



VANILLA PRODUCTION, PROCESSING AND PACKAGING



Richard Exley

International ISS Institute/DEEWR Trades Fellowship

Fellowship supported by the Department
of Education, Employment and Workplace
Relations, Australian Government

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Executive Summary

The Fellowship program included attendance at the biennial Vanilla 2009 conference in New Jersey USA, visiting a major European vanilla importer in Germany, a government research station and a commercial farm on Reunion Island in the Indian Ocean.

The Fellowship provided access to new skills and knowledge that will assist in the establishment of the fledgling Australian vanilla-growing industry. The Fellow enhanced his understanding of the climatic conditions suitable for vanilla cultivation and saw first hand the latest techniques used overseas to adapt local environmental conditions to provide optimal conditions for successful vanilla production. The Fellow returned to Australia with important new knowledge about world-best-practice including sorting, grading and packaging practices, as well as timely information about international market trends.

Controllable environmental conditions identified include the shade system, orientation or aspect of the site, drainage and mulching beds. The shade system most typically adopted is a simple flat green 50 per cent shade cloth either supported by steel cable or galvanised metal fence pipe. A south-east through to north-east aspect is most suited, with a gently sloping site for good drainage. Further improvements in shade house design can be achieved by using cloths with foil woven into them. These reduce the heat gain experienced under standard cloths, thereby mimicking the benefits provided by a canopy of foliage. Additional benefits may be gained by using twin layers to allow the manipulation of light levels. A saw-tooth roof pattern with the opening to the south or leeward side of the prevailing breeze used to encourage improved ventilation may also be beneficial.

Establishing a sustainable vanilla industry in the Australian 'Top End' poses substantial challenges as most of Darwin's rainfall occurs between December and April. Darwin's flat scrubby woodlands also experience greater variation in humidity levels, high summer temperatures and extended dry periods. These conditions are not generally favourable for growing vanilla. However, these difficulties may be readily overcome by improvements in plantation and shade house design and appropriate watering systems.

Tropical North Queensland, with its rain more evenly spread throughout the year, milder summer and tropical forests is more closely aligned with the optimal conditions needed for growing vanilla.

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Abbreviations and Acronyms

CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement (a French research centre that works with developing countries to tackle international agricultural and development issues)
CymMV	Cymbidium mosaic virus
DAFF	Department of Agriculture Fisheries and Forestry
DEEWR	Department of Education, Employment and Workplace Relations
GmbH	A company with limited liability
LLC	A limited liability company
INIFAP	National Institute of Forests, Agriculture and Fisheries (Mexico)
ISS Institute	International Specialised Skills Institute
pH	A measure of the acidity or alkalinity of a solution
UMR-PVBMT	Unité Mixte de Recherche – Peuplement Végétaux et Bioagresseurs en Milieu Tropical (Joint Research Unit – Plant Communities and Biological Invaders in Tropical Environments)

Definitions

Ariel/Adventitious Roots

Roots above ground used by the vine to cling to and support the host plant.

Bagasse

Residue left behind from sugar cane processing that is commonly used as mulch.

Bourbon (vanilla)

Vanilla originating from the Indian Ocean region including Madagascar, Comoros, Mayotte and Reunion Island (formerly Bourbon Island) and also the name commonly given to the curing process of the region.

Curing

The process that transforms the flavourless green beans into the world's favourite flavour: vanilla.

Design

Design is problem setting and problem solving.

Design is a fundamental economic and business tool. It is embedded in every aspect of commerce and industry and adds high value to any service or product—in business, government, education and training, and the community in general.

Reference: 'Sustainable Policies for a Dynamic Future', Carolynne Bourne AM, ISS Institute 2007.

Divanillin

A compound formed from vanillin during the enzymatic curing process that adds a creamy, fatty mouth feel to the flavour of vanilla beans.

Enzymatic

The reaction caused by the curing process that leads to flavour and aroma development.

Fusarium

This is a fungal disease affecting *Vanilla planifolia*.

