AUTUMN 2023

IFEAT WORLD

INTERNATIONAL FEDERATION OF
ESSENTIAL OILS
& AROMA TRADES

From the IFEAT 2023 Berlin Conference Chairman

Dear IFEAT family,

For our delegates, welcome to Germany's capital Berlin - we are happy and proud to be your host for the IFEAT 2023 Conference!

I hope you had a good and safe journey – now it is time to let yourselves be spoiled by the great surroundings and the charming Intercontinental Hotel.

On Sunday evening at the Welcome Reception we will meet again with more than 1,400 delegates and accompanying persons, Members, friends, speakers, and guests.

On Monday morning at 09.00 the lecture programme starts. As in previous years, only in the morning, so that all participants have enough time to visit the exhibition and, of course, to network.

Tuesday morning is traditionally dedicated to the IFEAT AGM and business session with various reports on IFEAT activities and the Medal Lecture. While the AGM voting is reserved for Members, all participants are welcome to attend and to hear the Medal Lecture!

The only afternoon session taking place will be on Tuesday and will take the form of a "roundpanelshop" on sustainability in our sector. We have reported on this frequently in advance - registration is free but signup is required - you can do this at the IFEAT information desk in the hotel foyer.

I would like to take this opportunity to draw your attention to our other evening events:

The IFEAT Dinner (by ticket, Members only) on Tuesday evening at the "Wasserwerk".

The Closing Banquet (free with full delegate and accompanying person registration) at the astonishing "Station" with lots of spectacle, excellent food, along with music and entertainment until early Friday morning!

One more request: if you already know today that you cannot attend the Closing Banquet, please let the IFEAT staff know so that we can inform the caterer in time.

We also hope that you will find some time to discover the incredible city of Berlin with all its culture, nature, architecture, political institutions, shopping, and sightseeing options! The InterContinental Hotel is an excellent starting point to explore Berlin!

At this point I would like to thank again the dedicated Berlin Conference Committee and especially the IFEAT staff – without you the organisation of this event would not have been possible!!

All the best for a great and successful Berlin Conference.

Yours,

Jens-Achim Protzen.
Chairman of the Berlin Conference Committee.

Contents

If you would like to contribute editorial, or write a "My Favourite" article, please contact the editor, Tina Hotchin, by email at: **tina.hotchin@ifeat.org**

ICATS Annual Review

by **Dr Tony Curtis**

The biggest news this year is the acquisition of ICATS by IFEAT which we are most excited about. This secures the future of ICATS and is part of IFEAT's vision to improve provision of Continuing Professional Development (CPD) for IFEAT Members. Continuity is being maintained with the full ICATS team and tutors remaining in post. The distance learning route to the IFEAT Diploma continues uninterrupted for new and current students but watch this space for future developments and additions to the courses on offer.

A key feature of IEAT's CPD provision is that ICATS courses are developed by aroma trades experts for the industry, being both suited to professionals and academically rigorous. Moreover, student projects are industry based giving added value to the individual and their sponsoring company. This is evident in two outstanding recent dissertations: Inga Raftery's dissertation *An Evaluation of Lavender and Lavandin Species and Their Applications in Perfumery* which was a comprehensive review of this key essential oil. In contrast, Brogan Pakey's dissertation: *Sustainability Issues Affecting Creative Fragrance Houses and How They are Addressed* examines a completely different but equally vital aspect of our business environment.

Last year Module 6 *Safety, Regulatory & Environmental Issues in the Aroma Trades* was split into two sections. The first section on Regulation has been completely rewritten and updated by industry authority, Penny Williams (Orchadia). It will soon be accompanied by *The Context of Regulation* which covers two issues: why regulation has been developed and how this complexity is managed in the industry (including Green Chemistry and Sustainability).

Development is not only restricted to the content of teaching material but to its format and delivery. We have transitioned (where possible) to e-books including the excellent Royal Society of Chemistry/Society of Cosmetic Chemists' *Discovering Cosmetic Science*. We will be developing our e-learning material going forward to improve our environmental footprint (with less paper being despatched for learning packs) whilst maximising value and accessibility for students, moving towards truly sustainable teaching.

ICATS staff continue to research and maintain contacts with the industry by attending events. Over the last year, we have visited the IFEAT 2022 Vancouver Conference, the 2022 IFRA-UK Fragrance Forum, the 2023 British Society of Perfumers New Materials Symposium and the 2023 British Society of Flavourists Table Talk exhibition. We look forward to meeting as many of you as possible at future events over the coming year!

The ICATS team can be contacted at **aroma@icatsaromaeducation.com** and would welcome your contribution to the development of ICATS/IFEAT Educational programmes.

ICATS
International Centre for Aroma Trades Studies

"My favourite part of the programme was the final dissertation module. My chosen subject was sustainability issues and how our industry manages these challenges."

Brogan Pakey

IFEAT Best Student - ICATS

This year's winning student from the ICATS programme told IFEATWORLD: *"After finishing my Chemistry degree in 2017, I joined CPL Aromas, a perfumery house based in Brixworth, Northamptonshire. I began my role in the Formulation Management team with next to no knowledge of the fragrance industry. I heard about the IFEAT Diploma in Aroma Trades from a colleague who had recently completed the course, and as I looked at what the course offered, I immediately knew it would be a great opportunity for me to continue my academic development and improve my understanding of the fragrance industry.*

"Completing this course has allowed me to interact with different departments and build relationships with my colleagues here at CPL. Thanks to their willingness to share their time and knowledge, I found that I was well supported in completing the assignments and the flexible, distance learning aspect of the course suited my work style. As a science student, working in my first graduate role, I previously had no exposure to subjects such as marketing and finance until the ICATS programme introduced them with enough detail for me to gain a top-level understanding, without being too complicated. Similarly, the course allowed me to delve more deeply into familiar topics that I already had a lot of exposure to at CPL, such as quality control, regulatory, and environmental issues.

"My favourite part of the programme was the final dissertation module. My chosen subject was sustainability issues and how our industry manages these challenges. My role in CPL involves working in a team that is responsible for managing fragrance raw material issues. Frequently, we face challenges with availability and quality of natural raw materials due to climate change, and as a member of the sustainability team within CPL, the impact of our industry on the planet and how we mitigate that impact, is very important to me. As part of my dissertation research, I gained a better understanding of the key reasons why businesses need to become more environmentally and socially responsible and how different organisations in the fragrance industry have implemented their sustainability strategies".

Reading Flavourist Training Course 2023 Review

By **Professor Don Mottram**

The Flavourist Training Course at the University of Reading is in its 21st year and continues to attract highly motivated junior flavourists, food scientists, and technologists from all over the world. It is a joint venture between the University and the British Society of Flavourists and has been sponsored by IFEAT throughout.

The annual course centres on practical flavour creation in the laboratory and is primarily designed for graduates working in the flavour or food industries seeking to upgrade their skills. The course tutors are very experienced flavourists and essential oil experts, who are members of the British Society of Flavourists, and lecturers in flavour science at the University of Reading. Over the course we call on 12 tutors to cover the different aspects of food flavours. The 2023 course was held from 9th to 26th May with 13 participants from 12 different countries - Austria, Chile, Dubai, Hungary, India, Italy, Mexico, Singapore, South Africa, Türkiye, UK, and USA. The popularity and the wide appeal is helped significantly by the publicity provided by IFEAT at the annual Conference and through its publications.

Each year IFEAT makes an award to the student who the tutors consider has made the most progress as a flavourist during the course. The participants were all very enthusiastic and highly motivated, so selecting one to receive the award was not easy. However, this year the IFEAT Best Student award has been given to Stefanie Holper from Red Bull in Austria. The two flavourings she created towards the end of the course attained the highest aggregated scores from the panel of six experienced flavourists who judged all the flavourings produced by the delegates.

For a number of years the course has been oversubscribed. Applicants who could not be offered places in 2023 have already reserved places on the 2024 course. This will be held from 7th to 24th May 2024. Since the course has filled quickly in recent years, early application is recommended.

More information can be found at:
https://www.reading.ac.uk/food/short-courses/flavourist-training

"I am so thankful for this opportunity, and I am sure I will apply a lot of what I've learned in my current position and in the future".

Stefanie Holper

IFEAT Best Student - Reading Flavourist Training Course

This year's winning student from the Reading course told IFEATWORLD: *"After graduating in nutrition science, I started working in the food industry as a product developer for a dairy company and beverage company. Because I was always obsessed with food, I got the opportunity to develop good tasting products. Thanks to this course, my interest in flavour development has increased enormously, I am very grateful for the insights and for being able to participate.*

"I was able to learn an incredible amount within the course. We evaluated flavour chemicals and essential oils, learned about flavour legislation, extraction techniques and analysis methods, and prepared reaction product flavours.

"Each speaker throughout the course was an expert in their field and spoke with passion and enthusiasm about their topic and experience. At the end of the course, we developed two flavourings of our own choice with the outstanding support and hints from the lecturers. I created a peach and strawberry flavour and applied it in an acidified beverage matrix.

"I am so thankful for this opportunity, and I am sure I will apply a lot of what I've learned in my current position and in the future".

Notes from the Chair

By Catherine Crowley,
Chair of the IFEAT Executive Committee

As you read this – we will have just started IFEAT's 2023 Berlin Conference. I believe we all continue to value more than ever our ability to meet and gather in person. We could see from our early registration numbers that having the Conference in central Europe this year was a great idea!

Jens-Achim Protzen, IFEAT's Berlin Conference Chair, together with his Committee and the fantastic IFEAT staff, put in all the work and extra work that can make an IFEAT Conference both productive for business, as well as being a memorable life experience. I know we will have in-depth coverage of the Conference in the next issue of IFEATWORLD.

Update on European Regulatory Developments

Background: as most of you will know, IFEAT undertook earlier this year a communications campaign based for now in Europe, to address real concerns about pending legislation in the European Union that could affect the availability and utilisation of essential oils and other naturals. FGS Global, a consulting firm with 12 European offices, was engaged to assist our industry in this process.

FGS began work with IFEAT in June 2023 to build out and execute a strategic campaign. The overall aim of this work is to support our industry's advocacy in the European Union with the ultimate objective being to ensure business continuity for IFEAT members.

Regulatory Developments: as an update, FGS states: "With ten months to go until the European elections in June 2024, the pressure is high in Brussels to deliver on the key legislative files of the current European Commission. The EU's planned overhaul of chemicals legislation under the Chemicals Strategy for Sustainability (CSS), represents a paradigm shift – away from the time-tested risk management to a more cautionary hazard-based approach. The trust in natural ingredients and the concept of 'safe use' are undermined by new concepts, such as *'MOCS', More than One Constituent Substances, or 'GRA', Generic Risk Approach*. The landscape is changing. The natural products you produce and distribute are increasingly under threat from this wave of EU proposals, and the risks of unintended consequences for the industry are high".

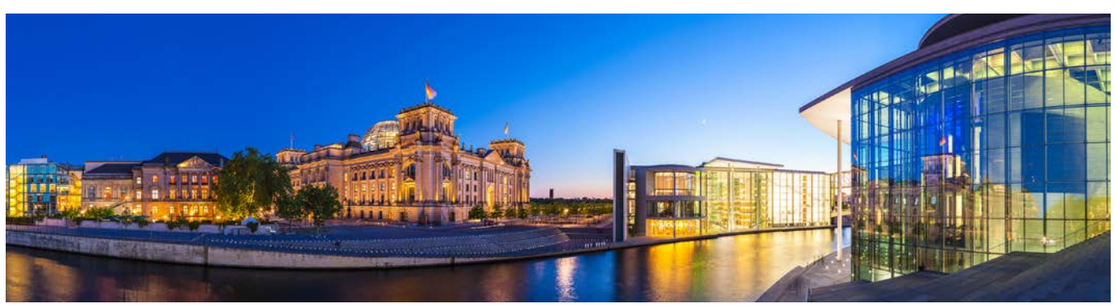
As we brought FGS on board, we realised immediately that we wanted to acknowledge and build on the significant work already done in this area by the European Federation of Essential Oils (EFEO). Fortunately, EFEO was willing to join our efforts, contributing their insight and knowledge to this work. We are now working determinedly to educate and inform EU policymakers on how they can protect the unique characteristics of essential oils in all EU chemicals legislation. We will continue to build awareness that "essential oils are natural ingredients that have been used in society for ages".

Next Steps: our focus over the next few months will continue to be our advocacy efforts on the EU's Classification Labelling and Packaging (CLP) regulation - we are now at the final stretch of negotiations. Once the CLP regulations are finalised, our work will then shift to the EU's upcoming revision of REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). The understanding at this point is that the European Commission will publish their REACH proposals still ahead of the EU elections, possibly in November of this year.

As part of our work in creating the right conditions for favourable treatment of essential oils in EU legislation, we are also undertaking a broader public relations communication campaign. Through different activities and events, this campaign seeks to shift the public perception on essential oils. Using everyday language, we can help people understand more broadly the value of essential oils, highlight the safe use of EOs and their related products, and dramatically explain that essential oils can be trusted.

Summary

This work continues. The issues are technical, intense to address, time-sensitive, and critical for our industry. **We are making progress**. During the Berlin Conference, we will be further highlighting the issues and the steps needed to address them. Going forward, we will continue to keep you informed both on our activities and the current status of pending regulations in Europe!



My Favourite

Helichrysum oil: joyful reminiscence

by **Priyamvada Sanganeria**, CEO, Ultra International - Far East

"Smell is a potent wizard that transports you across thousands of miles and all the years you have lived." – Helen Keller

Fragrances incite emotions that are difficult to explain. When passion and creativity converge, the captivating world of fragrances witnesses the artistry and sophistication of perfumery. I have always been charmed by fragrances that intrigue me to unravel their story. In this vast and enchanting world of fragrances, I have been caught by the allure of the shy *Helichrysum*.

While essential oils are about aromas and benefits, I look for my crowning jewel, that little extra, to call it a favourite. It is the farm visits that have been an allure for me. The revelation of the history of the product at the grassroot catches my attention. The delicate flowers, the mesmerising fields, and joy on the faces of farmers admiring the results of their labour, it ties together to make for a delightful tale. *Helichrysum* is special to me for many reasons, and its proximity to Grasse, the perfume capital of the world, is one of them. Growers in this region are passionate about their crop and passion fuels some of the greatest stories.

While exploring my memory of years spent in the aromatic lavender, clary sage, and *Helichrysum* fields, I was reminded of my numerous visits to the South of France. The countryside of France is hypnotic and surreal to me. Thus, whenever I take a whiff of these fragrances I am transported back in time and reminded of those beautiful memories. For me the aroma of *Helichrysum* signifies family, friends, beaches, holidays, filled with the joy of never-ending laughter and a good time.

Arguably one of the greatest gifts to the natural world, *Helichrysum* is native to the Mediterranean region. *Helichrysum* flourishes in various regions around there. The combination of its warm aroma, and the vibrant yellow flowers with silver-grey leaves, paint a mesmerising picture. Exuding the aura of a regal plant, it rightly derives its name from the Greek words, *helios*, which refers to the sun, and *chrysos* that means 'gold.' It is labelled as an immortal for the ability of its flowers to retain its vivacious yellow hue even after being plucked. Primarily, it has been a plant harvested from the wild, though an increasing demand for the product in the 21st century, and restrictions imposed on wild harvesting, has shifted the focus towards cultivation. Corsica in France is a minor producer of *Helichrysum*. With growing demand came the need for new plantations. Croatia, Bosnia and Herzegovina, and Serbia are the new entrants in the producer's space. In 2014, only 50-60 hectares (ha) was under *Helichrysum* cultivation. By 2015 this grew by 100 ha. As the area under cultivation grew and the supply increased, this had an adverse impact on the prices. Once the prices dropped, producers moved away from the product, especially in the Balkan region, ultimately seeing a reduction in production.

Italy, Macedonia, Montenegro, and Slovenia also contribute to *Helichrysum* production, though the produce in every region is unique with diverse organoleptic qualities. *Helichrysum* is considered as the only product to witness the doubling of production figures in the last decade due to rising demand.

For centuries the plant has been sought after for its therapeutic benefits. In fact, till today, it is known for its remarkable skin regeneration properties and wound healing abilities. It treats wounds on contact and heals the scars that follow. An elixir with compounds that promote circulation, healthy veins, reduce inflammation, and work wonders for the skin. *Helichrysum* is widely used in aromatherapy and numerous skincare products. Its tantalising aroma has also caught the fantasy of perfumers for niche products.

Types of *Helichrysum*

Almost 600 species form part of the *Helichrysum* family. It is also commonly known as immortelle, everlasting, or the curry plant. The most common variety grown along the Adriatic coastal region and continental Balkan areas is *Helichrysum italicum*. Its flowers are the primary ingredient for essential oil production. The Balkan variety is wild harvested, making it difficult to separate species. Thus, most of the essential oil produced is a mixture obtained from multiple species.

A couple of species native to South Africa and Madagascar, namely, *Helichrysum splendidum* and *Helichrysum gymnocephalum*, are also used for oil production. The most popular species, *Helichrysum italicum* has two chemotypes, rich in either neryl acetate or alpha-pinene. It also contains a spicy constituent, gamma-curcumene. The oil obtained from the *H. italicum* variety is rich in italidiones, which lend the oil its therapeutic properties. Italidiones are not found in other species of *Helichrysum* and consequently, the oil obtained from them. Neryl acetate is also not found in two other *Helichrysums* from South Africa (*H. splendidum*) and Madagascar (*H. gymnocephalum*). *H. splendidum* grows abundantly compared to *italicum* and is rich in beta-phellandrene. The *H. gymnocephalum* variety, on the other hand, has a large percentage of 1,8-cineole.

Due to its high level of active compounds, *Helichrysum* oil is a popular product in aromatherapy, and the production of cosmetics, fragrances, and flavours. The chemical composition of the oil depends on the species and habitat.

Helichrysum's popularity as a therapeutic ingredient inspired me to collect samples and bring them to our UK facility. Here, we tested the product and utilised it in formulations, and the results were exemplary. I have personally used many products with *Helichrysum* and been delighted by the results. Today, *Helichrysum* oil is a niche product with brands like L'Occitane sweeping the end-user off their feet.

However, the benefits of *Helichrysum* are not restricted to skin and hair care. Its healing properties can help aid in mental well-being too. Research indicates that mixtures of certain essential oils like *Helichrysum*, peppermint, and basil can help in the reduction of mental exhaustion and burnout.

But how difficult is it to produce this elixir? Spring is the best time to try and germinate *Helichrysum* seeds. Sown indoors in temperatures between 68-70 degrees Fahrenheit, they take about 15 days to germinate. Once the process is complete, they can be sown outdoors. It takes about three months after that for the plant to reach a significant size. The plant likes warm soil and should be protected from winter moisture. Once harvested, *Helichrysum* oil is obtained via steam distillation from the flowers of the plant. Approximately 1 litre of oil is extracted from 1-1.5 tonnes of *Helichrysum* flowers, which makes it an expensive proposition.

Certain scents are testament to the individuality, artistry, and pursuit of olfactory excellence. *Helichrysum's* unique scent profile, its extraordinary story and plethora of benefits make it a special oil in my fragrance enthusiast heart.

Over the years I have loved unveiling the secrets of scents, and it has given me many gems. I have dared to walk the unchartered paths with a passion to unlock the sensory delight the world of essential oils has to offer. And it is here that I have been captivated by hidden gems like *Helichrysum*.

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Conciliation Service & Success in Resolving Issues

Over the years the IFEAT Conciliation Sub-Committee has helped many Member companies to resolve problems and disputes that have arisen between themselves and other parties during the course of their business.

Several cases have been brought to the Secretariat requesting assistance from the Conciliation Sub-Committee, most of which were resolved swiftly once the issue had been outlined and the documentation was shared. This swift resolution is due to the fact that all parties involved were IFEAT Members and each responded quickly and efficiently and submitted the requested documentation out of mutual respect for their fellow Members.

Conversely, some further cases have been brought to the attention of the Secretariat by Members but in these cases the other parties involved were non-Members. Although documentation and acceptance of the service was submitted by the Members involved, it was difficult to reach the non-Member parties involved and unfortunately after many attempts to contact them, one case was unfortunately unable to be resolved.

Occasionally, there are cases brought to the Secretariat from non-Member companies and the Conciliation Sub-Committee can work on these if the other party has an active (paid) current membership,

As a result, the Conciliation Sub-Committee has seen how important it is for Members to do business with other Members in order to avoid any potential issues. Since 1st January 2020 Members have been required to read and agree to the Members' Code of Conduct as they renew their membership, which outlines good business practices, and this strengthens the message for Members to do business with each other.

Information on the Conciliation Service

The IFEAT Conciliation Service is available to all current Members of IFEAT who have paid their current membership subscription. Although it is not a legal court or formal arbitrary procedure, the IFEAT Conciliation Service is based on the goodwill of our Members who want to avoid formal procedures and are willing to use conciliation to find agreement on a fair and friendly basis using good business practices.

The Conciliation Service is run by the IFEAT Conciliation Sub-Committee that consists of a select group of individuals who are senior, experienced, and respected members of the Federation, known for their understanding of the industry and having proven experience in business and trading. The Conciliators, as agreed by parties concerned, consider the problem and, with the information and facts presented by both parties, do their best to propose an appropriate solution. It is the intention of the IFEAT Conciliation Service that in the end there is no winner or loser. It is expected that business partners will act in good faith and make an honest effort to find a satisfactory solution to their dispute with the assistance of the IFEAT Conciliators.

The IFEAT Conciliation Sub-Committee members

Alastair Hitchen (Chair until October 2023)

Ramon Bordas (Chair from October 2023 onwards)

Alan Brown

Catherine Crowley

Hussein Fakhry

Geemon Korah

Jens-Achim Protzen

We would like to thank Alastair Hitchen, the outgoing Conciliation Sub-Committee Chair, for his contribution and dedication to the Conciliation Service over the last six years. He has overseen many cases, leading the Sub-Committee in their discussions to offer advice and solutions to Members. Thank you Alastair!

