned notes. Both have sweet, terpenic, fresh and balsamic notes reminiscent of juniper berry and cardamom. Prices and availability are stable due to its particular sourcing. It is mainly used in perfumery, but can be used in flavors as well.

Lavandin Oil

This oil is distilled from four different cultivars of lavandin including ‘Grosso,’ ‘Super,’ ‘Abrialis’ and ‘Sumian’ of the *Lavandula x intermedia* Emeric ex Loisel, a natural hybrid of spike lavender and lavender, featuring properties of both of them. This hybrid plant thrives in lower altitudes than does lavender. Lavandin oil is the Spanish essential oil with the most plantations cultivated in the greatest number of areas of the country: Central Spain, Mediterranean coast, and Northern and Southern Spain. Production is stable at around 60 MT/year, but can be increased if there is a greater market demand (F-5). The crop is harvested in July. The production yield is the highest of the essential oils discussed in this article, ranging from 60–90 MT per ha or, in other terms, of 1–1.8% kg oil per kg processed (depending on the cultivar).

The development of the Spanish origin helped to moderate prices. It is an interesting alternative source due to its composition, which complies with the international specifications and has some specific characteristics. The major components are linalool, linalyl acetate with lesser amounts of camphor and limonene; however, the most representative characteristic components are lavandulol and lavandulyl acetate (F-6). The Spanish quality has, within the international range specification, higher contents



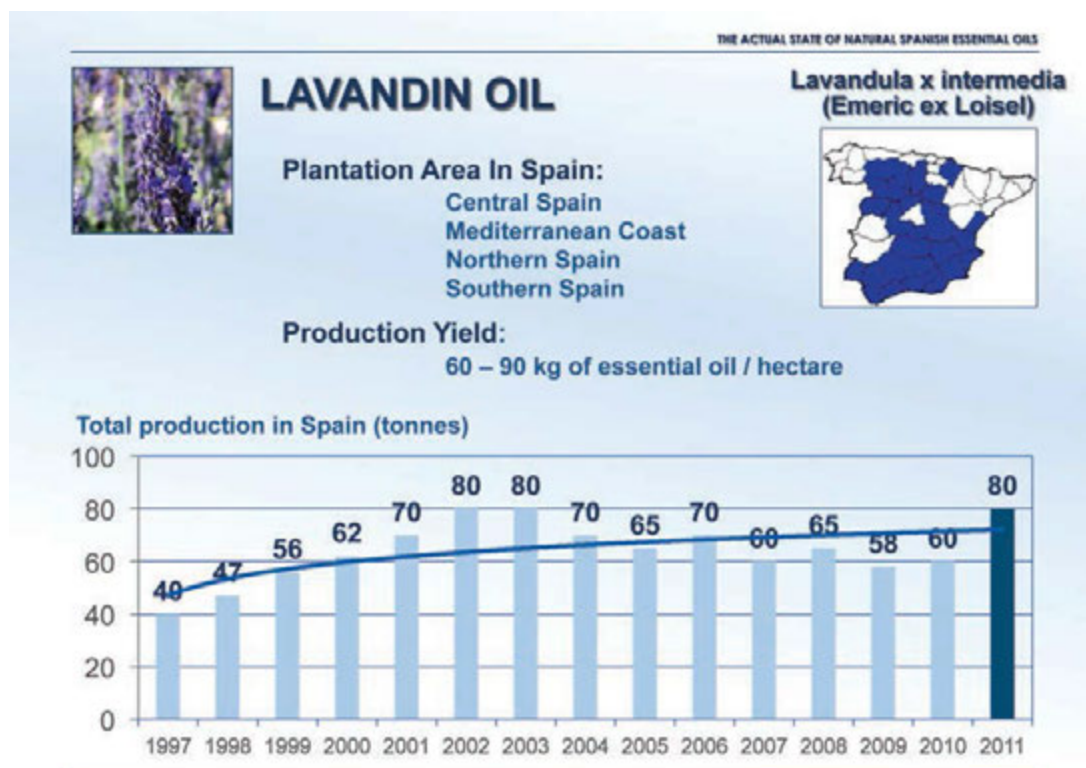
A cypress field



Lavandin

Lavandin oil

F-5



Key components of lavandin oil

F-6

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS

LAVANDIN OIL

Lavandula x intermedia
(Emeric ex Loisel)