A new, regular feature for IFEATWORLD by Dr Tony Curtis

Eating to Extinction: The World's Rarest Foods and Why We Need to Save Them

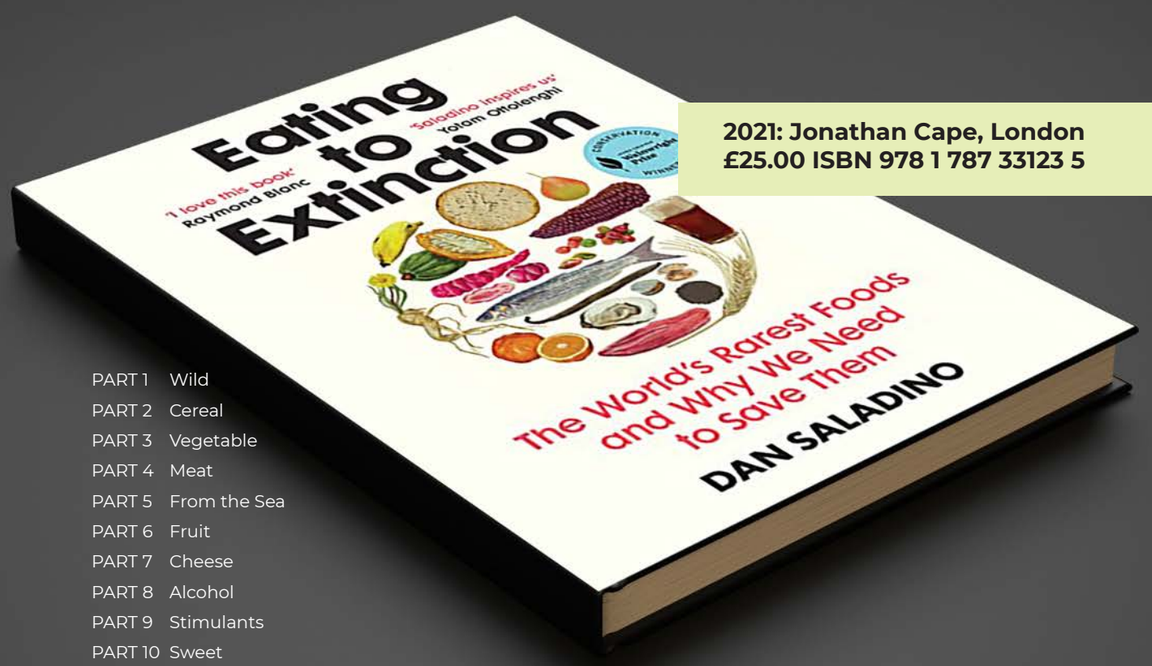
By Dan Saladino

This book was a very welcome gift. I knew it was going to be a good read when it opened with a quotation from *Silent Spring*, a top ten science book of all time and a personal favourite of mine.

Nature has introduced great variety into the landscape, but man has a passion for [over] simplifying it. - Rachel Carson

The book covers 36 case studies under the 10 headings below and there are common themes here with IN SEARCH of PERFUMES: A Lifetime Journey into the Sources of Nature's Scents which is also reviewed in this edition of IFEATWORLD.

It is impossible to forget the impact of climate change last winter: freak cold and snow in the USA, balmy Mediterranean temperatures in Central Europe, and life-threatening floods in Australia and California: this, in addition to last year's disastrous floods in Pakistan. What is the link to biodiversity?



2021: Jonathan Cape, London
£25.00 ISBN 978 1 787 33123 5

PART 1 Wild
PART 2 Cereal
PART 3 Vegetable
PART 4 Meat
PART 5 From the Sea
PART 6 Fruit
PART 7 Cheese
PART 8 Alcohol
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PART 10 Sweet

BOOK REVIEWS

Let us start with the Haber Bosch process to convert N2 to NH3. This produces some 157 million metric tonnes of ammonia and in the process consumes 1% of the world's total energy needs and releases 451 million metric tonnes of CO_2. To add insult to injury, excess nitrogen fertiliser run-off pollutes rivers and lakes with algae growth: eutrophication. The green revolution that feeds the world comes at a high cost. This is a 20th Century problem getting worse in the 21st. For over 10,000 years farmers had no Haber Bosh nitrogen. They had no need. It is possibly an oversimplification to say but they worked in synergy with nature, not forcing the issue. Genetic diversity, fallow lays, and intercropping were the order of the day. Those peas, beans, and clover do not need extreme temperatures and elevated pressures. They just quietly get on with the business.

In Chapter 22, Kayinja Banana, Dan Saladino provides an excellent cautionary case study overview. Bananas are a £14.7 billion industry with 20 billion tonnes of the fruit eaten around the world. Disaster hit the industry in the mid-20th century when the sterile (genetic monoculture) Gros Michel banana succumbed to the Panama disease. The brilliant solution was to introduce another monoculture with the Cavendish banana. After all, lightning will not strike twice in the same place: wrong! The world's banana industry is threatened with another fungus disease TR4. In Uganda the banana is not just a nice snack but a key staple food and a main source of carbohydrates for a substantial proportion of the population. Here, diversity is still the order of the day with food markets offering whole sections dedicated to a variety of different bananas. Work is in hand to capitalise on this with parallel efforts exploiting genetically modified and gene-edited bananas. The foundation of this is a rich heritage of diverse genes not found in the vast monoculture fields of South America but preserved here.

The green revolution had unintended consequences and the consolidation of seed companies compounded the issues. Wheat is one of just a handful of grains that now feed the world. It was thought that TR4 type problems could not hit our wheat production but this has been proved wrong as a fungus disease *Fusarium graminearum* is on the march. Wetter summers and shorter varieties allow the fungus to spread from the soil to the head. Chapter 5, Kavila Wheat, describes the 10,000 year history of wheat development. A problem with high yielding varieties introduced in the 20th century was that tall varieties were difficult to harvest. A quick fix was to move to shorter varieties. Soil-borne disease can now splash onto the heads. Heroic trail blazers fought for seed banks to rescue and preserve genetic diversity of wild and heritage wheat varieties (as well as other plants). This is providing a lexicon of genetics to draw upon to meet new challenges.

Genetic diversity is not only restricted to plants and animals but to the microbiological arena. The scientific literature is replete with how important the microbiome is to our health. One question often asked is 'if flavour is linked to odour, then what is the difference in the study of flavours and perfumes?' Well, perfumery material production does, in certain instances, depend on enzymic reactions (e.g. curing of vanilla). However, in food technology, microbiology is much more important. One of my favourite quotations, unusually for me from a politician, is from Charles de Gaulle, 'how can you govern a country that has 246 varieties of cheese?' My local Aldi stocks a mountain of cheese, yet I travel 20 miles to get my fix of Dorset Blue Vinny. Chapter 25 extols the virtues of Stichelton, a 'true' Stilton cheese made in the traditional way. This naturally produced cheese is made from unpasteurised milk. Under European Union law, Stilton may not be made from unpasteurised milk. Mass production tends to require mass standardisation which is not possible with flavours produced from 'wild' bacteria that can vary. Standardisation requires a more uniform starting point with sterilised milk and laboratory quality-controlled bacteria. The result is good cheese produced on an epic scale. The uniformly good (homogenisation) has a problem, it can squeeze out the truly excellent and unique. The resistance to the loss of the distinctive cheeses is nicely summarised by Dan Saladino:

> ***... to a small group of cheese enthusiasts, what had taken place was nothing less than an act of cultural vandalism and agricultural tragedy.***

Dan Saladino

Diversity, as this book proclaims, is not just a nice hobby for enthusiasts practising living archaeology but a vital hedge against an uncertain future. Food, drink, and perfumes have a common link; they are also part of humanity's multivariant culture. Just for once what is good for us physically (e.g. a good natural biome) can also bring joy and celebration into our lives.

It is impossible to do justice to this book in a short review. Much like *Silent Spring*, it is written in accessible language not requiring a PhD in Genetics. It is well researched with some 100 pages of further reading and notes to take the dedicated researcher to the frontiers of the subject. This is a book for everyone, not just the specialist. Food is vital for life, providing calories for energy but is also a part of our cultural identity, just as perfumery is more than a nice smell.

As I researched a few facts for this review I was struck by the paradox of the internet. It does provide mass media and can promote groupthink. However I can also find that farm shop that will allow me to buy my Blue Vinny, Shropshire Blue etc online. Do go and explore our heritage foods and help preserve the environment at the same time! After all, it may only be a click away!

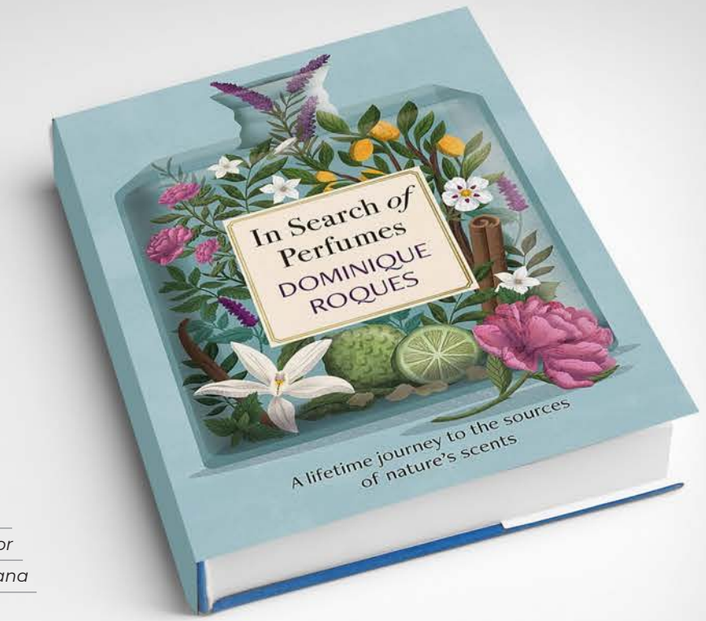
IN SEARCH of PERFUMES: A Lifetime Journey into the Sources of Nature's Scents

By Dominique Roques [Translated from the French by Stephanie Smee]

Recently I was in Waterstones, a major UK bookshop, and the racks of books were neatly arranged by type (fiction, non-fiction etc.); Non-fiction was organised by interest area. I do not envy the bookseller attempting to classify this splendid book. Is it: autobiography, a travel book, about world religions, a historical review, a case study in business studies, or focused on perfumes? It is, in fact, all of these. As we track regulatory affairs, the green agenda and technological advances we can forget the heritage and human aspect of perfumery. When people learn of my teaching about essential oils and natural extracts they often ask 'What is it like teaching such a specialist subject?' This book is a vivid explanation that it is not a specialist narrow subject. It is a lens through which the sweep of civilization and society can be viewed.

At the end of the year the magazines are full of book reviews including many biographies/autobiographies. Many of these, particularly those by politicians, are self-serving. We get to know Dominique in a different way as he lovingly describes the rich diversity of people and cultures linked by one passionate obsession: the production of wonderful natural aroma materials. In this, I am reminded of the jewellery trade. People go to endless lengths to produce beautiful gems just as a perfumer may use a rose oil to assemble into exquisite fragrances for us to wear and enjoy. We get to know the author further by him sharing his passion for these exquisite materials and the people who are the custodians of their continued production.

Every year, Classic FM, a UK music channel, runs its 'Hall of Fame' poll for listeners to select their favourite classical piece. From this, they assemble their top 300 all-time greats. Dominique's aroma selection is a good starting point for the top 20 favourite aroma materials. I have been honoured to join a galaxy of industry personalities to write about my favourite essential oil for IFEATWORLD. The back catalogue makes enjoyable and informative reading. I found a real dilemma in getting down to a single selection. How do you compare the radiant brilliance of bergamot oil with the heady depth of Indonesian patchouli or Haitian vetiver? Fortunately, unlike the Classic FM 'Hall of Fame', there is no such attempt to rank the beauty of these materials in this book. The sensuality and exquisiteness of the materials each stand in their own right. However, I had a real quandary in selecting chapters for this review so have taken a very personal approach and selected just three of them which also have a special place in my life in the industry.



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On joining the industry in the mid-1960s, I was tasked with the synthesis of selected materials as GC/IR standards. A few essential oils (e.g. petitgrain) have small amounts of nitrogen chemicals that are key to their characteristic odour. An oddity (for that time) appeared in the literature: the discovery of two sesquiterpene alkaloids, patchouli-pyridine and epiguai-pyridine, in patchouli oil. I singularly failed in my synthesis attempts but it was my first intimate encounter with an essential oil. Dominique introduces us not only to the iconic status of patchouli as the signature odour of the swinging-60s but then takes us to the new plantations of Sumatra. The laborious process of drying the harvest before distilling is well described. This is followed by an outline of the perfumery equivalent of diamond cutting and setting of patchouli to produce one of the greatest landmark original fragrances, Angel. We will return to patchouli later in this review.

Angel and patchouli naturally take us to vanilla and 'Queen of the Unhappy Tropics: The Vanilla of Madagascar.' One of the features of treasured aroma materials is the amount of effort and skill to produce them. Think of a single rose: it takes three tonnes of roses to produce a single kilogram of rose oil. The vanilla plant must be carefully tended and pods treated to yield the fine full vanilla odour/flavour profile so valued by consumers around the world. Tutor trees shade and support the vine. When in blossom, the flowers are hand pollinated. The ripened pods need blanching and drying over some four months. During this slow process enzymic reactions take place to produce the treasured deep and complex aroma. Such perfection is not achieved without skill and dedication. Synthetic vanillin (Note 1) is a small fraction of the price of natural vanilla. It is the complexity of natural aroma products which impart the prized organoleptic qualities to the materials. This commitment to quality is well described by the author.

On entering this industry, I was sceptical of the 'halo' effect of natural aroma products, after all, pure is chemically pure. Synthetic linalool is a small fraction of the price of rosewood oil. OK no problem, just do a little bit of GC/MS and identify the impurities and just as the philosopher's stone can convert base metal into gold, we could turn synthetic linalool to olfactory gold of rose wood oil with just a pinch of the right chemicals. It was a lesson well learned. Even to my untutored nose It was not possible to achieve this transformation.

I now turn to a special feature of this brilliant and insightful book. It tells the real story. Just as greed for gold has despoiled land with mercury used in illegal mining for the metal, the prized value of rosewood oil became a curse. After the Great War the product boomed and some 10,000 tons of wood a year were processed. This was not agriculture but extraction without renewal. Production in Brazil was also problematic. The tree is now C.I.T.E.S. (Note 2) listed. The progress in cultivation of the wood is described. I am reminded of the production of sandalwood oil in Australia where a long-term movement is in progress to ensure future supplies. The complex history of sandalwood oil is also well described in: The Sacred Tree: Sandalwood in India and Australia.

I return to my MBA teaching. No discussion of marketing would be complete without a discussion of Relationship Marketing: the move from the 4Ps (well 7Ps if talking about services!) to the 30Rs of relationship marketing. Students tend to be astonished when I start to cover Gummesson's relationship [marketing] number 17: The Criminal Network. 'What!' they say 'has that to do with day-to-day marketing?' Well, each weekend I back-up my hard drive and ensure my virus checker has been updated. Scarcely a day will pass without scam emails from criminals attempting to defraud and steal from me. Criminality is part of our day to day working lives. Often in the discussion of essential oils there will be a section on adulteration and its detection. The discussion is usually largely technical around GC/MS and like methods of investigation. Dominique's book does not avoid the human dimension. Theft and worse has devastated the sandalwood industry in India. This is the only book I have read that covers so well the more complex (non-technical) aspect of natural aroma product production.

As promised at the start of the review, I return to the author's masterly cover of patchouli. He gives a good account of the great patchouli oil crisis of 1976 where drums of water were shipped in place of patchouli. An exporter was caught out with a price spike (remind

Dominique Roques

you of 2022 gas trading?) and had fraudulently defaulted on forward contracts. The book *IFEAT: 40 [years] celebrating IFEAT around the world 1977 -2017* gives a good factual review of the events and the birth of IFEAT. However, Dominique gives us more with an insight to the emotion that surrounded the formation of IFEAT and the enduring importance of IFEAT and its annual Conference in the conduct of the industry.

This is a remarkable book, not to be missed. To newcomers to the industry it provides a historical background; where we are is in part determined by where we have come from. For professionals in the industry it is good to see the full multidimensionality of the industry explored. Many passionate people have and continue to produce these products and their colourful lives and commitment to excellence are well described. This book has a place on everyone's bookshelf. Dominique Roques has done a great service to the industry. This is much more than another coffee table book. It is an insightful account of the real industry: past and present. Do read and enjoy!

Note 1:
Synthetic vanillin is a technical classification. A major source of it is derived not from the processing of petrochemicals but as a by-product of wood pulping to produce lignin vanillin. The final product is extremely pure but lacks the radiance and complex depth of the true natural product.

Note 2:
C.I.T.E.S: Convention on International Trade in Endangered Species of Wild Fauna and Flora

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IFEAT is delighted to announce that next year's Conference will be held in Bangkok, Thailand from Sunday 10th to Thursday 14th November at the Marriott Marquis Queen's Park Hotel.

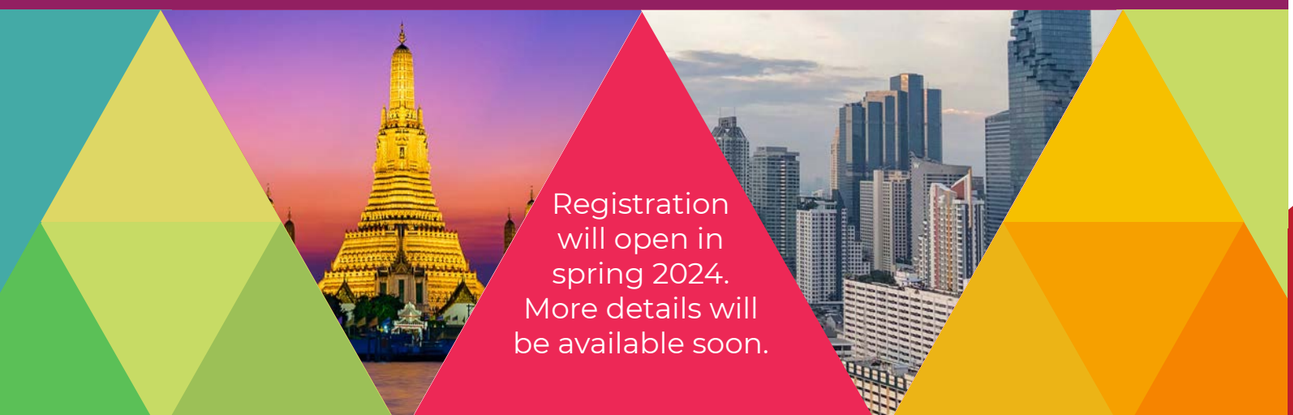
Since its earliest days as the capital of Thailand to its current incarnation as a massive city in the twenty-first century, Bangkok has captivated tourists for over 200 years. Every sense is on high alert in this place as numerous golden spires peer over wooden houses, musical neon-lit boats cruise the inky Chao Phraya River, saffron-robed monks ride past on tuk-tuks whilst a monorail weaves between the skyscrapers.

Bangkok is the largest city in Thailand and is home to more than 10 million people. It has evolved into one of Southeast Asia's most important and contemporary cities as a result of its expanding economic growth and enormous appeal as a destination for tourists.

The city is situated on the banks of the Chao Phraya River and was known as the Venice of the East because it relied on a vast network of canals for transportation between the 16th and 19th centuries.

With a significant international airport, it serves as the starting point for many travels to Thailand and other parts of Southeast Asia, but there are many good reasons to visit the city.

In Thailand, the expression "same same, but different" is used to describe practically everything. Alongside soaring glass skyscrapers, stylish rooftop bars, and enormous contemporary malls are bustling traditional markets and beautiful golden temples where you can immerse yourself in the local culture as it has been for decades.



Registration will open in spring 2024. More details will be available soon.

IN THE NEWS

Antimicrobial research finds Australian essential oils could prevent food and packaging waste

A Deakin University, Australia, winner of the Three Minute Thesis presenter is developing a prototype for antimicrobial food packaging that could help extend product life and reduce food waste and illness.

Agnes Mukurumbira from the Deakin CASS Food Research Center makes the food packaging prototype using native Australian essential oils. She is investigating using plant-based antimicrobials to help kill the bacteria and fungi that grow on foods.

To read the full story visit:
https://bit.ly/3qHmQmj

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SUNDAY 2ND JUNE TO FRIDAY 7TH JUNE 2024

IFEAT Türkiye Study Tour
Sunday 2nd to Friday 7th June 2024

IFEAT's first Study Tour to Türkiye will take place from 2nd to 7th June 2024 in western Türkiye starting in Izmir on the Aegean Sea and finishing in Antalya on the Mediterranean Sea. Türkiye produces a range of essential oils and is the world's largest producer of oregano and laurel leaf, and the second largest rose oil producer.

Delegates will gain an intimate knowledge of the growing, production, processing and marketing of these products alongside viewing both very modern and traditional distillation units. Following the Welcome Reception on the Sunday evening, the following four days provide an excellent programme of field and company visits enabling delegates to meet with Turkish producers, processors, and exporters. In addition, delegates will spend the tour with other F&F industry professionals from a variety of countries and disciplines - an intense learning experience.

The tour will focus on technical and economic aspects of essential oils, but this will be combined with an introduction to Türkiye's rich history and heritage as well as the excellent local gastronomy. Like the previous 14 IFEAT Study Tours, it will be enjoyable, educational, and unforgettable. Registration will open in early November and is limited to one delegate per IFEAT Member company. Since Study Tours are very popular, delegates are advised to book early.

For more information on the **Türkiye Study Tour** visit: **www.ifeat.org**

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IFEAT SOCIO-ECONOMIC REPORT ORANGE

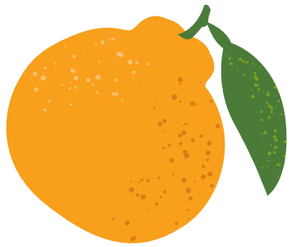
By Dr Peter Greenhalgh

IFEAT SOCIO–ECONOMIC REPORT ORANGE

By Dr Peter Greenhalgh[1]

Citrus sinensis

Family: Rutaceae



INTRODUCTION

Citrus species are grown throughout the world and citrus is the most important tree fruit crop. Citrus oils are the largest group of essential oils with orange oil and its derivatives being by far the largest citrus oil, followed by lemon. The orange fruit is obtained from the orange tree (*Citrus*) the origins of which are cited as southern Asia around 4,000 years ago. Trade and wars led to the expansion of cultivation and during the Middle Ages oranges were taken to Europe by the Arabs. One of Columbus's expeditions brought seedlings to the Americas in 1500.