Crop period: July

Part of the plant distilled: flowering tops

Main components of Spanish quality:

Myrcene	0.3 – 1.0%	Linalyl acetate	26 – 35%
Limonene	4.0 – 8.0%	Terpinen-4-ol	2.0 – 5.0%
1,8-Cineole	0.5 – 1.5%	Lavandulyl acetate	1.5 – 3.5%
Cis-Beta-Ocimene	0.5 – 1.5%	Lavandulol	0.2 – 1.0%
Trans-Beta-Ocimene	0.3 – 1.0%	Borneol	1.5 – 3.5%
Camphor	6.0 – 8.5%	Alpha-Terpineol	0.3 – 1.0%
Linalool	25 – 36%	Hexyl butyrate	0.3 – 0.5%

- The spanish quality parameters fit into the ISO specification.
- Spanish quality has higher (in range) Lavandulol and Lavandulyl acetate content.
- This higher content gives higher added value (quality and organoleptical performance) and natural character to some varieties.

compared to other origins. This provides increased added value, quality and organoleptic performance, and natural character to some varieties.

The main usage and properties of lavandin oil, which are similar to that of lavender oil, are perfumery, although it can also be used in aromatherapy. The main notes are strongly herbaceous with some notes of camphene and 1,8-cineole, as well as woody notes.

Spike Lavender

Spike lavender was traditionally collected in the wild. Cultivated production is less profitable than other plants and the durability of the plantation is relatively short (six or seven years) compared to 10–14 years for lavandins, for example. Plantation areas have not expanded as with



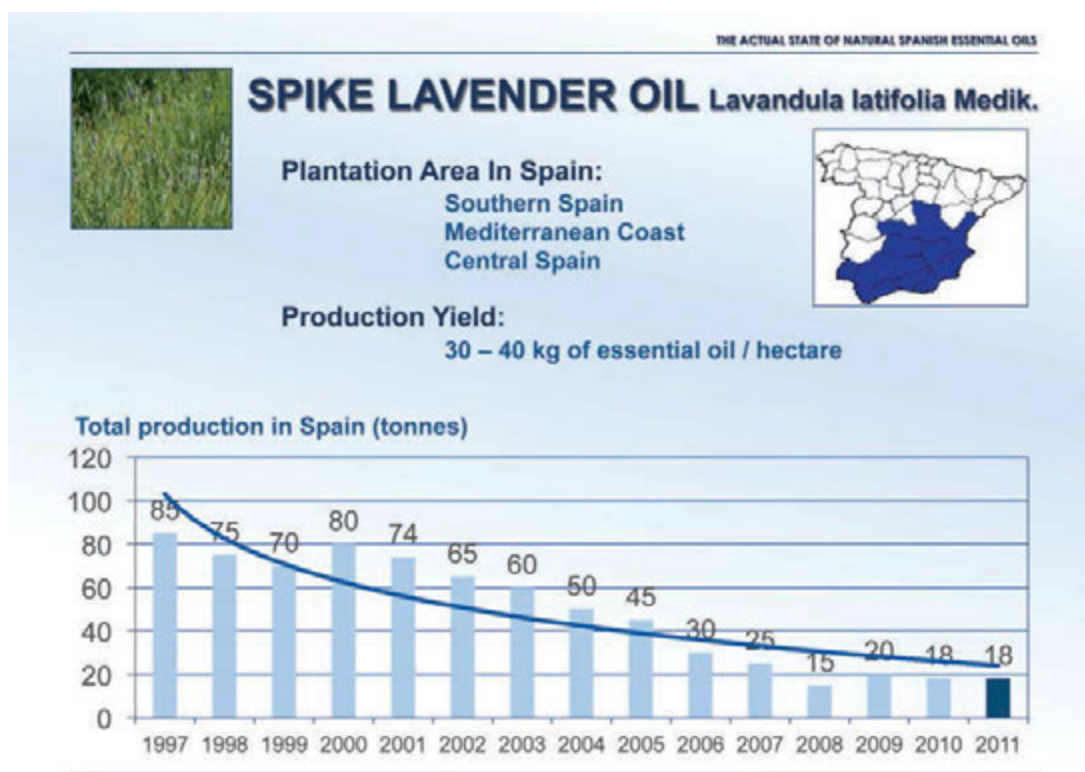
Rosemary

lavandins. It is mainly grown in Southern Spain, the Mediterranean coast and Central Spain. The crop is harvested in July and August.

Production of spike lavender oil is decreasing due to rising costs and the environmental protection for wild growing collection (F-7). In addition, the production yield is half that of lavandins and the price is almost double. This is causing a decrease in its use, mainly concentrated in high perfumery. The organoleptic properties are not too different from lavandins, and it is not too difficult to replace it, even though the components and contents are different (F-8). Spike lavender oil has higher 1,8-cineole, linalool and camphor contents, but is lower in linalyl acetate. The Spanish composition of Spanish spike lavender oil complies with the international specifications with tighter ranges. The main odor notes are camphor, fresh, herbaceous and woody with reminiscences to lavandin and rosemary. Prices have kept stable due to the balancing of production and demand and the increase of lavandin oil production and usage.

Rosemary


Spanish rosemary oil is distilled from *Rosmarinus officinalis* L., and it is a different type compared to the rosemary of North African origin. It was produced in Spain until the Spanish Civil War (1936–1939), during which the production dropped to nearly zero. It took more than 10 years to get back to previous production volumes. It was at that time that alternative North African sources were developed.



Key components of spike lavender oil

F-8

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



SPIKE LAVENDER OIL

Lavandula latifolia Medik.

Crop period: July and August

Part of the plant distilled: flowering tops

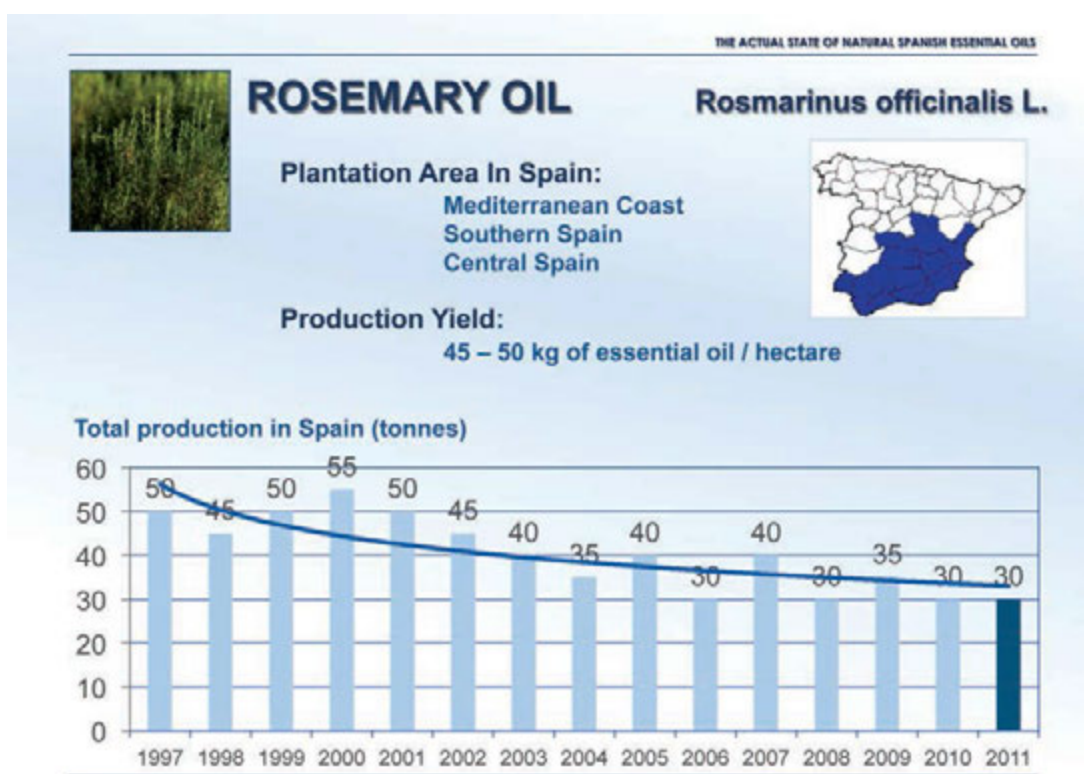
Main components of Spanish quality:

Limonene	0.5 – 2.5%
1,8-Cineole	20 – 35%
Camphor	10 – 15%
Linalool	38 – 46%
Linalyl acetate	tr – 1.0%
Alpha-Terpineol	0.2 – 2.0%
Alpha-Bisabolene	0.5 – 2.5%

- The spanish quality parameters range fit into the ISO specification.
- Spike Lavender is an autoctone product from Spain.
- Its composition gives an exclusive balsamic and strongly aromatic character to the essential oil.

Rosemary oil

F-9



Rosemary oils obtained from these two origins are different in content and olfactory properties. In Spain, it is mainly cultivated in the Mediterranean coast, Southern and Northern Spain. Production and usage has been moderately decreasing compared to the late 1990s, when there was possibly an excess of production (F-9). Today, it is stable around 30–35 MT per year. Production yield is 45–50 kg/ha, or about 1%. The plant can be harvested twice a year; the April–May crop is larger than the October–November crop.

Spanish rosemary oil has a lower 1,8-cineole content compared with North African rosemary oil, and consequently has higher camphor content and some other characteristic components like verbenone and ethyl amyl ketone (3-octanone) (F-10). This gives more variety of odor notes to the Spanish oil and more aroma to the product. The main notes of Spanish rosemary oil are herbaceous with woody, fresh, forestlike, balsamic and sweet notes. In the Spanish oil, the herbaceous note is more predominant, while the North African oil is more balsamic. Rosemary oil is widely used in fragrances and flavors.

Marjoram Oil

Spanish marjoram is distilled from *Thymus mastichina* L., an endemic *Thymus* species very different from *Origanum majorana*, the other major origin of marjoram essential oil. The main difference between the oils of these two species is that the oils from *T. mastichina* are rich in 1,8-cineole while oils from *O. majorana* are normally rich in carvacrol or sabinene hydrate acetate.



Marjoram


The essential oil of *T. mastichina* is obtained from wild growing plants, mainly in Southern and Central Spain (F-11). Its production tendency has behaved similarly to rosemary because it has been balancing the production and the usage of the essential oil.

Production yield is 40–50 kg per hectare, or 1–1.2% (in the range of origanum, red thyme red and cypress oils), which is very good and stable, even though it is collected from the wild. Availability has been very stable too, which is why it is not usually cultivated.

Spanish marjoram is a type of thyme. Its main component is 1,8-cineole; however, the lower amounts of camphor, α -terpineol, limonene and β -caryophyllene are