Oranges are produced worldwide, predominantly in tropical and sub-tropical regions. Fresh fruit and juice are the dominant revenue streams from orange production but the fruit provides other products including various essential oils and essences. Some very large orange growers, particularly China, Egypt, and India, produce negligible amounts of orange oil. The production of orange oils and other derivatives account for only a relatively small but increasing proportion of the revenues generated from the orange sector. Nevertheless, income from essential oils and limonene is an important contributor to profitability for orange growers and processors, as well as helping minimise risk since different markets with different dynamics are supplied. This is driven by the amount of fruit which goes to processing. In some major orange growing countries, most of the fruit is consumed as fresh fruit rather than juice, so the processing industry is small.

Brazil is the world's leading orange grower and processes most of its production into a range of orange products driven by orange juice concentrate. This contrasts with most other orange producing countries where growers aim to sell their fruit into the fresh fruit market. Fruit that does not meet specifications is processed into juice, and the essential oil is a by-product of producing juice. Brazil dominates global orange oil production with smaller quantities from Mexico, USA, South Africa, Spain, and Italy.

Since oranges are grown in both the northern and southern hemispheres and on all continents, they are available throughout the year. Brazil and South Africa are the major southern hemisphere producers and harvesting and processing is usually undertaken from June to December. The major northern hemisphere producers are, in scale of production, Mexico, USA, Spain, and Italy, with harvesting and processing taking place from November to June.

This report deals with sweet oranges from *Citrus sinensis* and not bitter orange (*Citrus aurantium*), which is the source of various aromatic materials including bitter orange, neroli, and petitgrain oils. Interestingly, the prices of these oils are much higher than orange oil in part because no juice and very few other by-products are produced. The following sections discuss the growth characteristics, varieties, and range of orange products; the processing, uses and varieties; global trends in production and in major producing countries; major challenges, price trends, economic, social, and environmental aspects.

GROWTH CHARACTERISTICS AND VARIETIES

Sweet orange trees have a long gestation period, taking three to four years before the first fruit harvest. Fruit yields decline after approximately 12 years and invariably trees are replaced after approximately 18 years. Thus, decisions made 20 years ago affect the industry today and decisions being made today will continue to affect the industry for 20 years.

Many hundreds of different varieties of orange trees are grown. These can be separated into several sub-groups including:

- Navel orange (e.g., Washington, Bahia, Cara Cara, Lane Late)
- Common blond orange (e.g., Valencia, Pera Pera)
- Blood/pigmented orange (e.g., Tarocco, Moro, Sanguinello)
- Sugar/acidless orange (e.g., Succari, Lima)

Considerable R&D is being undertaken by the larger orange producers and governments to increase output and yields as well as overcome pests and diseases, which are an increasing problem.

Brazil has three main orange varieties:

- Early varieties (Hamlin, Westin, and Rubi) with less yield and lower aldehyde content, and fruit nine months after blooming.
- Middle variety (Pera), better yield and higher aldehyde, stronger fruit, 12 months after blooming.
- Late varieties (Natal and Valencia), blooming comes later and fruit comes 12 months after blooming.

Climatic and soil conditions mean there are orange harvests practically the whole year round in Brazil. As regards varieties, 55% of the oranges grown in São Paulo State are Natal, Valencia, and other late-harvest varieties, 23% are Hamlin and early-harvest varieties, and 22% Pera, as well as other mid-season varieties. Late varieties are more productive and preferred by growers. Different varieties are planted to try to ensure more regular production as well as manage disease and reduce the impact of climatic factors. Several research institutes are devoted to orange in São Paulo and Minas Gerais. They are trying to overcome citrus canker and HLB disease (Huanglongbing also known as "greening"), as well as increase productivity. The different varieties help to keep factories running for a longer time than simply relying on one variety. All varieties are blended to standardise production and nature. Single variety oils like Valencia are usually only available from small processors in the south of Brazil.

To start blooming the tree can be stressed in two ways, either by water or temperature. A tree may have up to four different bloomings at four different times. Pickers will do their best to pick the best fruits for the fresh market and/or processing. Because of the multiple blooming there is no mechanical harvesting, only hand harvesting. If the tree is shaken it could be damaged and all the fruit could fall. In Brazil the dates of the blooms are the first usually in June/July, second in August/September, third in October/November, and fourth in December/January. The dates can vary between trees and orchards. Regarding the 2022/23 crop's production, 27.5% of production was in the first bloom, 58.3% in the second bloom, 12.4% in the third bloom, and 1.8% in the fourth bloom.

ORANGE PRODUCTS

Citrus processing and the recovery of citrus by-products (e.g., juice, peel oil, aroma and essence oils, frozen pulp cells, and cattle feed pellets) are vital economic components of citrus production, especially when large volumes of citrus are processed. Oranges have practically no waste, with most parts being used. An average orange is made up of pellets/peel (49.25%), juice (43%), frozen cells (2.70%), essential oil (0.2% to 0.4%), pulp wash (1.75%), d'limonene (0.092%), water phase (0.46%) and oil phase (0.011%). Both oil phase and water phase are dependent on juice being produced - none is produced if the juice is sold as NFC (not from concentrate), which is an increasing amount. The components and product yields vary between species, countries, volumes processed, equipment used, and their efficiencies. One guesstimate suggests that one metric tonne (MT) of oranges not only provides revenue from citrus pellets, pectin, and cattle feed, but also, more importantly, approximately 100 kg of frozen concentrated orange juice 65 brix (FCOJ), 3-4 kg of orange oil, 1-1.5 kg of limonene, 0.1 kg of oil phase essence, and 1 kg of water phase essence. Interestingly it is sometimes green oranges that are processed - suggesting the term "orange" is a misnomer! The green colour is chlorophyll which decreases after exposure to colder temperatures allowing the carotenoids to dominate leading to orange skins. Sometimes the oranges may be affected by HLB ("greening") which is not desirable.

Figure 1 shows the cross section of an orange in which four different types of orange essential oils are located, two from the peel and two from the fruit. The waxy cuticle is the fruit's outside protective barrier. The flavedo region immediately below is made up of oil glands from which two types of essential oil can be extracted. Below this is the albedo, the sponge-like white portion of the peel, which consists of large cells rich in pectic substances and hemicelluloses. The edible portion is the endocarp, made up of segments containing juice vesicles. Within the juice's composition there are two other flavouring components, namely the oil and water phase essences.

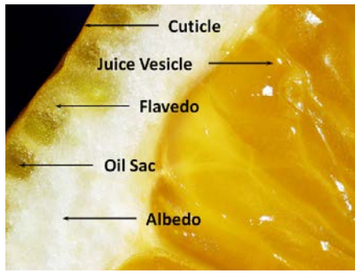


Figure 1: Structure of Orange Fruit
Source: Walsh (2008)

PROCESSING

Usually, the main aim of citrus farmers is to sell fruit into the fresh fruit market while any fruit that does not meet specification is often sent for juice processing, and the oil is a by-product from juice production. Brazil and Florida are the major exceptions in focusing on growing oranges for processing - Brazil (and Mexico) producing FCOJ while Florida produces NFC. Processing of orange is invariably undertaken close to where oranges are produced – they are not shipped and then processed, although there have been very rare exceptions such as when Cuba shipped fresh oranges to East Germany for processing. The recovery of citrus by-products is an increasingly important economic feature of citrus processing operations and the long-term upward trend in orange oil prices can have a significant impact on profits. It is particularly appropriate when large volumes of fruit are processed. Therefore, many juice processors have installed state-of-the-art centrifuges to maximise yields and de-winterising machinery to remove waxes.

While most essential oils are extracted by steam distillation, citrus oils, including orange, are extracted as a by-product of juice extraction by centrifugation, which produces a cold pressed orange oil (CPOO). The oil is extracted, without heat, from orange peel, predominantly using JBT (FMC) and, to a lesser extent Brown extractors, to express the oil from the fruit, although there are other extractors. The oil is captured in water and this oil and water emulsion can be separated using centrifuges. Essence oil and water phase essence are by-products of the juice concentration processes which Dr James Redd developed the processes for in the early 1960s - and as a result is considered the father of Florida's flavour industry. The CPOO is isolated from the surface of the peel by scraping the surface and washing off with water. This is centrifuged to yield CPOO.

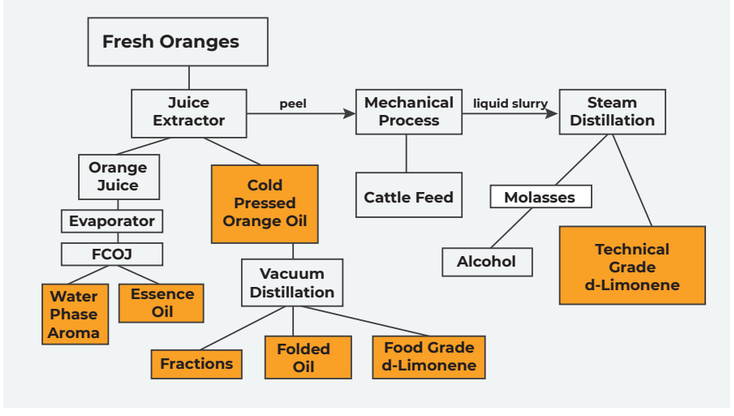


Figure 2: Orange Processing Flow Chart
Source: Florida Chemical Company

Figure 2 illustrates the complex industrial scale process by which oranges are processed into a range of orange products. The processing operations are usually very large scale, handling many thousands of tonnes of oranges each day. Following harvesting, the fruit arrives on large trucks and is washed, graded, sorted, and delivered to the extraction plant to produce three different streams: juice, peel oil, and peel solids. Cold pressed orange oil (CPOO) is liberated from the peel by pressing or rasping. The juice is then squeezed from the orange using modern commercial orange juice extractors designed to efficiently remove oil without changing its intrinsic properties. The two alternative approaches are (a) rasping the peel to force the oil out of the cell or (b) pricking the skin and rupturing the oil cell:

- JBT (FMC) equipment is the most used. It was developed around 1950 and extracts the oil and juice together but gives a lower oil yield. It punctures the outside of the skin releasing the oil, and simultaneously perforates the centre of the fruit to remove the juice and pulp. Many hundreds of fruit per minute can be processed. For greatest efficiency the fruit should be the same size and shape as the cup. FMC/JBT lease rather than sell their machines and when the patent expired, a Spanish copy called Exzel came on to the market, which can be bought.

- The Brown oil extractor from the USA uses a two-step system, like the Italian raspers (known as pelatrices or sfumatrice machines) but instead the peel is cut with small knives, and then in a second step the juice is extracted. It gives a higher yield of oil, which may be as much as 0.05%, but some believe the juice is of a poorer quality. Brown machines are also only leased. FMC has developed a similar oil extractor called the MORE.

When the extraction process is completed, the juice has the pulp and seed fragments removed. The juice is either pasteurised to produce not-from-concentrate (NFC) or evaporated into concentrated orange juice. Evaporators are used to concentrate the juice to approximately 65° Brix with most of the water removed. During the concentration of this juice, orange oil phase essence ex juice and orange water phase aroma (also called orange aroma) are removed and captured. In addition, the spent peel solids may be further processed at the feedmill to obtain several additional by-products. The main objective is to remove moisture from the peel and recover the remaining peel oil (approximately 40%) not collected by the FMC or Brown extractors. After lime (calcium hydroxide) addition and pressing of the peels, the press cake is dried to produce animal feed. The press liquor is distilled in the waste heat evaporator to concentrate the molasses and obtain feedmill d-limonene, normally at a minimum of 93% pure.

The main component of orange oil is limonene (up to 95%) but it can also be recovered from waste peel in the feedmill during the juice making process. Whereas orange oil is extracted using a mechanical process, d-limonene is produced by distilling orange peel. D-limonene can be obtained in several ways:

Food grade

- After cold press extraction, the water and oil can be separated and the waste water fractionated to obtain d-limonene food grade.
- Obtained from folding orange oil to produce orange terpenes food grade.
- Obtained from folding orange oil phase oil.
- The peels can be further pressed using charcoal and solvent to extract d-limonene technical grade. After lime (calcium hydroxide) addition and pressing of the peels, the press liquor is distilled in the waste heat evaporator to obtain technical d-limonene.

The volume of d'limonene produced is difficult to quantify but one industry source suggests that current annual production is approximately 35,000 MT (20,000 MT of technical grade + 15,000 MT of food grade d-limonene) as well as 40,000 MT of orange oil. Orange oil and d-limonene production vary according to the volume of oranges processed, the equipment used, the maturity and variety of the fruit.

Until recently, Brazil traded approximately 60%-65% of all orange oil and d-limonene produced in the world, followed by the USA with 25%-30%. However, the recent collapse of Florida's orange fruit production has led to a sizeable increase in Brazil and Mexico's global share.

The oil phase and water phase are referred to as "essences" and obtained by concentration of the juice. There is a shortage of these two products because of decreased demand for concentrated orange juice, and rising consumer preference for NFC orange juice, which does not lead to the production of orange essence oil. NFC dominates USA production and Brazil and Mexico produce approximately 80% and 20% of orange essences available globally. Over the past decade production of orange essences has fallen considerably with the growth of NFC production.

The crude orange oil and essence oils can be further processed into other products often used as ingredients for the F&F sector. The range of aroma chemicals that can be extracted from CPOO include aldehyde C8 octanal (0.4%), myrcene (1.5-2.0%), d-limonene/orange terpenes (95%), 8-3-carene (0.1-0.15%), linalool (0.5%), decanal (0.5%), sinensal (0.05%). In addition, ethyl butyrate can be extracted from the orange oil phase essence ex juice while valencene (used to produce nootkatone) can be extracted from d-limonene. For octanal and decanal, orange oil has been one of the cheapest natural FEMA/GRAS sources. Indeed, one of the benefits of orange oil as a production source was that its by-products or terpenes could be priced at approximately the same level as the starting or raw material oil. For many years it was considered that the terpenes should be approximately 20% cheaper than CPOO. This is not the case today, since the price of terpenes is limited by other competing substances derived from the pine industry.

One process is fractionation using complex distillation columns – known as folding oils – whereby the terpenes are removed to leave a more water soluble folded oil widely used in the beverage industry. D'limonene is used as a natural cleaning agent or degreaser and can be used in emulsions. Natural isolates are also fractionated from the oil, these will be used by flavour houses to enhance flavour profiles. Single fold citrus oils are also made into various forms of flavours and fragrances depending on the application.

To summarise, the following orange by-products are recovered from the processing operations:

From the peel:

1. *Cold pressed oils (orange oil, peel oil, CPOO)*
- 96-99% volatiles (97% monoterpenes, 4% oxygenates)
- 1-4% non-volatile wax residue
- Used for flavour and fragrances; imparts peely, citrus nuances

2. *Feedmill d-limonene*
- Evaporated product (97% monoterpenes, 4% oxygenates)
- Considered technical grade (non-food grade) material

From the juice:

3. *Essence oil phase (essence oil, OEO)*
- Evaporated product (96% monoterpenes, 5% oxygenates)
- Used for flavour and fragrances; imparts fresh, juicy, citrus nuances

4. *Essence water phase (aroma/aqueous essence)*
- Evaporated product (85% water, 13% ethanol, (^1% oxygenates)
- Used as flavour material; imparts fresh, juicy, citrus nuances

Source: Walsh (2008)

USES

Orange has excellent health properties and has multiple uses, mainly as fresh fruit, then as juice followed by as an essential oil. It is more widely used than any other essential oil and with its derivative d-limonene is used in a wide range of products and industries. The main sector buyers are the F&F industry followed by the resin manufacturers and increasingly in aromatherapy.

Large supplies of orange by-products over the past few decades have enabled them to penetrate many markets but higher prices are leading to significant changes. D-limonene has diverse and growing applications as a solvent, cleaning agent, fragrance additive, and is used by the resins industry in the manufacture of adhesives, tyres, and chewing gum. Limonene is also used to synthesise aroma chemicals such as l'carvone, an important flavour ingredient used in mint flavour compounding in confectionery and oral care. It is also used in the electronics industry as a degreaser and is a starting monomer for block copolymers, butyl rubber and polyisoprene rubber, and in paint solids to impart an orange fragrance.

However, some sizeable industrial uses a decade ago – including 20,000 MT of limonene - have been considerably reduced when the price of limonene jumped from the US$ 1.00/kg level to US$ 6.0/kg leading to long-term reformulations and a sharp drop of demand to less than 10,000 MT a year, even despite a limonene price decrease to levels below US$ 3.00/kg. It is interesting to note that 100% pure d-limonene has no odour, but lower purity has aldehyde c8 (octanal) which gives it odour.

Applications of orange oil include:
- Folded oils for use in flavour compounds (mainly 5x and 10x, with orange terpenes food grade as by-product) with beverage applications being the main one.
- Extraction of flavour natural molecules like decanal, octanal, linalool, and valencene.
- Use in fragrance compounds.

Thus, the sectors using orange products are remarkably diverse - flavours, fragrances, aromatherapy, pharmaceuticals, cosmetics, beverages, bakery, agriculture, oral care, detergents, animal feeds, cleaners, construction materials, confectionery, solvents, pest control, liqueurs, electronics, polishers, plastics, adhesives, paints, resins, disinfectants, and tyres.

However, demand for orange derivatives has become increasingly unbalanced. The market for the dominant products, FCOJ and NFC, has been decreasing for several reasons. Meanwhile, the demand for orange oil and terpenes/d-limonene had been increasing. In part, this was because of new applications and they were being used as substitutes for other products, such as kerosene, acetone, and turpentine as well as starting materials for chemical processes, because until recently they were seen as relatively cheap.

In addition, they are viewed by consumers as a natural product, non-toxic, eco-friendly, and have a lower carbon footprint with net global warming potential. Terpenes are marketed as both nature friendly and human friendly. There are synthetic substitutes but they are too expensive and not readily available, and are not acceptable for use in F&F.

As a result, revenues from oil and derivatives have become significantly more important over the past decade in the economics of orange processing. To keep orange oil and derivatives at acceptable prices for intensive industrial use, it helps that the main processors in Brazil have been running international campaigns to encourage consumers to drink more orange juice.

QUALITY

Quality has become increasingly important as consumer demands have become more stringent. Almost every year new parameters are set which must be complied with along with the old specifications. Moreover, quality specs can vary between different markets and end uses. An increasingly key issue relates to the level of agricultural residues both on the fruit and in the oil. This is discussed in greater detail below.

The quality of orange oil is influenced by several factors. Like most oils, a key factor is the percentages of various aromatic components - orange oil is composed mostly of d-limonene (>90%). Along with d-limonene the constituents in the oil are considered as terpenes, alcohols, and aldehydes. The compounds in the oil can vary depending on the variety, the extraction process, the location, and the weather. Some oil is juicier or fruitier than others, mostly due to the aldehydes and top notes and these notes are often sought after by buyers. Aldehydes can be quite unstable and volatile. One recent undesirable trend has been lower levels of aldehydes, making it increasingly difficult to find premium grade, considered to be a minimum 1.2%. Levels of aldehydes vary between orange products. Thus, single orange oil can range from 0.6% - 1.7%, folded oils, 5-fold 3.6%, 10-fold 7.1%, 20-fold 14.5%, orange terpeneless 41% and orange terpenes 95% - 0.2% aldehyde.

PRODUCTION CHARACTERISTICS

Over 100 countries predominantly within 40 degrees N and S of the Equator produce oranges. Approximately 50 million metric tonnes (MMT) of oranges are produced annually, of which approximately 40% are processed i.e., 20 MMT. Tables 1 and 2 provide estimates of world orange production and processing by major countries.

Table 1: Orange Production for Selected Countries 2018/19 - 2022/23 ('000 MT)

Marketing Years	2018/19	2019/20	2020/21	2021/22	Forecast from July 23 2022/23
Brazil	19,298	14,870	14,676	16,932	16,753
China	7,200	7,400	7,500	7,550	7,600
European Union	6,800	6,268	6,531	6,720	5,856
Mexico	4,716	2,530	4,649	4,595	4,200
Egypt	3,600	3,200	3,570	3,000	3,600
USA	4,923	4,766	3,981	3,108	2,288
South Africa	1,590	1,414	1,511	1,609	1,630
Turkey	1,900	1,700	1,300	1,750	1,320
Vietnam	855	1,017	1,150	1,150	1,583
Argentina	800	700	750	830	800
Morocco	1,183	806	1,039	1,150	783
Australia	515	485	505	535	505
Costa Rica	295	285	290	300	305
Chile	140	135	200	164	174
Guatemala	178	180	180	180	168
Other	309	356	356	397	377
Total	**54,302**	**46,102**	**48,186**	**50,410**	**47,765**

Source: USDA

Table 2: Orange Processing for Selected Countries 2018/19 - 2022/23 ('000 MT)

	2018/19	2019/20	2020/21	2021/22	Forecast from July 23 2022/23
Brazil	14,362	9,915	10,118	12,291	12,090
Mexico	2,200	900	2,200	2,150	1,760
USA	3,378	3,050	2,498	1,826	975
European Union	1,309	848	996	1,110	831
Egypt	360	335	350	300	300
China	520	400	350	249	220
Costa Rica	216	213	215	218	218
Australia	210	195	226	215	210
Argentina	307	190	186	200	200
South Africa	333	76	123	174	155
Other	197	182	196	219	192
Total	**23,392**	**16,304**	**17,488**	**18,952**	**17,151**

Source: USDA

Global orange production for 2022/23 is expected to be 5% lower at 47.8 MMT compared to the last crop owing to lower production in the European Union (EU), the USA, and Turkey, offset partly by a larger crop in Egypt. Fruits allocated to processing will be reduced, resulting in less orange oil production. The actual amount of processing will be dependent on the value the processor can derive from the juice and orange oil produced. Brazil dominates orange processing but the dramatic fall in recent US orange production which means that for the first time in history, Mexico is the second largest orange processor, followed by the USA and the European Union (EU).

The volume of orange oil, terpenes, and d-limonene produced is directly related to the quantity of oranges processed for orange juice. In 2022/23 orange juice production was estimated to be 9% lower at 1.5 MMT (65 degrees Brix) - equivalent to almost 2 MMT of oranges. Juice production fell because of the reduced fruit available for processing in the four major producing regions, namely Brazil, Mexico, the EU, and USA as illustrated in Figure 3. This in turn reduced the amount of orange by-products produced. Figure 3 illustrates trends in the production of orange juice - which in turn can be used as a proxy for the trends in production of other orange by-products. Orange juice - and therefore by-product production - has been substantially lower in the last four years than in previous years, leading to the sizeable rise in by-product prices.

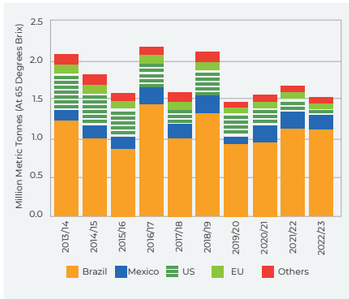
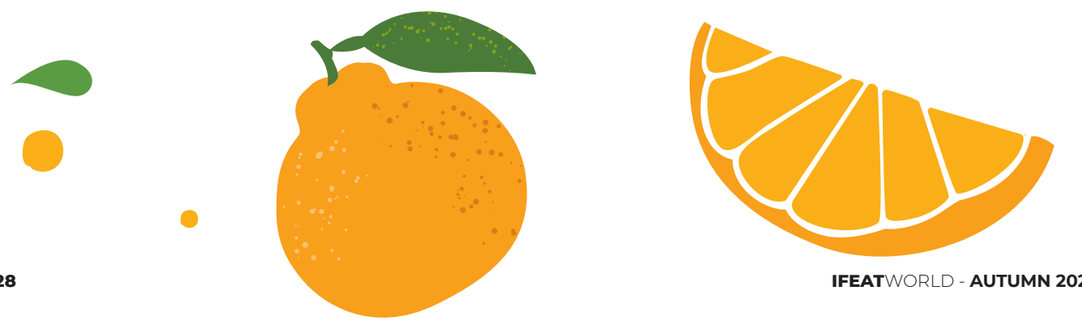
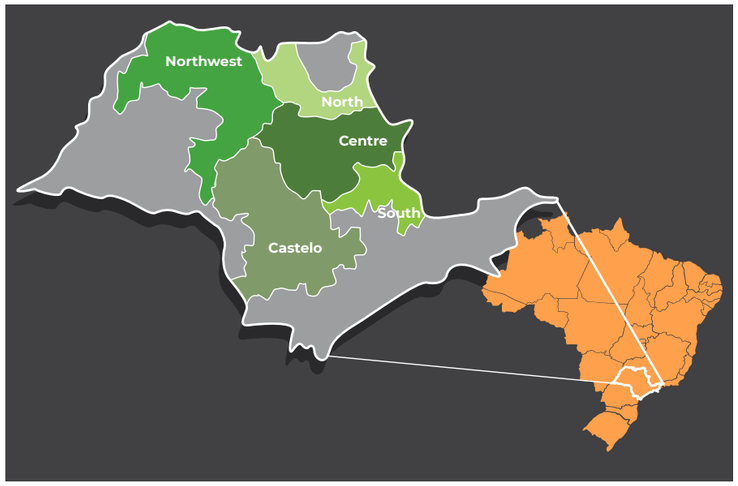


Figure 3: Global Orange Juice Production 2013/14 - 2022/23 (MMT)



Brazil Citrus Belt Regions (São Paulo and Triângulo Mineiro)

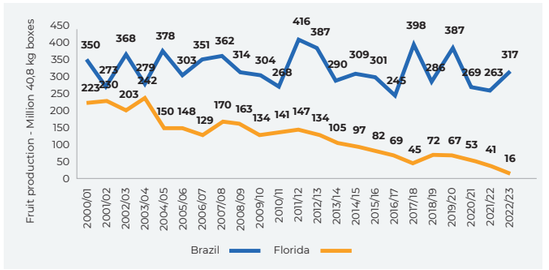


Future Production Trends

It is important to recognise that over the past century there have been sizeable shifts in orange oil production arising from economic, climatic, and other environmental factors which will continue to lead to shifts in the location of production. All growers face major issues with changing climatic conditions and natural variability while some major growers and processors, particularly in the USA and EU, face substantial pressure on land availability, combined with high labour and other costs. In contrast in China, Egypt, and Turkey, the industry is reported to be growing and thriving but their dominant focus is growing fresh fruit. The supply of orange by-products depends, to a large extent, on the size of the orange harvest and the volume of fruit available for processing in countries where a processing industry is established.

BRAZIL

Brazil's annual orange oil production varies from 30.0 to 40.0 MMT from some 344,389 hectares (ha) of orchards in the Citrus Belt concentrated in the states of São Paulo, which dominates production, and Minas Gerais (see map). Figure 4 illustrates the trend in Brazilian orange crop output in comparison with Florida in the USA. Production fluctuates between seasons but over the past two decades there has not been a significant variation in supply particularly in comparison with US trends. Over the past two decades the trend has been relatively stable despite wide annual fluctuations. The 2023/2024 crop shows a slight decrease compared to the last crop, partly because of the alternate bearing phenomenon. Prices have not fallen as much as expected because of the high demand from the processing industry, who are still filling contract requirements from the last two years because of no carryover inventory. Supply remains lower than demand because of lower-than-expected global output. Demand and prices are still firm. Moreover, input costs are rising, particularly fertilisers, energy, transport, and labour. Greening HLB remains a major issue, while quality is lower and failing to meet specifications for aldehyde content.



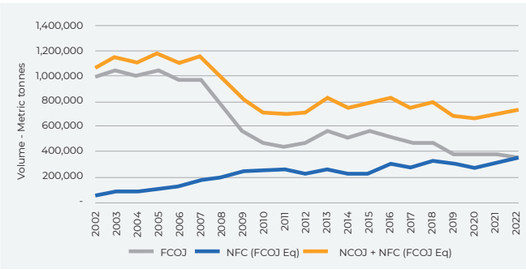
Source: Brazil Ministry of Development, Industry, Commerce and Services (MDIC) and USDA

Figure 4: Brazil and USA Orange Production 2000 - 2023 (Million 40,8 kg boxes)

Minas Gerais has a better juice because of the sweetness but the oil has generally less aldehyde and is lighter in colour. São Paulo is not as good for juice because the oranges are less sweet but the aldehyde is higher and the colour darker. There is no geographical area with high aldehyde material and light colour.

The fresh fruit market makes up approximately 30% of Brazilian production with only very small quantities exported. The remaining 70% is processed, of which 55% is used to produce juice (FCOJ Brix 66° and NFC Brix ≤ 20° - of which more than 90% is exported); 45% is pulp, rind, and seeds, predominantly for animal feeds. Essential oils is 0.3% of which over 90% is exported. Thus, orange is cultivated in Brazil predominantly for the juice and orange oil and other derivative production and prices are very much influenced by the juice market.

Despite global economic growth, there has been a sizeable decline in demand for orange juice over the past two decades and Brazilian exports of FCOJ have fallen by approximately one-fifth, although revenue has doubled because of unit price increases. Figure 5 shows the diverging trends in Brazilian exports of FCOJ and NFC over the past two decades. As yet, it is hard to say whether demand may have stabilised following the COVID pandemic and rise in citrus product consumption. Much will depend on the marketing the industry does to promote the product. In the past, demand was driven by the huge amounts of marketing undertaken by large juice companies, but these brands have now diversified their offers a lot and consumers have a much wider range of options.



Source: Brazil Ministry of Development, Industry, Commerce and Services (MDIC)

Figure 5: Brazil FCOJ and NFC Exports (FCOJ equivalent) 2002 - 2022 (MT)

Meanwhile the supply and exports of CPOO have been relatively stable while the price trend has been dramatically upward. Over the past six years annual average orange oil production has been 30,500 MT with a peak of almost 40,000 MT in 2017/18 and a low of 22,700 MT the previous year. Figure 6 illustrates Brazil's annual orange oil exports have remained relatively stable over the past two decades ranging between 25,000 and 31,000 MT with a peak of 34,765 MT in 2020. However, the unit value has increased substantially with exports in 2020 valued

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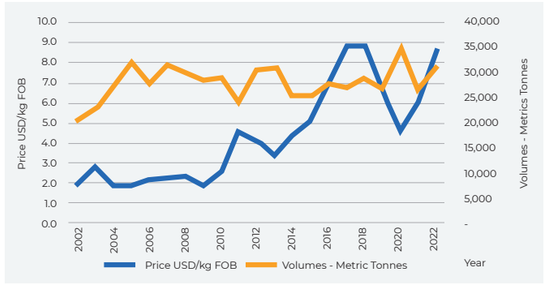
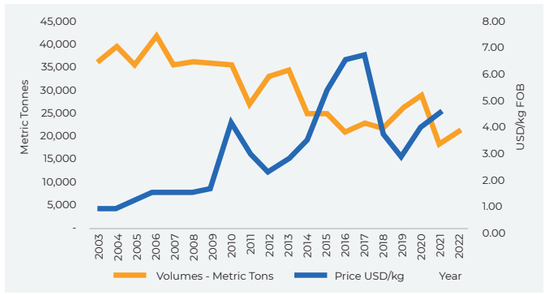
at US$ 159 m. and lower volume exports in 2022 of 27,141 MT valued at US$ 231 m. While orange CP oil exports have shown a relatively stable trend, orange terpenes, illustrated in Figure 7, have shown a slightly downward trend while prices have shown greater upward volatility. Orange terpene pricing is stuck at around $5/kg, when higher the demand goes elsewhere.



Source: Brazil Ministry of Development, Industry, Commerce and Services (MDIC)

Figure 6: Brazil Orange Oil Exports 2002 - 2022 Volume (MT) and Price (USD/kg fob)



Source: Brazil Ministry of Development, Industry, Commerce and Services

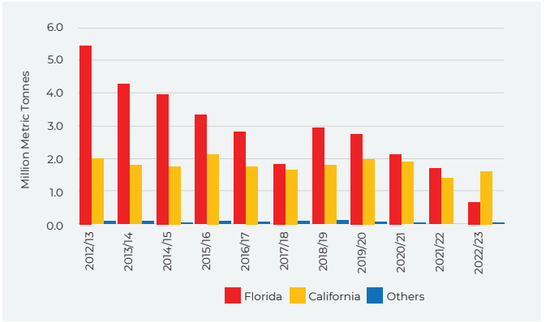
Figure 7: Brazil Orange Terpene Exports 2003 - 2022 Volume (MT) and Price (USD/kg fob)

Orange in Brazil faces competition from alternative crops particularly sugar cane, used for making biofuel. Moreover, sugar cane can provide a return within a year, whereas oranges not only have a gestation period of 3-4 years but also have added risks of greening and greater price volatility. Even though prices are at an all-time high, smaller and medium-sized Brazilian farmers have been reluctant to invest and orange production is increasingly concentrated in three companies: Citrosuco, Cutrale, and Louis Dreyfus, accounting for over 75% of orange processing/ production. Moreover, in the past year this market concentration has led to lawsuits alleging a cartel and price-fixing scheme.

Estimates of orange oil and d-limonene production are difficult to obtain. In 2011 one source estimated that global orange oil and d-limonene production was close to 95,600 MT of which 65,000 MT was produced in Brazil. 95% was undertaken by four major players namely Cutrale, Citrosuco, Citrovita, and Dreyfus. Some 25,000 MT were produced in Florida by four major players, most with plants in Brazil. Some 5,600 MT were produced in the rest of the world, mainly the EU. In total, this would be equivalent to more than 6,000 full container loads (FCL) of CPOO and d'limonene. However, much has changed during the past decade. Citrosuco and Citrovita, who also operated in Florida, have merged and are now under the Citrosuco brand. Mexico is producing more than the USA.

USA

Until the 1980s Florida used to dominate USA and global orange production but in recent decades and particularly in the last few years there has been a dramatic fall in output. As Figure 8 illustrates, this contrasts with California which has recently



Source: USDA

Figure 8: U.S Orange Production

replaced Florida as the largest US orange producing state. Several factors account for the collapse of Florida production including climatic conditions, real estate development, and the losses from citrus canker and HLB greening disease introduced in 2005. Since Florida processes about 90% of its orange crop, the substantially lower production volumes have affected global juice, oil, and other by-product supplies.

Between 2001 and 2021 Florida's citrus growing area declined by just over 50% from approximately 300,000 ha to 150,000 ha, while production volume for utilisation declined by 79%. Oranges accounted for 92% of Florida's citrus production in 2021. Orange essence water phase and essence oils are two by-products of the evaporation process used to produce FCOJ, but production of this form of orange juice has almost disappeared in Florida due to the popularity of freshly squeezed pasteurised orange juice (NFC). It is believed that Brazil now produces over 80% of these two oils available globally, with 20% from Mexico. Prior to the recent collapse of production, Florida annually produced 10,000 - 15,000 MT of orange oil and 5,000 - 10,000 MT of d-limonene. Recent production is almost certainly well below 10,000 MT.

Orange production in 2022/23 is estimated to drop by over a quarter to 2.3 MMT, the lowest level in over 50 years. Yields continue to decline in Florida due to fruit drop caused by citrus greening, reduced area harvested, and high winds from hurricanes. California is estimated to have produced over twice as many oranges as Florida in 2022/23. Consumption and exports are flat while oranges for processing have fallen by more than 50% in the last three years due to the drop in availability, leading to a substantial fall in FCOJ and by-product output (Table 2 and Figure 3). California predominantly produces oranges for the fresh market. US imports of orange products have risen substantially in recent years.

MEXICO

Mexico is a major citrus producer and over the past four decades orange production has shown an upward trend. It is now the third largest orange producer and processor in the world but very far from the volumes available in Brazil. Production is undertaken in 12 states and some 80% is Valencia and 20% early and midseason varieties. Production faces several challenges, the main ones being climatic conditions, the arrival of greening and the operation of criminal gangs. High temperatures and severe drought have impacted production in recent years. Also, aldehyde levels in CPOO have struggled to get close to 1.1%.

Total forecast production in 2022/23 is estimated at 4.2 MMT (103 M boxes), 9% lower than the previous crop. The fall is attributed to the prolonged drought and high temperatures in northeastern Mexico, particularly affecting the states of Tamaulipas and Nuevo Léon, as well as Veracruz and San

Luis Potosi. Fruit available for processing will be lower, while consumption is stable and exports unchanged. Orange processing is undertaken throughout most of the year except for September and October. In 2012/13 there were 15 plants processing an estimated 900,000 MT out of a crop of 4 MMT, with two companies accounting for almost two-thirds of production. Frutech estimated an oil yield at 0.34% producing 3,000 MT of oil. USDA data show wide annual variations in the level of oranges processed, sometimes accounting for almost half of Mexican production. Lower production in 2022/23 will lead to processing volumes falling by almost 20%, with a resultant fall in by-product output (see Table 2 and Figure 3). Orange oil and d-limonene/terpenes are being exported into the neighbouring USA in part to substitute for falling US output.

EUROPEAN UNION

Spain and Italy are at the forefront of European Union orange producing countries. Recent declines in production are due to adverse weather conditions, particularly record-breaking temperatures in Spain and drought conditions in Italy. Another problem for processors is that fresh fruit prices have remained strong in the EU, making it difficult for processors to compete, along with raising input costs. USDA forecasts that total orange for processing in 2022/23 will total only 659,000 MT - some 40% below the previous year.

ITALY

Italy has a thriving citrus industry with over 62,000 citrus farms and 144,000 ha under cultivation, of which 47,000 ha are organic (ISMEA). The average citrus farm is very small at 2.09 ha, reflecting the maintaining of family traditions and a smaller operating scale. The total area of orange groves in Italy in 2022 was estimated at 85,472 ha, with a total orange production of 1.8 MMT. The Tarocco blood orange (December-February) is the most abundant variety, followed by Navel (December-May) and Sanguinella blood orange (Feb-April) and the Washington Navel (December-May). In recent years the trend has been relatively stable in both cultivated area and output. Sicily accounts for just over 60% of the surface area in Italy devoted to oranges, followed by Calabria (23%), Apulia and Basilicata each 6%, and Sardinia (3%).

An estimated 40% of the citrus crop is further processed, which suggests that in the 2022/23 season an estimated 783,730 MT of oranges were processed. The estimated 10% fall in production in 2022/23, due mainly to climatic factors, suggests only 705,350 MT of oranges will be processed. However, this is substantially higher than the USDA forecast.

	Season 2019-2020	Season 2020-2021	Season 2021-2022	Season 2022-2023 (Forecast)
Oranges	1,772,769	1,793,468	1,959,303	1,763,372

Table 3 - Italy: Orange Fruit Production 2019/20 - 2022/23 (MT)

Source: ISTAT

When orange peel is processed to produce candied fruit there is no extraction of essential oil. It is estimated that approximately 55% of the total volume of Italian orange processed is to produce candied fruit, used in cakes and other baked goods. The remaining 45% is used in essential oil production. Based on an average essential oil yield of 0.4% then this would suggest essential oil production of 1,270 MT. Bredenberg (2004) shows Italian annual orange oil production in the decade 1994 to 2003 ranging between 700 MT and 1,520 MT.

SPAIN

Spain accounts for approximately two-thirds of the EU's citrus production and is by far Europe's largest orange producer of both sweet and bitter orange varieties. Spain has a range of both early and late sweet varieties, including Navel, Navelate, Salustiana, Valencia, and Sanguinello enabling it to supply the market throughout most of the year. Sweet orange is heavily concentrated in Valencia and Andalucía, and to a lesser extent the Murcia region. Recent output has fallen mainly because of adverse and extreme weather conditions including excess rainfall, high temperatures, and drought which have impacted the flowering, setting, and fattening phrases.

Production in 2022/23 is forecast to decline to 2.895 MMT of oranges, nearly 20% lower than the last five-year average, with production having peaked in 2018/19 at 3.908 MMT. After several consecutive years of economic slowdown, citrus farmers are increasingly leaving orange production for more profitable products. However, the Spanish orange planted area has been steadily rebounding since 2018, reaching approximately 143,000 ha in 2022, of which an estimated 108,080 ha was planted with sweet orange trees. Sustainable practices, the productivity of Spanish orange farms, and the use of efficient and high-performing varieties have kept Spain as the top orange producer and exporter in the EU.

Estimates vary regarding oranges processed, with one source stating that sweet oranges processed totalled 138,417 MT in 2020 rising to 199,984 MT in 2021, and 207,485 MT in 2022. The yields from 1,000 kg of sweet Spanish orange range between 1.6 and 2.3 kg of orange oil and between 1.5 and 2.2 kg of limonene. If all the by-products were extracted from the 207,485 MT of sweet orange processed in 2022 then using the lower yield estimates this would suggest the approximate production of 3,300 MT of orange oil and 3,000 MT of limonene. However, not all the essential oil by-products are recovered during processing and at best less than half of these amounts are probably achieved. The higher CPOO prices over the last decade have led more processors to install oil recovery units.

Miralles (2004) stated that on average sweet orange oil is only recovered from 80% of the total quantity processed by the industry and in 2002/03 essential oil production was 813 MT. Bredenberg (2004) shows annual orange oil production from 1994 to 2003 ranging between 500 MT and 820 MT.

SOUTH AFRICA

South Africa is one of the largest citrus producing countries in the world and most fruit is orange, accounting for almost two-thirds of citrus production, followed by grapefruit, lemon, and tangerine. Orange production in 2022/23 is estimated up slightly to a record 1.6 MMT because of favourable weather and a slightly larger area being harvested. Three quarters of production is exported and exports are at a record high for the third year in a row. The fresh fruit market dominates the industry and most of the fruit is treated with pesticides pre-harvest and then also post-harvest at the pack houses once the fruit is sorted. This leads to a problem in the oil because the pesticides remain on and in the oil pores on the skin of the fruit.

Approximately 16% is processed and the remainder sold domestically. Approximately 3 kg of orange oil is obtained from 1 MT of fruit. A range of further processing is undertaken to add value to the orange oil and d-limonene produced. This includes fractionation into flavour components and d-limonene, using a complex distillation column. The phase separation process known as folding oils involves the removal of some of the monoterpenes. The folded oil (concentrated) is used in the beverage and confectionery industries. The d-limonene/orange terpenes are used as a natural cleaning agent or degreaser and can be used in emulsions. Natural isolates are also fractionated from the oil, and these are used by flavour houses to enhance flavour profiles.

The past decade has seen a growth in orange production driven by expanding exports of fresh fruit, leading to a decline in processing levels. However, problems with residue levels have negatively impacted exports and could facilitate an expansion of processing.

CHINA

China is the world's second largest orange producer with annual production averaging approximately 7.5 MMT, almost all of which is consumed as fresh fruit. Approximately 250,000 MT are processed each year producing FCOJ and a small production of other by-products all of which are consumed locally. China is most unlikely to enter the international market and if it did then agricultural residues would be an issue.

EGYPT

Egypt is a major producer and exporter of fresh oranges with annual production in 2022/23 estimated at a record 3.6 MMT. Processing has been relatively stable in recent years, around 300,000 MT but is more known for its bitter orange essential oil production. However, the rise in product prices could facilitate increased processing and greater attention being paid to orange by-product production.

MOROCCO

The cultivation of citrus fruits, including oranges, dates back several centuries in Morocco and it is best known for its bitter orange oils, especially neroli. However, it has a rich history of producing orange oil, derived from the peels of oranges. Moroccan oranges are known for their exceptional flavour and aroma, making them highly sought after in both domestic and international markets. Morocco has developed a reputation for producing small quantities of high-quality orange oil. The main variety is Navel, and other varieties include Salustiana and Maroc Late (also called Valencia Late season type). In 2022/23 estimated production fell by almost a third to 783,000 MT because of unfavourable weather and water shortages. Annual orange oil production is approximately 60 MT.

TÜRKIYE

In recent years Türkiye's annual orange production has invariably exceeded 1.5 MMT but negligible quantities are processed so essential oil output is minimal. Moreover, Türkiye faces problems with the level of agricultural residues which have impacted orange exports.

OTHER PRODUCERS

As Tables 1 and 2 show there are other sizeable orange producers who also process orange, including Argentina, Australia, and Costa Rica, but it is not thought that these produce many orange by-products. Bredenberg (2004) estimated that Greece and Israel annually produced around 200-300 MT and 100 MT of orange oil in the early 21st century. Many of these smaller sources of oil are blended with larger production sources, so the oils lose their source identity.