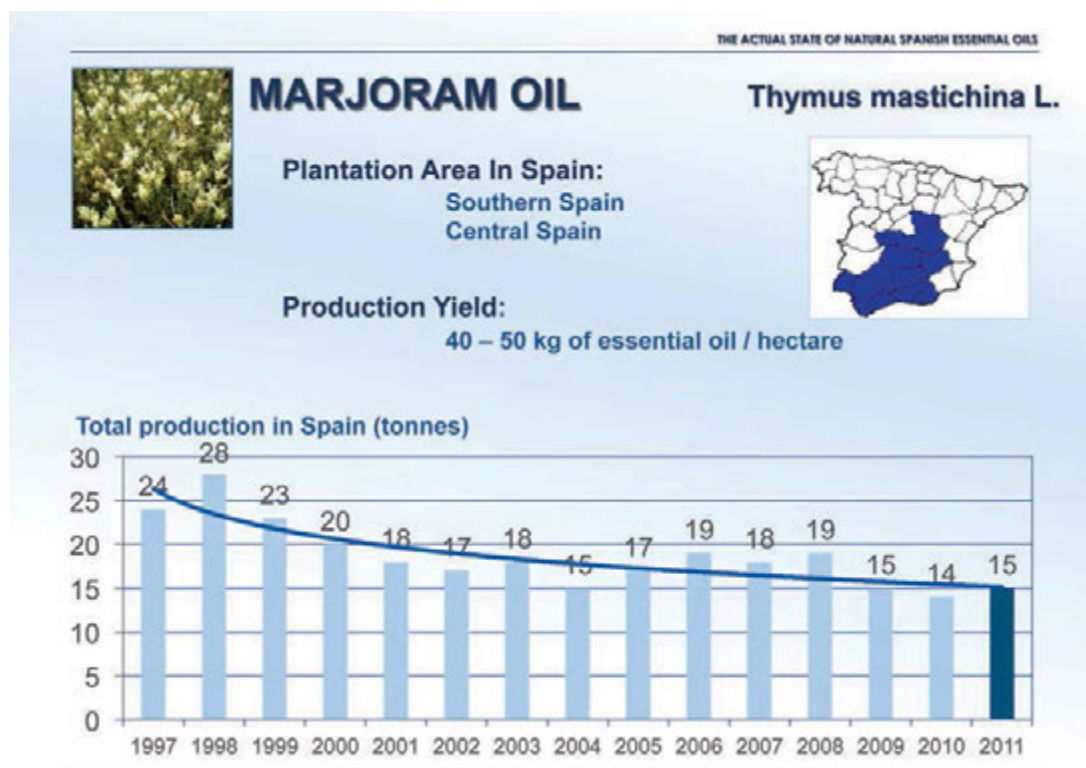
Key components of rosemary oil

F-10

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS			
	ROSEMARY OIL		Rosmarinus officinalis L.
	Crop period: April/May and October/November		
	Part of the plant distilled: whole plant		
	Main components of Spanish quality:		
Alpha pinene	18 – 26%	Camphor	12.5 – 22%
Camphene	7 – 13%	Bornyl acetate	0.5 – 2.5%
Beta-Pinene	2 – 5%	Borneol	1.0 – 4.5%
Myrcene	2.5 – 4.5%	Alpha-terpineol	1.0 – 4.0%
Limonene	2.5 – 5.5%	Verbenone	0.7 – 2.5%
1,8-Cineole	16 – 23%		
<ul style="list-style-type: none"> • Spanish quality has less cineol content and higher camphor content and other character components (like Verbenone and Ethyl Amyl Ketone) compared to Northern African quality. • This gives more variety of smell notes. • The different range of the components gives more aromaticity to the essential oil. 			