MAJOR CHALLENGES

There are several major challenges facing orange production and the industry:

- ***Climatic variations*** including frosts, droughts, heavy rains, and hurricanes have all seriously impacted production. La Niña, followed in mid 2023 by El Niño, continue to have major impacts on orange and citrus production and many key producing regions are experiencing droughts or intense, unseasonal rainfall that affect key blooming periods. These climatic factors reduce the fruit size and yields and hence the availability of fruit for processing and essential oil production.

- ***Disease and pesticides*** - oranges are susceptible to a range of diseases usually borne by insects that can substantially lower output. These include CTV (citrus tristeza virus), CVC (citrus chlorosis variegated), sudden death virus (SDV), and citrus canker. The dominant threat is greening (HLB), a bacterium spread by the psyllid insect, which reduces yields, kills trees, and impacts quality. Greening is having a major impact on the three major producers Brazil, Mexico, and the USA. In 2022 greening affected 20% of the Brazilian crop and is rising. Substantial research is being undertaken to control the disease which includes removing infected trees, planting resistant rootstock, and using pesticides. Older orchards have a higher proportion of greening, and the bigger the property, the lower the greening occurrence. In Brazil, Fundecitrus (The Citrus Foundation) promotes regular inspections at several farms to identify and quantify the effects of the disease.

- ***Agricultural residue*** issues arising from pesticide use. The industry faces unclear regulation on pesticides residues and there is a need to coordinate accepted reference values to avoid market distortion. Some smaller to medium Brazilian farmers still use pesticides banned by the EU and USA but not by Brazil, in part because they have multiple crops and the pesticides are only restricted to specific crops. Agricultural residue (AR) issues are an on-going challenge and new EU regulations are impacting global trade. Two markets are developing, good AR and poor AR oils.

Pre-harvest most citrus fruit is treated with pesticides and post-harvest at the pack houses once the fruit is sorted. This leads to a problem in the oil because the pesticides remain on and in the oil pores on the skin of the fruit. Often batches are tested to establish the pesticide levels which can influence the use of the oil. If there are low levels of pesticide this can be processed for consumption as flavours, but if it is too high, then it will have to go for a fragrance application. In addition, other physical tests are undertaken to determine the quality (e.g., density, refractive index, optical rotation, smell, and colour).

Over the past two decades agricultural residues (AR) in orange oil has become an increasingly important issue. Pesticides are used to eliminate the pests and diseases attacking the tree and the fruit – both aiming to raise productivity and improve the fruit's visual appearance. Pressure from consumers and processors has led to a reduction in the quantity of pesticide used – as well as a means of lowering costs. Fungicides are used post-harvest to prevent fungus development and prolong the life of the fruit. Often the fungicide is combined with wax to make the fruit look more attractive. There is an inherent conflict between fresh fruit customers and orange oil customers regarding ARs. Fresh fruit customers invariably require aesthetically pleasing fruit involving the use of agrochemicals while orange oil customers face increasingly strict specifications permitting only very low levels of ARs. As a result, those farmers and processors focusing on the fresh market have difficulty producing "clean" oil. Diligent testing protocol and continued AR reduction is vital for the future of the oil products.

Legislation and regulations on pesticides have become stricter and differ between countries. Also, industry requirements are often much stricter than the applicable legislation. Considerable efforts are being made to address these issues by the different processors in each producing origin and they are working closely with growers.

It has been suggested that reduced use of pesticides and herbicides is leading to lower productivity and less oil production but the reduction is difficult to quantify. Research is being undertaken using different planting techniques and rootstocks to increase oil yields per hectare while reducing the need for agrochemicals.

One challenge is that the oil is a good solvent for many of the pesticides and the oil is recovered from the surface of the fruit and the oil often contains much of the pesticide residue on the fruit. Regulations are normally established for the fruit but the oil can often have higher levels due to the concentration effect of the relatively low level of oil.

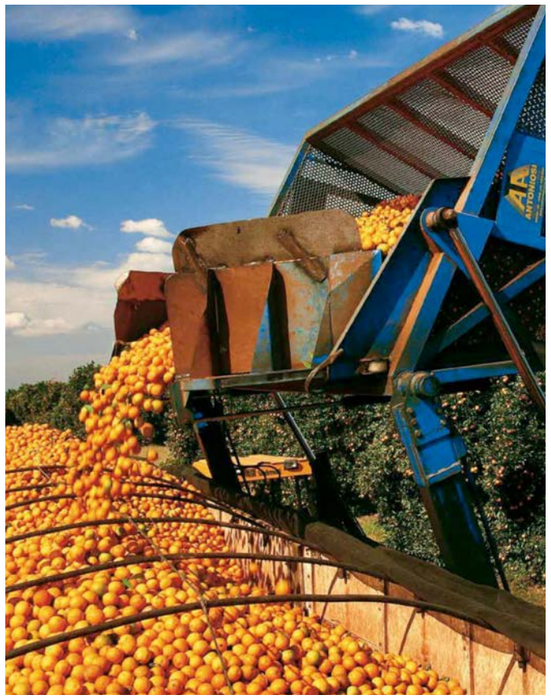
- ***Competition for land use*** - in Florida the population and urbanisation have increased, intensifying competition from the real estate sector. In Brazil land use competition comes from alternative crops particularly sugar cane, used for making biofuel. Moreover, sugar cane can provide a return within a year, whereas oranges not only have a gestation period of 3-4 years but also have added risks of greening and greater price volatility.

LEGISLATIVE AND REGULATORY ISSUES

Due to its many possible uses, orange oil and other by-products are regulated by a wide range of legislation in many countries covering its use in foods, fragrances, cosmetics, pharmaceuticals, aromatherapy, and chemical substances. A key challenge for the sector is adapting to the differing regulatory requirements between markets. Processors face the difficult task of producing high quality low residue orange oil and other products, while complying with regulations for all substances and countries, at an acceptable price. One example is the recent regulations restricting usage of pesticides, especially the banning of chlorpyrifos and chlorpyrifos-methyl in the USA, and limitations on their use in the EU. This has led to difficulties in selling significant volumes of orange oils into these markets, in part because orange oil is seen as a global product with similar specifications.

ORANGE OIL PRICES

There is considerable orange oil price volatility ranging from US$ 0.5/kg to a recent peak of US$ 19.00/kg. Many factors have impacted price levels: drought, frosts, hurricanes, global recession, reduced production and processing, disease, stock levels, increased production costs, currency fluctuations, the value of the US dollar, and economic and political instability in producing and consuming countries. Brazil and until recently the USA (Florida) dominate processing – normally accounting for more than 80% of global orange oil and d-limonene production. Thus, a major variation in either country's output has a serious impact on prices. In contrast, production trends in China, the world's second largest orange producer, do not have a major impact since it processes well below 5% of output. Ultimately prices will vary based on the supply-demand dynamics and stock levels. Since 2020 orange markets have remained firm, at least as far as the essential oils segment is concerned. Additional importance has been placed on aldehyde levels and pesticide levels, which can heavily dictate price points depending on quality and the sector (e.g., flavour and/or fragrance usage).



The relationship between the prices of various orange products is a complex one. The demand for folded orange oil tends to be fixed while that for orange terpenes is more elastic. Recently the spread between the value of orange oil and orange terpenes is so large that the cost of folded orange oils has been at an all-time high. The industrial alternative for d-limonene is turpentine based (dipentene) and other pine derivatives that are less expensive. This means that the gap between the value of CPOO is unlikely to narrow significantly - and the cost of folded oils is likely to remain high.

SOCIAL AND ECONOMIC CHARACTERISTICS

Oranges and their by-products are an important contributor to the health and wellbeing of much of the world's population. In addition, they make an important economic, social, and environmental contribution to the many countries where they are produced.

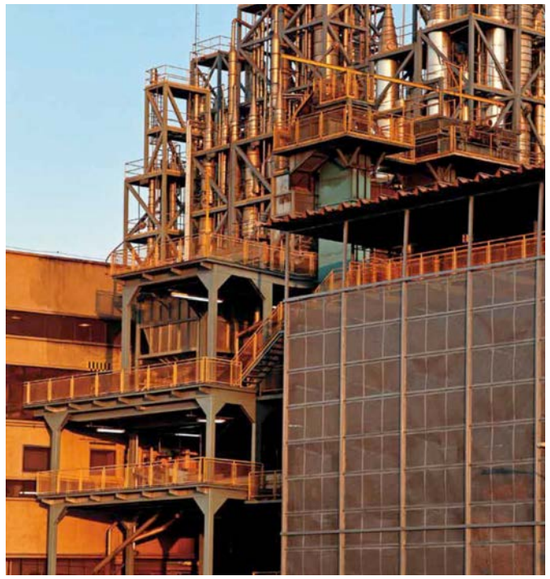
Orange oil production encompasses a wide range of economic activities including nurseries, planting, fruit production, harvesting, grading, packing, processing, juice extraction, distilling, input supplies (equipment, fertilisers, pesticides etc.), transportation, and shipping. The orange industry makes significant contributions in many other sectors due to supply chain linkages and spending incomes that have direct and indirect multiplier effects. The revenues and incomes generated are greatly influenced by the price of orange and its by-products which can be quite volatile. While some data are available on the economic and social impact of the orange sector in producing countries, orange oil and terpenes account for only a proportion of these impacts but given the overall size of the orange sector the contribution will be substantial and much larger than for any other essential oil. Moreover, the viability of the orange sector is dependent on the sizeable contribution made by orange by-products.

In all the major orange oil producing countries there are a variety of initiatives related to the production of these products that could have substantial socio-economic and environmental benefits for the producing regions and countries.

BRAZIL

Abecitrus, the Brazilian Association of Citrus Exporters, which represents the producer and export sector for concentrated orange juice in Brazil, recently reported that the sector directly employs around 400,000 people and is an essential economic activity for 322 municipalities in São Paulo and 11 in the Triângulo Mineirão region, and annually generates foreign exchange of the order of US$ 2.0 billion. Many hundreds of millions of dollars are paid in salaries and taxes by the sector. Moreover, whereas the orange sector generates one job for each 9 ha of production the equivalent figure for sugar cane is one job for 80 ha. Hand picking of oranges is a major employer of labour in the orange sector and as yet efforts at mechanical orange picking have not proven commercially viable.

Of course, orange by-products only account for a relatively small proportion of this overall contribution, but even if it is only 10% it would be substantial. Moreover, the contribution is rising not only because of inflation but also because the value of orange by-products has risen substantially in recent years. Thus, in 2022 the value of Brazilian orange oil exports was US$ 274 m and combined orange terpene and d-limonene exports totalled US$ 95 million.



USA

A recent major study estimated the regional economic contributions of the Florida citrus industry (Cruz et al 2023). Alongside its direct contribution through product value, employment and taxation was added to the multiplier effects measuring the economic activity in other sectors supported through supply chain spending and the spending of income directly or indirectly associated with the sale of Florida citrus products.

Orange dominates Florida citrus production and the study found that the value of citrus fruit production was nearly US$ 785 million, with fruit for processing valued at nearly US$ 673 million and fruit for fresh consumption valued at more than US$ 112 million, based on delivered prices. Florida citrus juice processors produced 666 million gallons of citrus juice in 2020-21, valued at US$ 2.983 billion (FOB price basis). Florida citrus processors also produced by-products of citrus pulp, meal, molasses, and essential oil and d-limonene, valued at nearly US$ 63 million. The analysis estimated total industry output contributions of US$ 6.94 billion, including US$ 1.43 billion from citrus fruit production (grower receipts), US$ 5.33 billion from citrus juice manufacturing, and US$ 177 million from packinghouse sales of fresh citrus. The citrus industry supported a total of 32,542 full-time and part-time jobs in the state. Total value-added contributions, estimated at US$ 2.84 billion, represent the industry's contribution to Gross State Product. Labour income contributions amounted to US$ 1.61 billion, representing earnings by employees and business owners. Total state and local tax contributions of the Florida citrus industry were US$ 151 million.

Over the past decade the trend in orange oil/terpene prices has been upward and these by-products have played an increasingly important role in the economics of orange production. On the heroic assumption that these products account for approximately 10% of the contribution of the orange sector then their economic contribution is of the order of $0.69 billion and over 3,000 employees. In addition, Californian orange production and processing would make an additional contribution, but at a lower level since the proportion of Californian oranges processed has been much less than Florida.

Spain

There are no exact numbers of the farmers and pickers who work in the Spanish orange orchards. Assuming one farmer can manage 25 ha then the 108,000 ha of sweet orange groves would need around 4,300 farmers to work in these orchards. In addition, there are substantially more pickers working in the sector. Assuming a person can pick 800 kg per day and the season lasts approximately 180 working days then there are between 26,000 and 30,000 pickers during the season for the fresh fruit and between 2,000 and 2,500 pickers for the industry fruit. Many additional people are employed in other parts of the value chain e.g., processing, transport, agricultural inputs, marketing, management, and finance.

Italy

In 2021 in Sicily there were some 42,500 citrus farms with 21,636 production workers and 9,900 processing workers. With more than 30,000 workers employed in Sicily then the total number in the Italian citrus sector was not less than 60,000 workers. In addition, a sizeable proportion of Italy's orange and by-product production is exported. As with other orange producers there is substantial employment in other parts of the value chain.

SOCIAL, ENVIRONMENTAL, AND SUSTAINABILITY INITIATIVES

Increasingly a large range of initiatives is being undertaken in the orange sector aimed at facilitating greater sustainability and helping to combat climate change. Since most production of processed orange products is undertaken by large, often multinational operations, they recognise that improving and multiplying social, economic, and environmental best practices is the most sustainable way to raise productivity and ensure the continuity of their operations and the planet. These companies, along with the companies purchasing their products, are often at the forefront of environmental and sustainability policy initiatives. They endeavour to ensure that production is socially just, environmentally sound, and economically viable. Their wide-ranging initiatives include commitments to reduce scarce water usage through more efficient utilisation as well as efforts at reducing emissions and CO_2 capture, and the achievement of a positive CO_2 balance.

Pressure to implement change has also come from consumers and end-use companies that are increasingly concerned about the environmental impact of their purchasing decisions, leading to the demand that products are sourced from sustainable farming practices and align with their values of sustainability, transparency, and health. As a result, companies involved in orange production, processing, packaging, and distributing are having to adapt their practices to meet these evolving expectations.

Brazil

Carbon Footprint

Since 2009 the Brazilian orange sector has been studying its carbon footprint with the objective of achieving a reduction. Following a 4-year study a detailed analysis was available which provided one of the most comprehensive analyses of the carbon footprint of the orange sector which influenced future policy decisions. Most industrial processes are powered by biomass to generate heat, steam, and electricity and few industrial processes are powered by natural gas to replace oil. Most companies' light vehicles run on 100% ethanol and Brazilian diesel contains 5% of biodiesel for road transport. The energy matrix in Brazil is predominantly formed by renewable energy.

Land Use and Biodiversity

Brazil produces approximately two-thirds of the world's orange juice and by-products, using just over 1% of the total of Brazil's planted land. Moreover, the sector prioritises the occupation of land already degraded and is constantly raising productivity and lowering the area occupied. Orange production in the Citrus Belt has proven to be an important environmental asset. Fundecitrus, a research centre bringing together producers and the industry, has shown that the sector has greatly reduced its productive area while substantially increasing productivity. Over the past three decades, the producing area (i.e., trees of production age) has fallen by 40% from 631,000 ha in 1988 to 376,000 ha in 2019. During the same period, employing technologies and increasingly efficient planting systems, orange production has increased from 13.75 MT per ha to an average of 42.64 MT per ha - an increase of 210%. Meanwhile the average number of trees per hectare has more than doubled.

Another environmentally important role for the orange sector is the preservation of natural forest and biodiversity. Brazilian legislation is very strict and every producer must leave an area of 20% to native woodland to help preserve local flora and fauna. Moreover, since orange trees last approximately 20 years this favours the preservation of flora and fauna compared to greater disruption arising from less perennial crops. Fundecitrus data show that in the 2019/20 harvest, properties with citrus crops encompassed 181,750 ha of native forest. For every 2.52 ha planted with citrus crops, 1 ha corresponds to native forest areas. The sustainability and increased biodiversity of the sector is illustrated by growth during the past decade of honey production in orange producing areas of São Paulo State which grew by 136% encouraged by using technologies and the balanced application of pesticides. The Citrus Belt now accounts for a large proportion of the state's honey output.

Social Policies

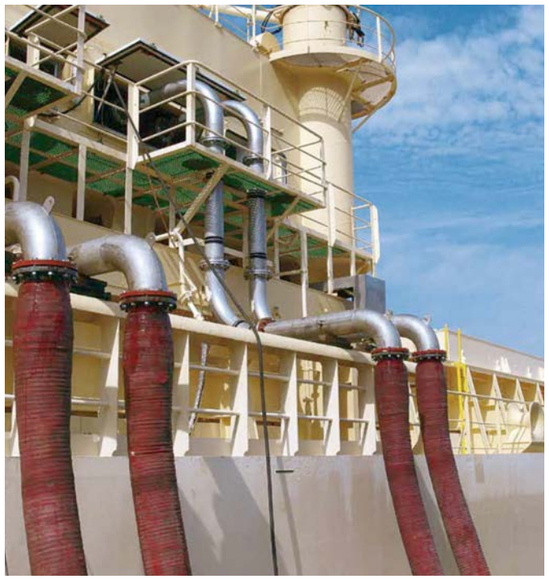
The orange processing companies have adopted a wide range of economic and social policies to benefit the workforce and the communities where the orange plantations and processing operations are located. Besides creating well-remunerated employment and training programmes, they provide educational, health and sports facilities. In Brazil in 1977 a non-profit organisation, Fundecitrus, was established through a partnership between São Paulo State, orange growers, and juice industries to keep orange groves healthy and competitive and develop a social project maintaining supplementary education centres for children, an initiative that has received various awards.

Water Usage

Over the past decade, Brazilian companies, via CitrusBR and using Water Footprint Network methodology have investigated opportunities and adopted policies to substantially reduce water usage. More than 75% of the water used in industrial processes comes from the orange itself from the process of juice concentration. Irrigation and fertigation techniques have been developed and improved and relative to other crops (e.g., soy, coffee, and corn), oranges are a low water consumption crop. A high percentage of the orange groves, more than 70%, have their own irrigation systems and water storage with pipelines fed directly into the roots.

Agrochemical Usage

While the number of pests and diseases affecting orange groves has increased, extensive research and the adoption of new technologies, has led to agrochemical usage and biological controls becoming much more rational and precise, thus lowering risks to the environment and humans. The agrochemicals allowed for use in citrus groves are listed in the PIC (Integrated Citrus Production) list, which is stricter than Brazilian legislation. Fundecitrus provides training, literature, and individual assistance to small and large growers.



Other good practices

Companies have adopted a series of other good practices in the groves, industries, and terminals such as: recycling, reforestation, and various socio-environmental certifications and codes of conduct using both international and national auditing organisations.

Many of the social, economic, and environmental policies adopted in Brazil have also been utilised in the other major orange producing countries.

Italy

In Sicily and Catania, a "Social Farming" project has used the orange sector to develop training programmes aimed at professional qualifications and social inclusion for young people, women, disadvantaged, and immigrants. Skills have been developed in the field of cultivation (including organic), tourist reception and rural tourism, water management, labelling of fresh and processed products, management of citrus by-products, communication, e-commerce, promoting product, process, and marketing innovations within the citrus supply chain.

Spain

Spain has been undertaking a range of sustainability initiatives covering environmental, social, and economic aspects. Initiatives on the environmental side include efforts to reduce scarce water usage, through more efficient utilisation, minimise the carbon footprint along the value chain, expand renewable energy use and reduce agrochemicals and pesticide use. Unfortunately, the Spanish orange sector does not have an organisation similar to AILIMPO in the lemon sector which provides a leading coordinating and disseminating role regarding best practices on economic, environmental, and social policies.

SOME CONCLUSIONS

The most lucrative part of the orange market is the sale of fresh oranges rather than orange juice or by-products generated from processing oranges. The market for orange by-products including orange oil and d'limonene is both a global and a volatile one with price levels similar throughout the world. Prices have increased significantly in the last few years. The combination of citrus greening, climatic factors, labour availability, competitive land usage, limited natural substitutes, rising production costs, lower aldehyde levels often below 1.1%, rising demand, and reduced stock levels all signal a paradigm shift in the market.

The industry faces a range of challenges, including:

- Climate change in the form of droughts, hurricanes, frosts, and unpredictable weather patterns is having a dramatic impact on production trends.
- Investment requirements are high, not only because of oranges' long gestation period before yielding fruit but also high capital costs (e.g., land, equipment for harvesting, and processing) and input costs (e.g., labour, water, agrochemicals).
- Citrus fruit diseases especially HLB – greening.
- Increasing demand for healthy, natural "green" products should facilitate growing consumption of orange products.
- The focus on fresh fruit markets has led to pesticide residues becoming a major concern regarding orange by-products as consumers become more quality conscious.
- Political and economic instability.
- Currency variability and price volatility for both the fresh fruit and orange oil and other by-products can create difficulties.
- Considerable competition from a range of producers and countries, with considerable variations in efficiency and productivity along the different supply chains. Some existing producers face pressures from land development, competitive crops, environmental issues, and input costs and may struggle to remain competitive.

Orange production and processing, including the production of orange oil/d'limonene and terpenes, make vital economic, social, and environmental contributions to the orange producing regions in producing countries, particularly São Paulo (Brazil), Mexico, until recently Florida (USA), Sicily and Catania (Italy), Valencia and Andalucía (Spain).

The industry provides livelihoods for hundreds of thousands of people as well as generating millions of US$ in sales and export revenues. In addition, the sector makes substantial environmental contributions, and initiatives are being adopted to combat climate change by capturing CO_2 as well as providing other environmental benefits.

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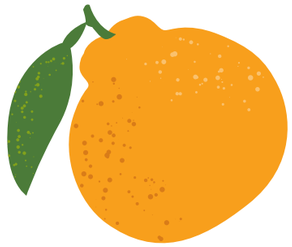
Glossary

CPOO	-	Cold Processed Orange Oil
FCL	-	Full Container Load
FCOJ	-	Frozen Concentrated Orange Juice
FOB	-	Free On Board
ha	-	Hectare
HLB	-	*Huanglongbing* ("greening")
M	-	Million
MMT	-	Million Metric Tonnes
MT	-	Metric Tonnes
NFC	-	Not From Concentrate
US$	-	United States Dollar



[1] The author would like to thank the many people who have contributed to this study including Ramon Bordas, Hugo Bovill, Karin Bredenberg, John Cavallo, Felice Chirico, Antonella Corleone, Sean Farley, Alain Frix, Juan Antonio Garcia, Eduardo Mattoso, Richard Pisano, Colin Ringleib, and Peter Wolfe. The author is responsible for any errors and would welcome any comments **pgifeat@yahoo.co.uk**

Reducing CO_2 emissions in the F&F value chain

Why it can only be tackled jointly

By **Cordula Mock-Knoblauch**, Head of Sustainability Accelerator, Thiago Siqueira Caixeta, Sustainability Manager and **Sarah Haberkant**, Marketing Manager, Aroma Ingredients, BASF

The sustainability transformation in the F&F industry is putting existing production processes, established products, and current purchasing decisions to the test. As sustainability is a broad field with many different aspects, it is essential to identify the most pressing issues and focus on developing solutions to solve them. When IFRA and IOFI asked their members about their priorities regarding sustainability at end of 2021, the picture was clear: the most urgent and most important priority was carbon footprint. The commitment to the reduction of CO_2 emissions is reflected in the fact that almost two thirds of the respondents to the F&F industry sustainability charter survey conducted in 2023 are tracking their CO_2 emissions and have actions in place to reduce them.[1] The large F&F houses as well as the consumer goods companies have set ambitious science-based targets. Taking a closer look at the F&F value chain and where CO2 emissions occur, it becomes evident that collaboration along the value chain will be vital in the endeavour to reduce emissions in the coming decades.

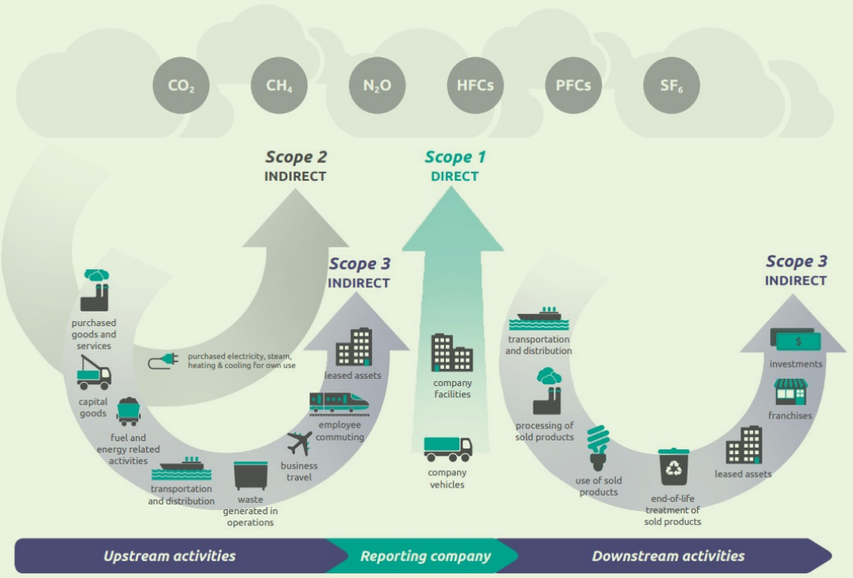


Figure 1: Overview of GHG Protocol scopes and emissions across the value chain

Transparency on CO_2 emissions

To be able to reduce CO_2 emissions, it is crucial to understand their origin. According to the *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* companies are obliged to classify their CO_2 emissions into three scopes.[2] GHG emissions from sources owned or controlled by companies are reported as scope 1 (direct emissions). The emissions from the generation of purchased energy are reported as scope 2 (indirect emissions). Scope 3 allows for the accounting of further indirect emissions that occur as a consequence of the activities of the company. For example, this includes upstream emissions from production of purchased raw materials, as well as downstream emissions from product use by the consumer (see Figure 1). As scope 1 and 2 emissions are directly related to the assets a company operates and the energy it consumes in its operations, they are within the immediate sphere of influence of a company. In contrast, the scope 3 emissions of a company are the scope 1 and 2 emissions of its partners along the value chain.[3] Collaboration along the value chain thus is required to enable all players to bring down their scope 1, 2, and 3 emissions.

The quantitative understanding of where emissions are caused is the basis for the development of concrete plans for action. A study performed by Takasago showed that, on average, more than 95% of the CO_2 emissions of a cosmetic fragrance composition can be attributed to the provision of the raw materials and the production processes required for their conversion into aroma ingredients; less than 5% stem from compounding at the F&F houses (see Figure 2).[4] The downstream value chain emissions from formulating flavours and fragrances into consumer products can be assumed to be quite small as well. The emissions occurring during the consumer use of end products of the F&F industry like shampoo[5], food, washing powder or perfume are highly variable and cannot be influenced by the F&F industry. Thus, the focus for significant CO_2 emission reduction will be activities driven in the upstream value chain by raw material providers, chemical companies, and aroma ingredient suppliers, while requiring supporting innovative practices from the downstream players.

Innovations required along the value chain

Changes in the choice of raw materials are the foundation. In addition to lowering CO_2 emissions from fossil raw materials by using oil or gas rather than coal, the use of renewable feedstocks like biomethane, bionaphtha, or sugars has to be increased, along with CO_2 utilisation. Bio-based raw materials are an important option to reduce CO_2 emissions as they are produced from plants or trees that absorb CO_2 from the atmosphere during their growth. This is known as biogenic carbon uptake and it reduces the CO_2 emissions in the respective value chain. It is important to note, however, that using bio-based raw materials does not necessarily result in low CO_2 emissions overall. A recent study undertaken by L'Oréal, MANE, and EVEA on fragrance ingredients shows that especially natural absolutes extracted with volatile solvents from cultivated plants show poor environmental profiles in life cycle analysis compared with essential oils from harvested wild plants and turpentine-based or fossil-based synthetic products. While large differences in categories like land use and eutrophication would be expected, the analysis also shows differences of up to two orders of magnitude for the climate change impact, which are linked to fertiliser use and diesel required for tractors.[6] Looking at the economics, it has to be said that these more sustainable feedstocks mostly come at a considerably higher cost due to a lack of economy of scale and decades of production process improvements.

Next in the value chain is the conversion of the raw materials into aroma ingredients. This spans a lot of different processes from extraction of natural flavours and fragrances from

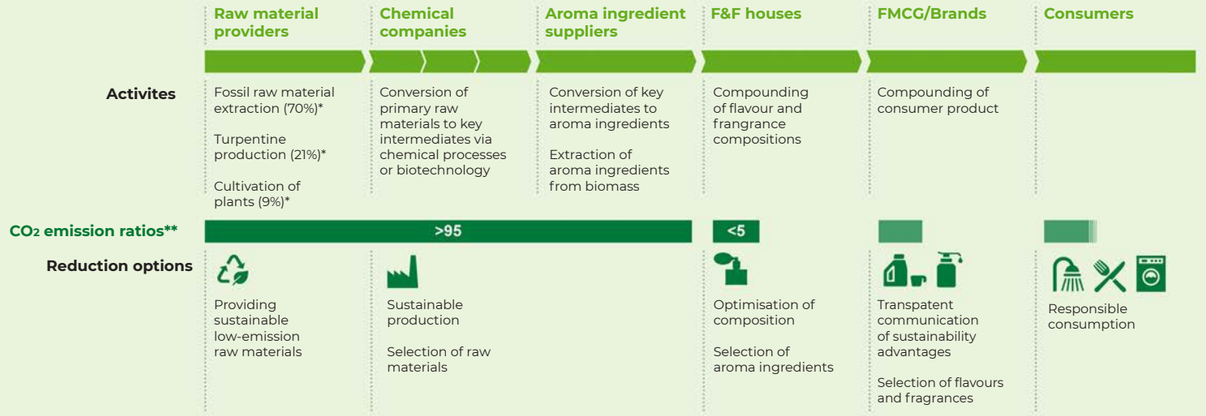


Figure 2: Sources for GHG emissions along the flavour & fragrance value chain and reduction options

*Share of primary raw materials according to source 7.
**CO_2 emission ratios for a typical cosmetic fragrance composition according to source 4.

biomass to multistep chemical reactions to produce synthetic aroma ingredients based on fossil as well as bio feedstock, namely turpentine. With synthetic fragrances having a market share of about 90%[7] and the processes often being carried out by chemical companies, chemical industry data can be taken as a proxy to assess future emission reduction opportunities. Such data show that in the past three decades, the chemical industry has been absorbing investment costs to reduce absolute CO_2 emissions while production volumes increased.[8] The most known measures applied towards this end were continuous improvements in the energy and resource efficiency of production processes and the shift to a renewable electricity supply, which has started in the past years.

Achieving further reductions down to net zero emissions will require substantial investment into research, development, and deployment of new or fundamentally changed production processes. Also, the electricity and steam consumed during production will have to shift completely from fossil-based to renewable. A study focusing on the European chemical industry concluded that the financial need to reach the net zero target amounts to around €35 billion annually until 2050. This is more than 50% above the European chemical industry past spendings on investments for growth and plant maintenance.[8]

For the F&F houses in turn there is no need to invest fundamental sums in new plants. However, they will have to combine very smartly the evaluation of sustainable options with their expertise in fragrance formulation to develop products with improved carbon footprints, taking into consideration sustainable sourcing practices and regulatory profiles, such as biodegradability.

Last but not least, in the final stage of the value chain the consumer goods companies will need to bring in their marketing expertise to launch products with improved sustainability, accompanied by transparent consumer communication on the carbon footprint advantages. In the absence of globally comparable regulatory schemes supporting CO_2 emission reduction the role of these consumer-facing players cannot be overrated. As pointed out before, investments required in the upstream part of the value chain are fundamental. However, studies show that the cost increase at the consumer product level for many consumer goods is well below 5%.[9] Thus, finding ways to convince consumers to pay a slightly increased price for a product with close to zero CO_2 emissions will be their task.

Including CO_2 in purchase decisions

As can be seen from Figure 2, players along the value chain will have to select raw materials, aroma ingredients or F&F compositions while taking into account the CO_2 emissions caused in the upstream value chain. This information is contained in cradle-to-gate product carbon footprint (PCF) data from the respective suppliers. Today, the ability of suppliers to provide primary PCF data for their products still varies. Unfortunately, secondary data, though available for basic chemicals, is seldom available for the large portfolio of aroma ingredients used in the F&F industry. In addition, publicly available studies show a huge spread in the PCF of aroma ingredients ranging from about 1.5 kg CO_{2e}/kg for bio-based fragrance intermediate myrcene[6], over 6.5 kg for fossil-based hexyl salicylate[10] to 128 kg for patchouli oil[10] and above 1,000 kg for natural absolutes[6]; the PCF of a typical cosmetic fragrance composition being estimated at 15.3 kg CO_{2e}/kg[4]. Another key issue is comparability of data, which has been greatly helped by the publication of *The Product Carbon Footprint Guideline for the Chemical Industry*[11] in 2022. Calculating primary data according to accepted standards and making it available along the whole value chain will therefore be a key task for all players, as such data will be the basis for including CO_2 emissions in purchasing decisions.

Speeding up the transition

The activities of aroma ingredient suppliers are key for enabling the transition. By choosing different feedstocks and introducing production process improvements, they have the ability to influence the vast majority of the CO2 emissions. Considering the substantial additional costs mentioned above, the challenge is to find a way for a step-by-step ramp-up of the changes in line with growing market demand and ability to pay.

The mass balance approach offers a solution to this challenge: a low-PCF feedstock is mixed with the conventional feedstock; likewise, the energy used at a production site is a mix of conventionally produced electricity and steam and renewable energy, like wind power. The amount of alternative low-PCF feedstock and renewable energy introduced at a production site is accounted for and then virtually attributed to selected products.

The advantages of using mass balance for further reductions of CO_2 emissions are that the approach makes use of the existing highly-efficient production assets and can be scaled to market demand. This increases the speed of implementation, lowers the technical risk, and limits the increase of production costs. Additionally, mass balanced products are so-called “drop-in” solutions which are of identical product quality and performance compared to the conventional products. Thus, the F&F houses can seamlessly incorporate them in their production without the need for reformulation.

While a clear focus on the urgent need for CO_2 emission reduction will certainly help in gaining momentum for action, other environmental aspects such as water and land use will grow in importance. However, the same holds true for all environmental challenges: they cannot be tackled at one step in the value chain alone - concerted action is imperative to making a significant and lasting difference.

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IFEAT 2023 BERLIN CONFERENCE
Speaker Overview

MONDAY

Keynote speech: The Global Essential Oil and F&F Market: Yesterday – Today – Tomorrow

Essential oils have been produced and used for thousands of years. They are an important component for the F&F industry, and play a major role in natural formulations. Looking back over the last three decades both the essential oils and F&F industries have experienced substantial changes and major consolidations. These have been influenced by various factors, including advancements in technology, evolving customer preferences, regulatory developments, and an increasing emphasis on sustainability.

This presentation gives an overview into the major shifts within the essential oils industry and their implications. In this respect it will discuss the ongoing and notorious volatility in raw material pricing, together with the increased regulatory challenges and global supply chain dynamics. The F&F Industry in itself has undergone a massive consolidation process. During the last 30 years the major F&F companies have not only been expanding by organic growth, but mainly by taking over a large number of small and midsize companies.

Tillmann Miritz
CEO and Owner,
MCI Miritz Citrus

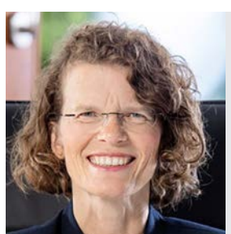
Tillmann Miritz's growing expertise in citrus followed an academic education in economics. Before taking over the boutique family-owned business in 1988 he worked for four years as a consultant in a prominent American consulting company. He developed MCI Miritz Citrus into a leading citrus ingredients supplier with a strong emphasis on innovation and technology. He served as a board member of the IFEAT Executive Committee, as well as the German Flavour Association. With more than 30 years of experience he has been keeping a close watch on the transformation and development of the essential oil market, as well as the ongoing industry transformation and worldwide consolidation process of the flavour and fragrance industry.

Essential Oils Past and Present Under the Scrutiny of Analytical Chemistry

Essential oils have been used for millennia and have recently grown in popularity as natural ingredients to give flavour to food, in fragrance and natural cosmetics, but also in the context of phytopharmacy and, increasingly, aromatherapy applications. With the growing importance of essential oils and natural ingredients it has become very important that users are aware of the natural origin of the oils.

This presentation gives an overview of state-of-the-art and classical analytical methods used to analyse essential oils and natural ingredients and determine their origin, such as different isotopic analytical methods, GC, chiral GC, residual impurities etc. It will discuss how some methods have been introduced successfully in the originating countries close to the agricultural settings therefore ensuring a sustainable supply chain while other methods can only be used further up the supply chain.

Understanding the strengths of analytical methods is a chance for the entire supply chain to strengthen natural products, to ensure consumer safety by ensuring the identity of the products, and to act on regulatory issues rather than to react to them. With very different players using different analytical methods with a very different degree of background knowledge, it is key that the essential oils industry and the trade take control and know their products on a chemical level in order to defend them.



Dr Maja Zippel
Manager,
FREY&LAU, Germany

Dr. Maja Zippel is Managing Director of FREY&LAU, a leading medium-sized producer of essential oils, flavours, and fragrances and also trades in aroma chemicals. She is in charge of the R+D, quality, and production divisions. Her speciality is focused on essential oils, the continuous progress in production methods in the origin and supply chain and their analytical control, but also on the diverse regulatory framework governing essential oils.

Before joining FREY&LAU in Germany, Dr. Zippel studied chemistry in Lausanne, Switzerland, obtained her PhD at Georgia Tech in Atlanta, USA, and spent time as a postdoctoral fellow at UCLA and the University of Colorado.

MONDAY

From the Lavender Fields to the EU Green Deal: Current State of Play and Impact on the Essential Oils Sector

The objective of this presentation is to share with the audience how the Green Deal, and in particular the Chemical Strategy for Sustainability (CSS) and its corresponding CLP and REACH revisions may be a direct threat for essential oils and why this is not only an EU issue but most certainly will have a global impact on our essential oils sector.

It will discuss EFEO's approach/position, mainly focusing on upstream supply chain and in particular SMEs who may be considered a perfect fit for the Green Deal but nevertheless are having to face contradictory consequences. Manolo will also give an up-to-date state of play on CLP amendments and how joint advocacy activities at EU institutions, such as the Commission, Parliament and Council have come into place.

Manolo Donaire
Sales Europe
Berjé Inc

Manolo Donaire is Key Account Director Europe for the Berjé Group where he continues to expand Berjé's footprint in Europe, its expertise, values, and commitment to the industry; being also the first ever American company to have its own production facilities of rose and lavender at Berjé Trakia in Bulgaria.

Manolo currently also serves as President at EFEO (European Federation of Essential Oils) firmly engaged to continue supporting the essential oils sector in Europe.

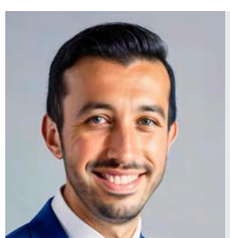
With over 15 years of experience in the F&F industry, Manolo has held executive positions in sourcing and sales of essential oils, leading cross-cultural teams in regions such as Europe and Asia Pacific. Originally from Belgium, he obtained his university degrees in Brussels, Granada (Spain), and Sheffield (UK); and is now based in Spain.

Natural Oils in a New Landscape: Regulatory and Legislative Trends in North America

Fragrance Creators Association is the trade association representing the majority of fragrance manufacturing in North America. The North American legislative and regulatory climate is highly active and rapidly evolving. Federally, the U.S. Food and Drug Administration (FDA) is implementing the Modernization of Cosmetics Regulation Act (MoCRA), which the U.S. Congress passed in 2022. MoCRA was the first significant update to FDA cosmetics regulation since 1938. Provisions within the act are still developing; specifically, the agency seeks to cement a stance on fragrance allergen identification and require transparent labelling of such allergens in all consumer products.

The U.S. Environmental Protection Agency (EPA) regulates fragrance ingredients through the Toxic Substances Control Act (TSCA), but approvals of new chemicals are stifled, and a sector-specific approach for fragrances may be needed. At the state level, jurisdictions such as California are currently developing regulations on key components to essential oils and aromas such as volatile organic compounds (VOCs) and microplastics; continued advocacy has been critical for proposing scientifically judicious solutions. The Canadian regulatory landscape is no less active; federal agencies Health Canada (HC) and Environment and Climate Change Canada (ECCC) maintain lists of substances requiring specific regulations that are often updated, subject to feedback during open public comment periods.

Here, Fragrance Creators will elaborate upon federal and state regulatory activity, discuss key wins in the US essential oil trade, and outline the worldwide ramifications of the European Green Deal. At the state level, jurisdictions such as California are currently developing regulations on key components to essential oils and aromas such as volatile organic compounds (VOCs) and microplastics; continued advocacy has been critical for proposing scientifically judicious solutions.



Dr Dan Selechnik
Director of Regulatory Science
Fragrance Creators Association

Dr. Dan Selechnik is the Director of Regulatory Science with the Fragrance Creators Association. After earning a Ph.D. in the biological sciences from the University of Sydney, Australia, he served in several roles (most recently as Senior Scientist) at the Research Institute for Fragrance Materials (RIFM) over the course of four years. His expertise is in the science of fragrance safety, specifically in the systemic toxicological endpoints. He now oversees Fragrance Creators' regulatory programmes and he manages the association's Regulatory Science Executive Committee.

MONDAY

The EU's Chemicals Strategy for Sustainability and its Impact on the Essential Oils Industry

The future of essential oils is uncertain as they risk being restricted in upcoming regulations in the European Union. Maria Spyraki is the Member of the European Parliament who is shepherding key legislation impacting our industry through the EU's decision-making procedures. MEP Spyraki has tabled compromise amendments intended to protect the production and use of essential oils. She will share her insights on how the important plenary vote in the European Parliament scheduled for 3rd October 2023 on the Classification, Labelling and Packaging Regulation and the ensuing negotiations with EU Member States and the European Commission are likely to play out. She will also give her point of view on other ambitious chemicals policy revisions that could still have an impact on the essential oils industry.

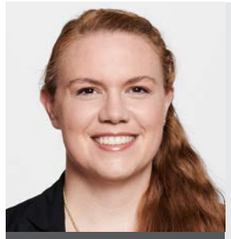
Maria Spyraki
Member of the European Parliament

Maria Spyraki has been a Member of the European Parliament since 2014 for Nea Demokratia (EPP), most notably serving on the Environmental and Industry Committees. In 2019 she was MEP of the Year for Industry, Research, and Innovation. MEP Spyraki initiated a Parliamentary Resolution on the Chemicals Strategy for Sustainability in July 2020 and earlier this year she took up the Rapporteurship of the Revision of the Regulation on the Classification, Labelling and Packaging of substances and mixtures (CLP). The role is of great importance to her as it represents a "significant step towards protecting both the consumers and the environment. It is critical to increase the level of information provided for all products containing chemicals and address risks arising from online sales. It is also important to support our industry and SMEs to adapt and maintain their competitiveness and provide enough resources to the European Chemicals Agency." Ms Spyraki is a journalist by trade and studied chemistry at the Aristotle University of Thessaloniki.

IFEAT's Response to the EU's Regulatory Tsunami

Susan is part of a team of consultants from FGS Global, who have been supporting IFEAT since June 2023 on EU advocacy and communications. The European Union is the initiator of a 'regulatory tsunami', a massive part of this regulates chemicals in the EU – with ambitions to export its standards to the global level. The overall aim of the IFEAT-FGS collaboration is to support IFEAT's advocacy in the EU with the ultimate objective being to ensure business continuity for IFEAT Members involved in essential oil production, aroma chemical manufacturing, flavour and fragrance compounding, trading, and consumer product manufacturing.