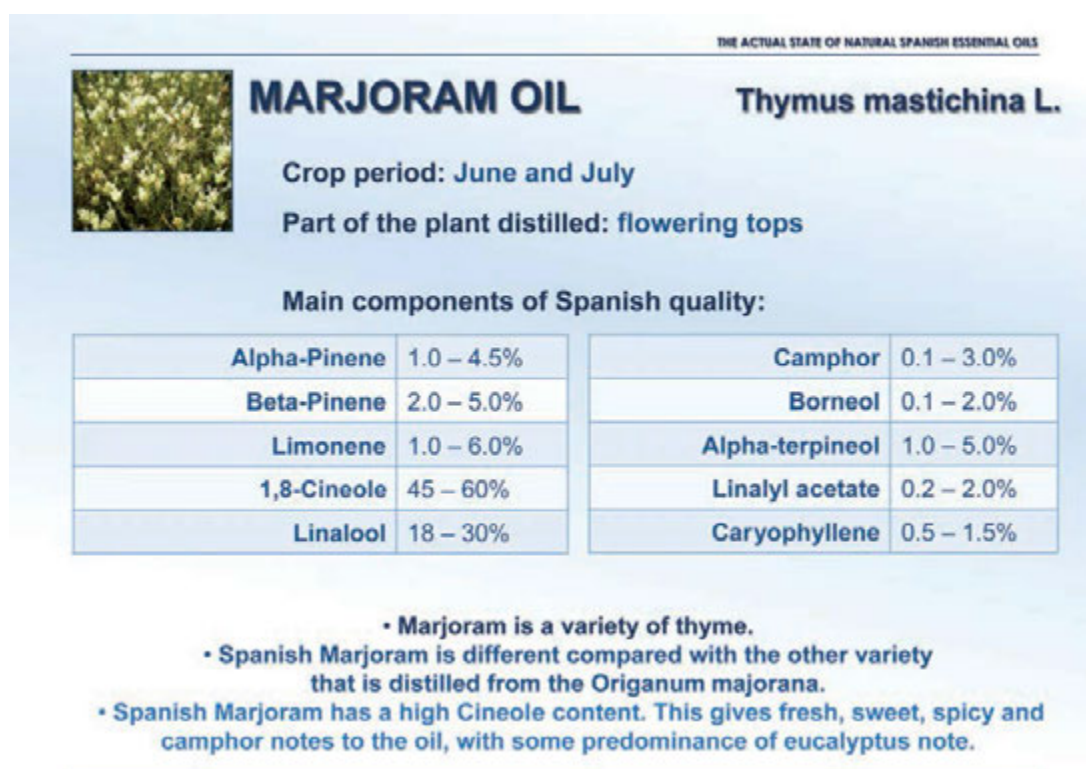
Marjoram oil

F-11



Key components of marjoram oil

F-12



important to the overall aroma of the oil (**F-12**). Even though Spanish marjoram is a different *Thymus* species to that of *T. vulgaris* and *T. zygis*, it has a stable dissimilar oil composition.

The main odor notes of Spanish marjoram oil are fresh, sweet, camphor and spicy with a predominance of eucalyptus due to the 1,8-cineole content. It is not commonly used in perfumery, but it is widely used in spicy flavors.

Petitgrain Lemon Oil

This is a by-product of the lemon plantations, which are extensive in Spain, mainly on the Mediterranean coast. The material is distilled from the pruned nonproductive branches of lemon trees (*Citrus limon* (L.) N.L. Burm.). The crop period is in late winter or at the beginning of

spring when the lemon trees are pruned for the next fruit crop.

The main components are limonene, which gives a citrus character, and β -pinene, but the presence of traces of some pyrazines makes it very interesting for its organoleptic performance. The main odor notes are citrus, fresh and aldehydic.

Production yield for petitgrain lemon is 20 kg of essential oil per ha (**F-13**). In 2011 the total production was expected to be 7 MT.



Petitgrain lemon

(Continued on Page 52)

Petitgrain lemon oil

F-13

49

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



PETITGRAIN LEMON OIL

Citrus limon (L.) N.L. Burm.

Plantation Area in Spain: Mediterranean Coast

Production: 20 kg of essential oil / hectare


Total production in Spain (2011): 7 tonnes



Key components of petitgrain lemon oil

F-14

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



PETITGRAIN LEMON OIL

Citrus limon (L.) N.L. Burm.

Crop period: March and April

Part of the plant distilled: leaves of the lemon tree

Main components of Spanish quality:

Beta-Pinene	14 – 18%
Limonene	36 – 46%
1,8-Cineole	1.0 – 4.0%
Trans-Beta-Ocimene	2.0 – 4.0%
Neral	3 – 6%
Geranial	4 – 8%

- The main notes of Petitgrain Lemon oil are the green leaf and the citric character coming from the main components.
- Some pirazines, present only as traces, give a very specific organoleptical performance.
- These characteristics make this oil an interesting product to be introduced in fine perfumery compositions.

Hyssop oil

F-15

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



HYSSOP OIL

Hyssopus officinalis L. Subsp. officinalis

Plantation Area in Spain: Southern and Central Spain

Production: 25 kg of essential oil / hectare


Total production in Spain (2011): 4 tonnes



Key components of hyssop oil

F-16

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



HYSSOP OIL

Hyssopus officinalis L. Subsp. officinalis

Crop period: June and July

Part of the plant distilled: whole plant

Main components of Spanish quality:

Beta-pinene	20-35%	3-10%	Aromadendrene	1 – 3%	0.2 – 0.5%
Methyl myrtenate	1.0-3.0%	0%	Germacrene D	1.5-4.0%	1 – 2%
Pinocamphone	15-25%	0.5-1.5%	Elemol	0.2-2.0%	0.1-0.5%
Isopinocamphone	25-35%	0.3-1.0%	Spathulenol	0.1-1.5%	Tr - 0.3%
Caryophyllene	1 – 3%	0.5-1.0%	1,8-Cineole		60-70%

- Same parameter range compared to other European origins.
- Higher range values in the tail components (natural minority components) that give more aromatic and less camphor notes.
- This 1,8-cineole-rich oil is from a different *Hyssopus officinalis* subspecies

Savory oil

F-17

THE ACTUAL STATE OF NATURAL SPANISH ESSENTIAL OILS



SAVORY OIL

Satureja montana L.