To achieve this, our collaboration rests on two pillars:
- Amplifying IFEAT's voice on key pieces of EU legislation
- Enhancing the perception of the sector among key stakeholders through strategic communication. Today's presentation will recap advocacy efforts that we have undertaken together so far, introduce you to the elements of IFEAT's campaign and invite you to join our call to action!



Susan Schneider
Associate Director
FGS Global, Brussels

Susan is an Associate Director in the Brussels Office of FGS Global, the Strategic Advisor to the Stakeholder Economy. She advises a range of clients in the chemicals and industrial sector in the context of the EU Green Deal and Chemicals Strategy for Sustainability and is helping them develop compelling advocacy strategies around regulatory procedures and issues. Before joining FGS Global, she worked as Policy Advisor for two Members of the European Parliament. Prior to that she worked for a German political foundation on EU and transatlantic issues. She obtained her BA and MA in International Politics at the American University in Washington, DC. Susan lived and worked in Germany, China, Saudi Arabia, the US, Cuba, South Korea and Belgium. She is fluent in German, English, Dutch and Spanish and understands French.

TUESDAY

The IFEAT Medal Lecture - Three Decades Working in and for the Fragrance Industry – a Personal Perspective

For the Medal Lecture, Dr. Matthias Vey will look back on a career dedicated to fragrance, sharing his wide experience and unique perspectives. Having spent 30 years working in and for the fragrance industry, it is only fitting that smell has played a central role in his life. Initially training as a perfumer, he then moved to a creation role in the cosmetics industry and later became a quality assurance manager. At the turn of the millennium, Dr Vey was appointed Director of Scientific Affairs – and latterly Vice President - of the International Fragrance Association (IFRA), where he has driven the association's commitment to science, in particular through the IFRA Standards that underpin the safe use of fragrance around the world.

Now firmly part of the fragrance establishment, Dr Vey has had the opportunity to see and shape some of the evolutions and changes that the fragrance industry has undergone over the past three decades. Now more than ever, this unrivalled experience is helping him lead IFRA into capably handling the challenges the sector is facing, pushed partly by internal factors and compounded externally by expansive changes sought by global regulators. The fragrance landscape is changing faster and faster for the creative industry, and Dr Vey's intervention will examine these changes in this wider context.

Dr Matthias Vey
Vice President Scientific Affairs, the International Fragrance Association (IFRA)

Dr Matthias Vey is a chemist by training from the Technical University of Darmstadt, Germany. After his studies and a short period of training as a perfumer, he started in fragrance research and development for Marbert Cosmetics in Düsseldorf, Germany. He then became global regulatory affairs manager for Coty/Lancaster in Mainz, Germany.

In 2000 Dr Vey joined IFRA. He is Vice President of Scientific Affairs and is responsible for the fragrance industry's worldwide safe use programme, known as the IFRA Standards. He also manages IFRA's science related committees and is involved in IFRA's advocacy activities. He is responsible for the management of the International Dialogue on the Evaluation of Allergens (IDEA), a multi-stakeholder initiative. He regularly presents at international meetings and conferences, including the Safety Course at the Free University of Brussels.

"Roundpanelshop": Sustainable Sourcing and Beyond – Initiatives in the Global Flavour and Fragrance Industry

Jens-Achim Protzen
Chairman of the IFEAT 2023 Berlin Conference Committee

Everyone defines "sustainability" differently, and the phrase has unfortunately been somewhat overused in recent years. However, it is now evident to everyone that we must think holistically - and that, above all, sustainability begins with raw material production.

But this was not always the case: there were periods when some people in our sector just overlooked the origins of amazing raw materials like essential oils, concretes, and absolutes - the beginning of our value chain was simply forgotten. Furthermore, some buyers did not consider the conditions under which the production took place - the further away, the better (or the more difficult it is to look closer).

Producing these raw materials is not just a significant and largely secure source of income for millions of people throughout the world. The indirect contributions, such as the preservation of cultural landscapes and the consequent good side effects for tourism, can also be substantial (in this light, we would like to remind you of the socio-economic reports published on a regular basis in IFEATWORLD).

Fortunately, our industry's self-image has improved since the early 2000s. Companies, organisations, and groups have made important interventions with standards and labelling. Consumer social pressure has undoubtedly had a significant influence. And, of course, we must not overlook the United Nations initiatives. The legislator is now active in some areas, as seen by the European Corporate Sustainability Due Diligence Directive. It has been touched on from time to time at previous IFEAT conferences - but this is the first time we are addressing this topic in the context of such an event.

We will hear a case study from Türkiye - embedded in the presentation of various organisations, standards, and initiatives. Of course, this is not only about presenting the situation, but about how it may be concretely improved! And we gladly welcome the contributions of a global and diverse audience.

The afternoon's working title is "Roundpanelshop" - a hybrid of a round table, a panel discussion, and a workshop. The number of participants is not limited as of now, however registration by name is essential. The programme will last 2.5 hours and will follow the "Chatham House Rules".

The following speakers and moderators are already on board:

Sven Ballschmiede (IOFI), Martina Bianchini (IFRA), Ralf Kunert (naturamus GmbH), Rik Kutsch Lojenga (UEBT), Dominique Roques (Balsam Consulting) and Deborah Vorhies (Fairwild Foundation)

Of course, such an event can only be the beginning; subsequent discussions and, importantly, tangible steps, must be continued afterwards. But if we carried the following message with us, we would have already accomplished a lot:

"A horse without a rider is still a horse, but a rider without a horse is only a human." Our supply chain would simply not exist without the millions of committed farmers, pickers, employees, owners, and communities!

I look forward to discussing the topic with you in Berlin on Tuesday afternoon.

Yours,
Jens-Achim Protzen
Chairman of the IFEAT 2023 Berlin Conference Committee

WEDNESDAY

Perfumery & Essential Oils: As Diverse As It Gets - An Insight into the ICATS Diploma

This presentation is intended to offer the audience an insight into the learning opportunities available from IFEAT via the ICATS diploma. This is a distance learning programme with modules focused on both flavour and fragrance pathways in addition to logistics, regulatory, commercial and foundation science. They can be taken individually and at your own pace thereby offering continuous professional development opportunities across an organisation.

Essential oils and naturals have always been close to the heart of most perfumers. It doesn't matter that they have access to thousands of synthetic aroma molecules, what excites them most is the natural whiff of a pure, natural essential oil. In the world of scintillating synthetics and amazing reconstitutions, a perfumer would still want to give their fragrance an extra edge with a tinge of naturalness and the purity of an essential oil.

This presentation will highlight why essential oils are preferred over reconstitutions and how different varieties of these oils increase a perfumer's palette multi-fold. To give an example, when a perfumer wants to add a warm woody but fresh cedarwood character to their fragrance, the world displays very complex options with many varieties of cedarwood – starting from Virginia, Atlas, Texas, Moroccan, Indian, or Chinese. No matter, the cedarwood oil from all of these six regions is botanically cedarwood, but they all have different species and different analytical profiles – and of course a totally diverse olfactive profile. This is not just the case with cedarwood - there are many such oils that share a similar scenario, like geranium, vetiver, frankincense, lavender, and chamomile, to name a few.

Ashish's presentation will showcase some of these essential oils from different parts of the world and will show the analytical differences between them. It will also discuss why a perfumer would choose a particular variety of oil over the others and what the parameters are that they would consider before choosing a particular oil. The presentation will also feature the olfactive differences of these diverse oils and allow the audience to feel the depth of it by way of a smelling session which will incorporate some of these selected oils.

Ashish Jhunjhunwalla
Director
AFFAROM

Ashish Jhunjhunwalla completed a degree in BA (Hons) Business of Perfumery from the University of Plymouth in the United Kingdom. He was awarded the 'Best Perfumery Student' Award by IFEAT in the year 2000. Thereafter he worked and trained himself in the fragrance development field for almost six years at International Flavours and Fragrances (IFF) – initially in London and then at the IFF Creative Centre in Hilversum (The Netherlands).

He has played a pivotal role in revolutionising the fine fragrance/deodorant and body spray market in India over the past 18 years and has been the nose behind a lot of fragrances that we as consumers see and use in the Indian and the international market. He is one of the very few Indian members of The British Society of Perfumers (UK). He is a proud faculty member of the Fragrance and Flavour Development Centre (FFDC) based in Kannauj and a part of the Ministry of MSME by Govt. of India.

He is currently serving for the last couple of terms as the Vice President (East Zone) of Essential Oil Association of India - EOAI and as the Regional Secretary (East Zone) of Fragrances & Flavours Association of India - FAFAI.

WEDNESDAY

Using Blockchain to Unlock Value in Difficult Supply Chains: Lessons from Frankincense, Rosewood, and Palm

As regulations become more stringent, consumers grow more aware of sustainability issues, and companies commit to ambitious ESG targets, sourcing personnel have grappled with how to ensure the necessary transparency in supply chains to achieve these goals. Challenges are particularly acute for wild-harvested plants, and products coming from areas where instability or conflict make on-the-ground verification difficult. Yet, as old trade routes contend with the increasingly stringent requirements of modern supply chains, new technologies can offer solutions.

Blockchain is a powerful tool to address these issues by allowing widespread data collection at source, preserved in an indelible ledger that prevents tampering. Simply put, it is a cost-effective, scalable solution to prove good practices and demonstrate positive environmental and social impact, even in particularly difficult supply chains. In this presentation, we discuss lessons learned in implementing complete plant-to-bottle transparency, drawing on case studies in frankincense (Somalia), palm (Liberia/Ghana), and rosewood (Peru), among others. In particular, we focus on the use of blockchain to de-risk sourcing of natural materials, measure supply chain practices against environmental and social KPIs, and increase brand-side value.

Stephen Johnson
Director
FairSource Botanicals

Stephen is the founder of FairSource Botanicals, LLC, which focuses on building regenerative supply chains for wild-harvested plants that enhance environmental and social benefits across the value chain. He is an interdisciplinary ecologist focused on the sustainability and conservation of wild forest products, particularly by leveraging commercial value to promote conservation. He has been working on frankincense sustainability issues since 2016 as a supplier, researcher, and technical consultant, and has published more than a dozen peer-reviewed papers, book chapters, and technical reports, and conducted socio-ecological research on frankincense in Somaliland (Somalia), Puntland (Somalia), Ethiopia, Oman, Burkina Faso, and Ghana.

Stephen has previously presented at the International Symposium on Essential Oils, University of Vermont's Sustainable Innovation MBA program, and has been a guest speaker for various institutions including Wageningen University, the Airmid Institute, and Saint Michael's College, among others.

Andy Thornton
Managing Partner
Silvan Ingredient Ecosystem

Andy Thornton is the founder and Managing Partner of Silvan Ingredient Ecosystem. Silvan connects the world's best brands with the world's best ingredients and helps sustainable and regenerative ingredient growers scale their impact and find new markets. He has spent 15 years working in international development and agricultural supply chains, working globally but with a particular passion for West Africa. Andy holds an MBA from the University of Oxford where he studied as a Skoll Scholar. www.silvan.eco

Andy has had experience speaking at conferences including: Advancing Good Governance in International Development Conference; Emerge Conference (Oxford University); School of Social Entrepreneurship and as a guest speaker in a range of universities globally on the topics of social entrepreneurship, emerging market social business strategy, and supply chains.

WEDNESDAY

Plant Protection Products (PPP) in Naturals - Identification, Quantification, and Interpretation

Plant Protection Products (PPPs) and their corresponding residues are a point of major concern in the production and trade of essential oils. This is because compliance with regulations on maximum residue limits (MRLs) is mandatory for placing any agricultural product on the market, especially so for organic certified products.

Although analytical technologies have made huge steps forward in terms of sensitivity, selectivity and accuracy, the analysis of PPPs in essential oils remains extremely challenging as they represent highly complex matrices. On the other hand, several actors in the business chain and competent authorities expect that the same analysis quality and quantification limits applied for fruit and vegetables can be obtained. This difference in expectation and analytical possibilities often creates tension among the laboratories, business operators, and regulators.

When positive results are reported, the question is how to evaluate the result. Questions that are regularly asked include:

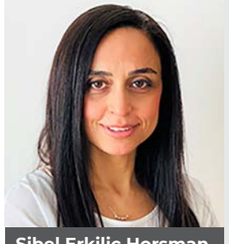
- Is the PPP or metabolite found related to its direct use or other factors?
- Is the result compliant with the relevant legislation?
- Will this result lead to a rejection by the client?
- Is the found concentration a potential food safety issue?
- Was the sampling process robust and the sample itself truly representative?
- The raw material was free from contamination, so where is this PPP in my EO coming from?

In parallel, the rapidly evolving regulatory landscape leading, for example, to the recent ban of commonly used PPPs such as chlorpyrifos and chlorpyrifos-methyl, among others, in the EU and USA has encouraged the IFEAT Scientific Committee to initiate a stepwise fact gathering and range finding study aimed at (i) identifying the most commonly used PPPs & establishing their regulatory status; and (ii) determination of the processing factors (degradation or concentration) through robust scientific analysis of both the original plant materials and the resulting essential oils or extracts.

This session is a follow-up to the Round Table discussion hosted during the IFEAT Virtual Conference 2021 entitled, 'Agricultural Residues in Naturals - A Scientific and Regulatory Landscape'. On this occasion, Hans Braeckman of Primoris and Sibel Erkilic Horsman from the Scientific Team at IFEAT wish to highlight and demonstrate some of the practical and analytical difficulties so as to stimulate a more realistic expectation of the current PPP analysis possibilities and provide some suggestions on how to evaluate positive results.

Hans Braeckman
Development and Support Manager
Primoris Holding

Hans Braeckman is Head of Product Management & Development for the entire Primoris Group. His 30 years of experience allow for a clear view on the analytical challenges of essential oils and how to interpret the concentrations of contaminants in essential oils.



Sibel Erkilic Horsman
IFEAT Scientific Administrator

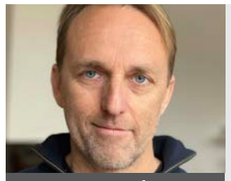
Sibel has over 20 years of experience in procurement, focusing on engineering and strategic investment and for the past 20 years has lived and worked in a number of countries including the US, Spain, the Netherlands, and Switzerland. Prior to joining IFEAT, she was the Global Category Manager, Engineering and Utilities Lead at Givaudan and has also worked for SC Johnson, Philip Morris, Cognis and the Ford Motor company. Sibel has experience in category management, energy sourcing, and sustainability, holds a BSc in Chemical Engineering and a Masters in Industrial Engineering from Bogazici University in Istanbul, Turkey. Sibel has also worked as a PhD research assistant for Boeing in the US. She speaks English, Spanish, French, and her mother tongue (Turkish) and lives in Zurich with her husband and young daughter.

WEDNESDAY

Creating Innovative Fragrance Materials Using New Botanicals from Africa: Marula Fruit

This presentation will focus on the potential of the marula fruit, a botanical found in Africa, for the fragrance industry. The presenters will discuss the cultural, economic, and medicinal significance of marula fruit in Southern African communities and highlight the importance of sustainable and ethical use of genetic resources and associated traditional knowledge in accordance with the Nagoya Protocol to the UN Convention on Biological Diversity. The project, which involves collaboration with GIZ, Symrise, and Herbs-Aplenty, aims to analyse and select innovative processes and products for utilising marula skin and pulp in the flavour and fragrance industry while establishing a sustainable marula supply chain and generating employment for local communities. It will also provide information on the fragrance, traditional use, and cultural significance of marula fruit, and describe the efforts to train individuals from seven villages in sustainable propagation, cultivation, and harvesting of marula trees for planting in their homestead gardens.

Furthermore, the presentation will discuss the potential industrial uses of waste marula fruit material. The presenters will share their findings that the hydro distillation process for producing marula essential oil is not economically viable due to very low yields, but the small amount of oil produced could be used as an exotic flavouring agent. They will also explore the potential for using fragrant floral water produced through the hydro distillation process to enhance the flavour of non-alcoholic and alcoholic beverages. Additionally, they will describe their efforts to develop a tincture of marula peel through long-period extraction with high purity ethanol, which shows promise as a potential flavouring raw material. Finally, the presenters will touch upon the challenges involved in the production of marula schnapps by fermenting and distilling marula juice and pulp, specifically regarding the high pectin content of the pulp. Overall, the presentation offers a unique perspective on utilising a lesser-known botanical for the fragrance industry, while emphasising sustainable and ethical practices and their impact on local communities.



Marc vom Ende
Senior Perfumer
Scent & Care/Research
Perfumer/Principal
of Perfumery School,
Symrise AG

Marc vom Ende is a senior perfumer at Symrise and started his career in 1988 and has worked for all perfume categories.

He has lived in different cities including Hamburg, New York City, Paris, Holzminden and Berlin. Besides his creative work he is a research perfumer involved in the process of developing new synthetic and natural products for use in perfumes.

He is mentoring and training young talents and is Principal Of The Perfumery School in the Symrise AG.

Sascha Liese
Director Corporate
Sustainability
Symrise AG

Sascha Liese is a business & biodiversity expert with an academic background in biology, environmental systems science and sustainable development. He works as Corporate Sustainability Director at Symrise, a globally leading flavour, fragrance and ingredient manufacturer headquartered in Germany. Since 2016 Sascha is responsible for the development, implementation and continuous improvement of Symrise's biodiversity strategy and management system. He represents Symrise in the joint Nagoya Protocol Task Force of the International Fragrance Association (IFRA) and the International Organization of the Flavor Industry (IOFI) and is a board member of the German Biodiversity in Good Company Initiative.

In addition to his work at Symrise, Sascha has also shared his expertise as a speaker at various events and platforms.

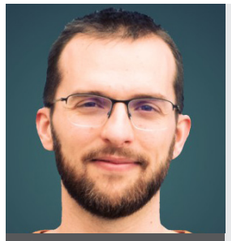
Pietersarel de Bruyn
Director
Herbs-Aplenty

Pietersarel de Bruyn is an agricultural economist who earned his post-graduate degrees from the University of Stellenbosch. Since 1994 he has been actively engaged in the essential oil, extract, and botanical industries. With three decades of experience in the plant-to-bottle process of essential oil and extract production, Pietersarel is committed to natural and organic production methods. He firmly believes in the importance of asking the question, "does nature approve?" as a litmus test for our actions. Pietersarel has shared his expertise on various platforms and has lectured extensively on farming, essential oils, distillation, and extraction, with a particular emphasis on extracts and botanicals. His innovative concepts and ability to find solutions in the interaction between sustainable production and feasible processing have led to several collaborations, enhancing the HERBS-APLENTY basket with a variety of botanical products. He also consults and mentors other companies in related fields. The most recent focus is on the utilisation of "waste-products" in a sustainable processing line, resulting in a marketable end-product.

WEDNESDAY

Next-generation Essential Oil Extraction: Introducing D.I.C. Technology

In today's rapidly evolving industrial landscape, innovation has become the key to unlocking new possibilities and efficiencies. This holds true for the essential oil and aroma extraction field, where traditional methods often entail time-consuming processes and energy-intensive operations. This presentation introduces a cutting-edge technology known as D.I.C. (Instant Controlled Pressure Drop), which offers a revolutionary approach to essential oil extraction. D.I.C. technology optimises extraction capacities, significantly reducing processing times, ensuring the preservation of delicate compounds in the oils, and reducing energy requirements. By harnessing the power of pressure drop, this technology seeks to enhance extraction efficiencies, deliver superior quality aromas, and contribute to a greener extraction line. This session will delve into the technical intricacies of D.I.C., exploring how it redefines the essential oil extraction landscape. Attendees will gain valuable insights into the advantages and potential applications of this innovative technology, offering new perspectives on the future of aroma extraction processes.



Victor Lefrançois
CEO
ABCAR D.I.C. Process

Victor, an IT engineer and CEO of Abcar D.I.C. Process, transformed his family company into an industrial leader by standardising equipment based on 30 years of R&D and 500 scientific publications. With his dedicated team, he aims to establish D.I.C. as a new standard for essential oil extraction, promoting greener and more efficient practices, and exemplifying the fusion of tradition and technology for responsible and efficient industry standards.

THURSDAY

Regenerative Mint Farming – The Next Big Step In Sustainable Mint Supply Chain

In India, menthol mint is cultivated in a large area of the Indo Gangetic Plains of Uttar Pradesh, Punjab, Haryana, and Bihar. The state of Uttar Pradesh is the leading producer of mint in size and production. India is a leading exporter of menthol crystal, essential oil, and similar products, contributing more than 80% of the total production worldwide. In the Indian context, farming is proportional to mass employment. Because of this, farming should be given top priority if it is to continue providing a stable source of income for the greatest number of people. Specifically, from the perspective of mint farming, considered to be 'liquid cash' or 'golden crop' for the smallholding farmers, which, as a result of the low prices of mint oil, has been entering a crisis for some time, reducing yield, increasing cost of cultivation, escalating issues in farming, along with an uncontrollable environment, and climate issues resulting in farmers losing interest in agriculture and mint farming in particular. Farmers will miss another chance if this problem is not managed or cared for and another crop, which until very recently ushered economic security to smallholding farmers, i.e. natural mint, will become a less competitive commodity for their business.

The talk will detail the strategy with three objectives:

- Helping farmers to become independent in knowledge, skills, and resources/inputs required for farming.
- Rejuvenating means of production and creating access to production sources.
- Eco-system services for maximising yield and production.

By encouraging farmers to adopt sustainable and regenerative farming practices for the entire farm, the cost of cultivation will surely decrease with an increase in productivity, making mint farming financially sustainable and, overall, an economically secure farming-based livelihood.

Vaibhav Agrawal
Managing Director
and Owner
Norex Flavours
Private Limited

Vaibhav Agrawal is the Managing Director and Owner of Norex Flavours Private Limited, a 28-year-old family business. At Norex, Vaibhav handles the business with 25 years of experience and represents the second generation of the family.

He is an engineering graduate from MIT Aurangabad (1994-98) and manages a dedicated team of professionals. Proactive in social services and for the benefit of trade, Vaibhav has been instrumental in uniting most mint producers under the banner of MMEA (Mint Manufacturers & Exporters Association). Also, being aggressive on sustainability, he always puts efforts in at personal and federation levels to promote natural mint crops, with the help of CIMAP (Central Institute of Medicinal and Aromatic Plants), among Indian farmers.

THURSDAY

Sustainable Menthol: Addressing the Environmental and Social Challenges of India's Natural Menthol Industry

India is the world's largest producer and exporter of natural menthol, with the country's production being a significant source of income for many farmers and small-scale producers. However, the production and use of natural menthol in India have come under scrutiny in recent years due to potential environmental impacts. This presentation aims to provide a comprehensive overview of the environmental and social impact of natural menthol production in India.

The talk will examine the various stages of the production process, including cultivation, harvesting, distillation, crystallisation, and refinement. The social impact will be discussed describing the role of mint and menthol production in improving the livelihood and the benefits for local communities. We will also analyse the impact of menthol production on climate change and ecosystems (biodiversity, water consumption, GHG emissions) in India and the use of synthetic menthol as a substitute for natural menthol. The conference paper will conclude with a discussion of practical solutions to mitigate the impact of natural menthol production in India. These solutions may include the use of traditional cultivation and production techniques, modern technologies, and measures to ensure that the benefits of menthol production are positive.

Tony Phan
Head of Natural
Ingredients Production
and Methods
MANE

As the Head of Natural Ingredients Production and Methods at MANE, a global leader in the flavour and fragrance industry, Tony has developed expertise in the field of natural aromatic ingredients and sustainable innovation. He holds a Master of Science degree in Chemical Engineering from the Ecole Nationale Supérieure de Chimie de Paris (Chimie ParisTech - PSL), where he specialised in process engineering and green chemistry. With over a decade of experience, Tony has led pioneering efforts in the development and production of natural aromatic ingredients. His expertise extends across digitalisation, operations leadership, process optimisation, and supply chain management.

Tony's commitment to sustainable practices has notably led him to co-create GREEN MOTION™, the industry's first tool for evaluating the environmental impact of flavours and fragrances, based on the 12 Principles of Green Chemistry. More recently, Tony completed an Executive MBA at HEC Paris in June 2023 to drive innovative and sustainable business strategies.

United States Mint Industry – The More Things Change, the More they Stay the Same

Significant changes in the past decades in the USA mint industry have occurred. Yet, despite the many changes that have in many instances unfavourably impacted mint farmers and the multiple vendors that support the American mint farmer, dealers of American mint continue to see repetitive trends and behaviours by stakeholders. In the past 20 years, we have seen significant reduction in the amount of acreage tilled and managed for mint. In the Pacific far west, decreasing acreage due to a variety of factors including competition from India and China, challenges with verticillium wilt, along with alternative, more attractive crops, have impacted planting and managing cultivation of mint.

The risk of reduction of American mint oil available to the large users of mint in the world, has not been an impetus for these conglomerates to consistently support the American mint farmer. So, we will continue to see price swings in these commodities going forward. This presentation will delve into the many reasons why the seesaw effect of American mint pricing has been and will continue to be inconsistent.

Alan Brown
CEO and President
Lebermuth Company

Alan S. Brown is CEO and President at Lebermuth Company in the USA; established in 1908, Lebermuth is a fourth-generation family-owned business. He graduated from Indiana University where he studied business with a concentration in business management and entrepreneurship. Alan began working at the firm in 1984. He has served on the IFEAT Executive Committee since October 2019. "In my more than 35 years working in the firm I have worked in nearly every department and have been honoured to study and work with some of the finest perfumers and essential oil experts in the world." Alan has been married for more than 30 years, blessed to have three amazing children, loves to snow ski, play tennis and golf, and enjoys a glass of red wine with friends as regularly as possible.

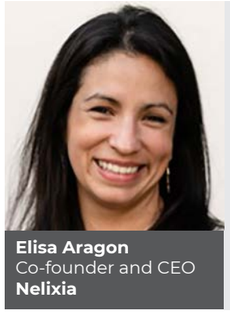
THURSDAY

Natural F&F Ingredients can Protect and Promote Biodiversity: Peru Balsam, a Case Study Using Satellite Image Analysis

The United Nations Post-2020 Global Biodiversity Framework aims to halt biodiversity loss by 2030 and achieve biodiversity recovery by 2050. Many brands and creation companies are taking a position regarding this goal. This presentation will aim to explain how the sustainable management of a natural ingredient can protect and promote biodiversity. The flavour and fragrance industry can stop the biodiversity loss and even enhance its potential.

The Peru Balsam, *Myroxylon balsamum*, is a tree native to Central America, growing up to 34m in height across tropical forests, with a lifespan of more than 300 years. Despite its namesake, El Salvador is the only producer of Peru Balsam resin in the world. Nelixia started to work with this value chain in 2016, and since 2018 implemented, thanks to its certifiable internal methodology, the Fairwild certification and then the UEBT verification standard. After more than seven years of well-grounded implementations at the source, a scientific study with a spatial analysis expert was conducted to measure its environmental impact.

The study of satellite images analysed, thanks to different technologies, the evolution of forest health and density over the last decades. The results are remarkable and encouraging, demonstrating the positive impact that can generate a sustainably managed forest. These conclusions will be demonstrated in a scientific way thanks to the study of spatial analysis of the forests of El Salvador.



Elisa Aragon
Co-founder and CEO
Nelixia

Co-founder and CEO of Nelixia, Elisa Aragon has been devoting her energy to the creation of a new standard in sustainable and ethical sourcing since 2009. Elisa bridges the gap between the western world and Latin America to apply the excellence of her clients to the reality of the field. As a result, her company writes and implements its own certified sustainable methodology, and places social and environmental aspects at the heart of all operations.

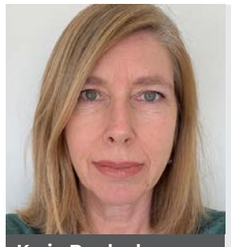
With a scientific background, Elisa completed her studies in chemistry at the prestigious perfume school, ISIPCA in Versailles. She worked for two years at Firmenich, a world leader in perfumes. After a master's degree in entrepreneurship and innovation at ESCP in Paris, she founded Nelixia.

Crop Market Report on Citrus

Introduction: General Market scope, size of each citrus oil market.

Market updates on:
- Orange oil - main producing origins, current situation, explanation of dynamics, forecast.
- Lemon oil – main producing origins, current situation, explanation of dynamics, forecast.
- Lime oil (Key & Persian) - main producing origins, current situation, explanation of dynamics, forecast
- Grapefruit oil - main producing origins, current situation, explanation of dynamics, forecast
- Soft citrus (mandarins, clementines, tangerines) - main producing origins. current situation, explanation of dynamics, forecast
- Bergamot – main producing origins, current situation, explanation of dynamics, forecast
- Yuzu - main producing origins, current situation, explanation of dynamics, forecast

Conclusions including challenges on the market.



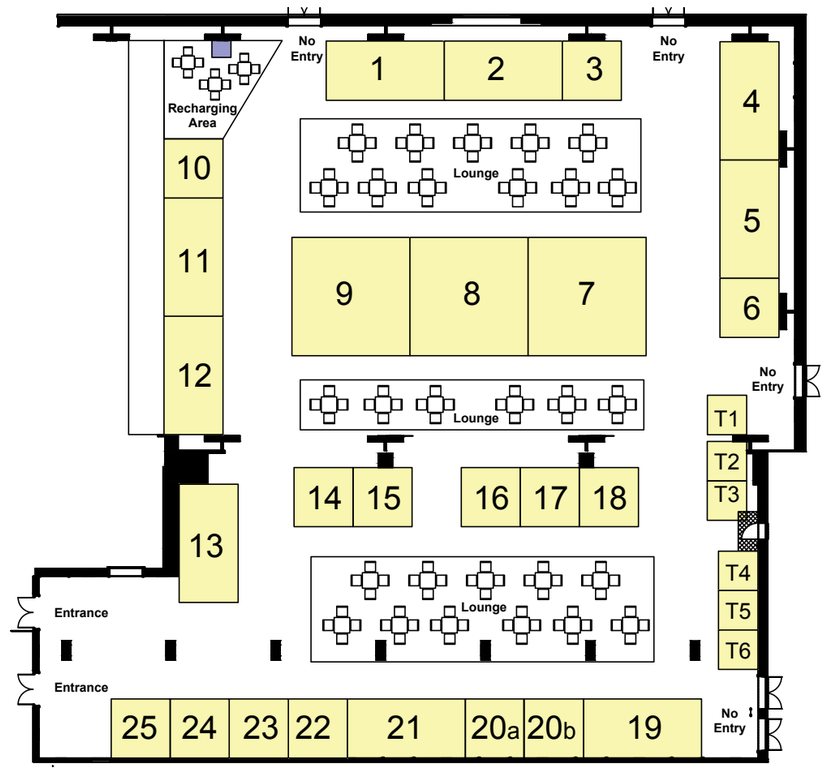
Karin Bredenberg
Business Development Director Citrus Ingredients
IFF

Karin Bredenberg is Business Development Director Citrus Ingredients at IFF. She is currently leading a team at "LMR Naturals by IFF" focusing on a range of citrus specialities with full traceability to the source, partnering with producers who have ambitious environmental and social governance policies. LMR is a leader in premium, pure, and transparently sourced ingredient oils, mainly for fragrance use but increasingly for flavours, with headquarters in Grasse, France.

Karin has a degree in Business Administration and a Master's in Marketing and has been working in the citrus industry for 20 years. She has held several positions developing sales and markets for citrus processors, citrus speciality blenders, as well as flavour and fragrance producers in Spain, UK, and USA. During this time, she gained an extensive insight on the mechanisms of the global citrus industry.

She is from Sweden but has lived in Spain for many years and has been based in Madrid since 2021.

Thank You to our IFEAT 2023 Berlin Conference Exhibitors



Booth No.	Company Name	Booth No.	Company Name
1	Hunan Hetong Bio-tech Co	17	Tanemura & Co
2	TMV Natural Oils & Extracts	18	Gupta Aromatics
3	Som Extracts	19	Shanghai M&U International Trade Co
4	Mamta Polycoats	20a	Essential Oils of Tasmania
5	Prakash chemicals International	20b	Kutas
6	FRICKE Abfülltechnik GmbH & Co. KG	21	Hangzhou Grascent Co
7	OQEMA Limited	22	Jayshree Aromatics
8	Jiangxi Shamhai Bio-Technology Co	23	Quintis Sandalwood
9	Van Aroma	24	Purong Essence MFG Co
10	H J Arochem	25	John Kellys (London)
11	Tech Vina JSC	T1	Pavlovi Food Industries
12	ShengYuan Flavors & Fragrances Co	T2	Changyi City Ruihai Biological Technology Co
13	Saraogi Shellac and Aromatics	T3	KLJ Plasticizers
14	TOURNAIRE	T4	Zalabi
15	Kelvin Natural Mint	T5	Etheleo
16	Dongying Kehong Chemical Co	T6	Siyomicro Biotech

NEW IFEAT MEMBERS

Below is a list of new IFEAT Members who had joined by 23rd August 2023

ACM Natural Product Pvt Ltd
19/334 ACM Valley, Pulipadam (P.O)
Mampad, Malappuram (Dist)
Kerala (St) 676542, India
Contact: **Shafeer Ali**
Email: **shafeerali@acmnaturals.com**
Web: **www.acmnaturals.com**

ACM GROUP is a manufacturer of spice oleoresins, essential oils, and curcumin 95% in the volume of 300 MT/year and a leader in turmeric, ginger, and other spices for the last three decades. Our manufacturing facility is situated in Kerala and our unit has a total build up area with an annual capacity of 14,000 MT. We are certified with Halal, Kosher, HACCP, FDA, FSSC 22000 etc.

Imexco International PVT Ltd
709, Tower 1, Assotech Business
Cresterra, Sector 135, Noida, Uttar
PRADESH 201301, India
Contact: **Utsav Agarwal**
Email: **utsav@imexcoglobal.com**
Web: **www.imexcoglobal.com**

Established in 2006, Imexco International is a leading supplier of natural essential oils and pine chemicals from India.

Sri Anandateertha Aromatics (P) Ltd
Sy. No. 56 & 57, Sri Vijayaraja Estate,
Chokkanahalli, Jakkur Post, Bangalore,
Karnataka 560064, India
Contact: **Madhu R / Vighneshwar Hegde**
Email: **madhu@saaromatics.com**
vighnesh@saaromatics.com
Web: **www.anandateertha aromatics.com**

Sri Anandateertha Aromatics Pvt Ltd started in 2005, with experience in aromatics and medicinal plants. The company's major activities include cultivation, distillation, and procurement of over forty essential oils in both conventional and organic segments. Our company is tied up with more than 2,000 farmers across the country with a land bank of around 4,500 acres which produces more than 300 metric tonnes of essential oils per annum.

Fueguia S.R.L.
Via Ferrante Aporti 26, 20127,
Milan, Italy
Contact: **Julian Bedel / Ambra Betancourt**
Email: **julian@fueguia.com**
JulianPA@fueguia.com
Web: **www.fueguia.com**

Fueguia 1833, a vertically integrated artisanal perfume atelier and ethnobotanical project founded in 2010 by the artist and researcher Julian Bedel in Buenos Aires. Its factory and laboratory are located in Milano.

Chengdu Sunshine Flavors Co., Ltd
Oom 1913 Building 2, Jitai Road 5,
No.88, Chengdu High-Tech Zone, Sichuan Pilot Free
Trade Zone, China
Contact: **Lu Li**
Email: **lilu@cdsunshineflavors.com**
Web: **www.cdsunshineflavors.com/index.html**

Chengdu Sunshine Flavors Co., Ltd. was founded in 2018 and owns plants in China. We engage in R&D, production, and trading of flavours and aroma chemicals.

Kunming International Aroma Co., Ltd
Yiliang Industrial Zone, Kunming,
Yunnan, China
Contact: **Maggie Li / Janna Wang**
Email: **maggie_liqin@kiaroma.cn**
janna-wang@kiaroma.cn
Web: **www.kmhraroma.com/en**

Kunming International Aroma Co., Ltd is a manufacturer specialising in the R&D, production, and sale of natural essential oils and natural isolates.

Essential Distillation Equipment
Plot 2055, Kloof Street, Riebeek
Kasteel, 7307, South Africa
Contact: **Werner Bester**
Email: **werner@edesa.co.za**
Web: **www.edesa.co.za**

Design and manufacturing of equipment for the essential oil and other plant extraction industries including consultation on post/pre-processing facets, operating worldwide since 2001.

Satyasha Chemicals
87/153, Achraya Nagar, Kanpur,
Uttar Pradesh, 208003, India
Contact: **Atul Agarwal**
Email: **satyasha2000@gmail.com**
Web: **www.satyasha.com**

Satyasha Chemical was established in the year 2000 by Mr. Atul Agarwal. We are engaged in the distribution and manufacturing of essential oils, concretes, and aroma chemicals.

Soda Aromatic Co., Ltd
1-12-3, NihonbashiBakurocho,
Chuo-ku, Tokyo, 103-8366, Japan
Contact: **Ko Tsurumaki**
Email: **ko.tsurumaki.j3@soda.co.jp**
Web: **www.soda.co.jp/en**

Painting a glorious future with the invisible shades of odours.

Destilaria Oliveira Ltda.
Estrada Liga São João do Paraíso a
Fazenda, Roça do Mato, km 52.
Fazenda Roça do Mato. São João do
Paraíso. Minas Gerais. Zip Code:
39.540-000, Brazil
Contact: **Aroldo Antonio Santos de Freitas Oliveira**
Eduardo Vidal
Email: **aroldo.oliveira@eucaliptus.com.br**
eduardo.vidal@eucaliptus.com.br
Web: **www.eucaliptus.com.br/english**

We have worked with essential oils since 1998. Our eucalyptus chain encompasses the entire process: we plant, we harvest, we distill, and we sell.

Reschem Italia SPA
Via Olona 75, 20015 Villastanza Di
Parabiago, (MI), Italy
Contact: **Luca Garegnani**
Email: **l.garegnani@reschemitalia.com**
Web: **www.reschemitalia.com/en**

Distributor of chemical specialities and ingredients since 1990. Operating in Italy and the Balkan region.

Vessel Essential Oils
Anthemounta 0, Farmakeika, Neo
Risio, 57001 Thessaloniki, Greece
Contact: **Vasileios Varsamis**
Email: **info@vessel.gr**
Web: **www.evessel.gr**

Vessel is the biggest essential oils company in Greece focusing on the cultivation and distillation of aromatic plants in order to produce essential oils.

Origin Oils Pvt. Ltd
83-85, Baker Street, London
W1U 6AG, UK
Contact: **Samr Calcutawala**
Email: **samr.calcutawala@origin-oils.co.uk**
Web: **www.origin-oils.co.uk**

A manufacturer leveraging technology to supply sustainable, transparent, traceable, and ethically sourced essential oils by working with small farmers from emerging markets and enabling their meaningful participation in global essential oil supply chains.

Pureness Asia
5F, No. 42, Zhongmin S. Rd.,
Taichung city, Taiwan 40361, China
Contact: **Ariel Liu**
Email: **Ariel@aliz.com.tw**
Web: **www.pureness.asia/?lang=en**

Pureness has been importing essential oil since 2002. Our precise vision in the global essential oil market is based on our team of experts.

NEW IFEAT MEMBERS

Expressions Parfumees
136 Ch St Marc, 06130 Grasse, France
Contact: **Cecile Leja**
Email: **C.Leja@epparfums.com**
Web: **www.epparfums.com**

Anchored since 1982 in the Grasse region, Expressions Parfumées is a perfume composition house.

Nako naturals GmbH
Am Bahnhof 6, 21357 Bardowick,
Germany
Contact: **Sönke Koop**
Email: **Soenke.koop@nakonaturals.com**
Web: **www.nakonaturals.com**

Nako Naturals Group is a distributor based in Germany and India, specialising in supplying and researching sustainable, high-quality essential oils and aroma chemicals.

Nat'Green
38 avenue Chevreul 92600
Asnières-sur-Seine, France and 7
passage Eugène Barbier 92600,
Asnières-sur-Seine, France
Contact: **Maïssa Meriem BESSALAH**
Email: **contact@natgreen.fr**
b.meriem@natgreen.fr
Web: **www.natgreen.fr/?lang=en**

Nat'Green is dedicated to the sourcing of raw materials and to assure traceability and price control especially in Indonesia, Madagascar, Comores, and Tunisia.

Xi'an Angel Biotechnology Co., Ltd.
Room L-1301,No.3269 Yanxiang Road,
Qujiang, New District, Xi'an, Shaanxi,
710061, China
Contact: **Lyla Shi**
Email: **zhe@angelbiology.com**
Web: **www.angelbiology.com**

Xi'an Angelbio is a fast-growing company committed to providing more innovative ingredients for flavour and fragrance purposes.

Jiangxi Brother Pharmaceutical Co., Ltd.
Jishan Industrial park, Pengze county,
Jiujiang city, Jiangxi Province, China
Contact: **Jennifer Zhang**
Email: **jennifer_zhang@brother.com.cn**
Web: **www.brother.com.cn/en**

The Group's vision is striving for a better life. Our current aroma products include vanillin, ethyl vanillin, guaiacol, o-Vanillin, and veratrole.

Indras Agencies Private Ltd
Knowledge House, No. 06, Kasturi
Rangan Road, Alwarpet, Chennai
- 600 018, India
Contact: **Srinivas Rao / Chittaranjan Palai**
Email: **rao.srinivas@indras.co.in**
chittaranjan@indras.co.in
Web: **www.indras.co.in/**

INDRAS is a US$75 million trading and distribution firm headquartered out of Chennai, Tamil Nadu, India trading in aromatic chemicals, food and pharmaceutical ingredients. The company has a national footprint and operates through eight offices in India.

La Nature India Private Ltd
No.9, Annai Avenue,
Vadaperumbakkam, Chennai
- 600060, Tamal Nadu, India
Contact: **Dilip Kumar**
Email: **dilipkumar@lanatureindia.com**
Web: **www.lanatureindia.com**

We are one of the leading manufacturers of essential oils and major suppliers of floral concretes, absolutes, spice oils, and extracts located at South India. Having a wide range of farmer networks, after serving the domestic industry with our best quality and quantity over the years, we have extended our hands by supporting our farmers by diversifying our company by shedding the sustainability spotlight on essential oil crops.

Nantong Weide Flavor Co., Ltd
Room 301, No.186 Huizheng Road,
Rucheng, Subdistrict, Rugao,
Jiangsu, 226500, China
Contact: **Leo Fu / Scott Xiong**
Email: **xiong@aromaingredient.com**
fuqingfeng@aromati chemical.com
Web: **www.weideflavor.com**

Nantong Weide Flavor Co., Ltd is a manufacturer and designer of raw materials to the flavour and fragrance industry.

Iba Botanicals Inc.
Unit 804A Richville Corporate Tower
Unit 804, 1007 Alabang Zapote Road,
Madrigal Business Park, Muntinlupa,
Metro Manila 1781, The Philippines
Contact: **Ashok Singh**
Shieldera Lynn Yagyagen
Email: **ashok@ibabotanicals.com**
businessdev@iba botanicals.com
Web: **www.ibabotanicals.com**

Iba Botanicals, Inc. is pioneering the essential oils industry in the Philippines. We are passionate about sharing the exceptional quality of Philippine essential oils with the world and our mission is to have the Philippines recognised as a global supplier of premium-grade essential oils.

FairWild Foundation
Stampfenbachstrasse 38, CH-8006
Zürich, Switzerland
Contact: **Emily King**
Email: **eking@fairwild.org**
Web: **www.fairwild.org**

The FairWild Foundation promotes sustainable trade in wild plant ingredients through the FairWild Standard and certification, for the benefit of communities, nature, and business.

Midhills Rosin and Turpenes
Sood Building, Village Nandal, P.O
Oachghat, Solan , H.P. 173212, India
Contact: **Sidharth Sood**
Email: **sidharth@midhills.com**
Web: **www.midhills.com**

Midhills, established in 2009 by Sh Sudhir Sood in the Shivalik Hills mountain range in the Himalayas, is one of the leading pine and pine derivatives producers in India.

Gamma Flavour & Fragrances Egypt
Plot 95, Third Industrial Zone,
6th of October, Egypt
Contact: **Fouad Fayad**
Email: **fouadfayed@general aromatic.com**

Currently no website available
Gamma Flavors & Fragrances is a private Egyptian manufacturer in the flavour and fragrance business covering the products of essential oils, fragrances, flavours, and cosmetics.

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