Plantation Area in Spain: Central Spain and Mediterranean Coast

Production: 30 kg of essential oil / hectare

Total production in Spain (2011): 4 tonnes





SAVORY OIL

Satureja montana L.

Crop period: July

Part of the plant distilled: whole plant

Main components of Spanish quality:

Gamma-Terpinene	15 – 30%
Para-Cymene	4 – 10%
Thymol	0.5 – 4%
Carvacrol	35 – 47%

- There are two chemotypes: from *Satureja montana* (Spanish) and from *Satureja hortensis* (France and Eastern Europe).
- Spanish quality compared to Eastern Europe origin is more spicy and aromatic. It has some similarities to *Salvia*, *Origanum* and *Thyme* oil.
- Savory oil has similar components to *Origanum* oil in different ranges that give specific smell notes to it.

(Continued from Page 49)

This essential oil is appreciated for high perfumery and cannot be compared to other petitgrains (**F-14**). Its price is high because the production yield is low and collection is difficult due to the presence of thorns (needles).

Hyssop Oil

There are four known subspecies of *Hyssopus officinalis* L., the oil compositions of which are all different. *Hyssopus officinalis* subsp. *officinalis* is the subspecies from which Spanish hyssop oil is obtained. This oil is similar in composition to other oils of European origin obtained from the same subspecies with some specific differences. The other subspecies found in Spain are *H. officinalis* subsp. *montanus* (Jourdan et Fourr.) Briq. or *H. officinalis* subsp. *canescens* (DC.) Briq., and not *H. decumbens* Jourdan et Fourr., which is a synonym of *H. officinalis* subsp. *officinalis*.

Production yield of hyssop oil is 25 kg of essential oil per ha; in 2011 the total production is expected to be of 4 MT (**F-15**). Hyssop is a dry cultivation plant; the cropping time is June and July. The main components of the variety from *H. officinalis* L. are β -pinene, pinocamphone and isopinocamphone, while the minor components, such as aromadendrene, germacrene D, elemol and spathulenol, which are primarily not available from synthetic origins, are important to the oil (**F-16**). The composition and ranges are similar to other European origins, but the Spanish quality has higher concentrations, within the specification ranges, of these tail natural components, which give a more aromatic and less camphoric character. The main odor notes are sweet, camphor, herbaceous and spicy.

The other Spanish subspecies of *H. officinalis* has a very high 1,8-cineole content and very little similarity



Hyssop

to the pinocamphone/isopinocamphone-rich type of *H. officinalis*. Its oil has more fresh notes with eucalyptus tones from the 1,8-cineole.

Production and market demand of hyssop essential oil has increased significantly due to its high aromatic performance.

Savory Oil

Spanish savory oil is distilled from *Satureja montana* L., which differs compositionally from *Satureja hortensis* L., which comes mainly from France and Eastern Europe. The Spanish oil has some similarities to sage, origanum and thyme oils, but it is spicier and more aromatic. Its composition is similar to that of carvacrol-rich origanum oil but with a different range of components that give specific odor notes to this essential oil. Production yield of Spanish savory oil is 30 kg of essential oil per ha; in 2011 the total production was expected to be of 4 MT (**F-17**). The cropping period for Spanish savory is in July.

The main usage of this material is in flavors, especially in meat sauces. Production and market demand has increased in recent years due to its competitive price. It can be used as an alternative to origanum due to its similar composition, but with specific notes (**F-18**).

Conclusion

Spanish essential oils can be used in many different applications. Spanish origin essential oils are specific and very characteristic products, with a regular and stable production due to the cultivation areas and climate of the country. The cultivation and distillation are sustainable; this is very important now that natural resources are limited and more and more people every day are starting to consume fragrances and flavors. Industry must reduce the pressure on the environment as best it can.

This is the reason that Spain is promoting the cultivation of aromatic plants: to ensure regularity in quality and availability, and sustainability of sourcing.

Address correspondence to Jordi Calonge, Ernesto Ventós S.A., Ctra. Real 120 A, 08960 Sant Just Desvern, Barcelona, Spain.

To purchase a copy of this article or others, visit www.PerfumerFlavorist.com/magazine. 