Innovation

Creating and meeting new needs with new technical and design styles. (New realities of lifestyle).

Reference: 'Sustainable Policies for a Dynamic Future', Carolynne Bourne AM, ISS Institute 2007.

Inter-cropping

The cultivation of two or more crops simultaneously, occurring on the same field.

Definitions

Killing

The method of starting the enzymatic curing process, most commonly the act of dipping the green beans into water heated to 65 degrees Celsius.

Raceme

This is the term for branching and associated flowers that develop off the main stem.

Penicillium and asperfillus

Mould species with a detrimental impact on vanilla vines.

Skill deficiency

A skill deficiency is where a demand for labour has not been recognised and training is unavailable in Australian education institutions. This arises where skills are acquired on-the-job, gleaned from published material or from working and/or studying overseas.

Reference: 'Directory of Opportunities. Specialised Courses with Italy. Part 1: Veneto Region', ISS Institute, 1991.

There may be individuals or individual firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the intellectual property to themselves. Over time these individuals retire and pass away. Firms likewise come and go.

Sustainability

The ISS Institute follows the United Nations for Non-Governmental Organisations' definition on sustainability: "*Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*".

Reference: http://www.unngosustainability.org/CSD_Definitions%20SD.htm

Trellis

A timber frame or steel wires used to support vines in a plantation.

Tutor(s)

Traditionally a term used to describe a shrub or small tree on which the vanilla vine is grown, now also used in reference to artificial supports such as timber poles.

Vanillin

This is the principal compound responsible for the flavour and aroma of vanilla beans.

Acknowledgements

Richard Exley would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide him throughout the Fellowship program.

Awarding Body – International Specialised Skills Institute (ISS Institute)

The International Specialised Skills Institute Inc is an independent, national organisation that for over two decades has worked with Australian governments, industry and education institutions to enable individuals to gain enhanced skills and experience in traditional trades, professions and leading-edge technologies.

At the heart of the Institute are our Fellows. Under the **Overseas Applied Research Fellowship Program** the Fellows travel overseas. Upon their return, they pass on what they have learnt by:

1. Preparing detailed reports to government departments, industry and education institutions.
2. Recommending improvements to accredited educational courses.
3. Offering training activities including workshops, conferences and forums.

Over 180 Australians have received Fellowships, across many industry sectors.

Recognised experts from overseas also conduct training activities and events. To date, 22 leaders in their field have shared their expertise in Australia.

According to Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010':

Australia requires a highly skilled population to maintain and improve our economic position in the face of increasing global competition, and to have the skills to adapt to the introduction of new technology and rapid change.

International and Australian research indicates we need a deeper level of skills than currently exists in the Australian labour market to lift productivity. We need a workforce in which more people have skills, but also multiple and higher level skills and qualifications. Deepening skills across all occupations is crucial to achieving long-term productivity growth. It also reflects the recent trend for jobs to become more complex and the consequent increased demand for higher level skills. This trend is projected to continue regardless of whether we experience strong or weak economic growth in the future. Future environmental challenges will also create demand for more sustainability related skills across a range of industries and occupations.¹

In this context, the Institute works with Fellows, industry and government to identify specific skills in Australia that require enhancing, where accredited courses are not available through Australian higher education institutions or other Registered Training Organisations. The Fellows' overseas experience sees them broadening and deepening their own professional practice, which they then share with their peers, industry and government upon their return. This is the focus of the Institute's work.

For further information on our Fellows and our work see www.issinstitute.org.au.

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¹ Skills Australia's 'Australian Workforce Futures: A National Workforce Development Strategy 2010', pp. 1-2 http://www.skillsaustralia.gov.au/PDFs_RTFS/WWF_strategy.pdf

Acknowledgements

Fellowship Supporter

This Fellowship has been supported by the Department of Education, Employment and Workplace Relations (DEEWR).

DEEWR provides national leadership and works in collaboration with the States and Territories, industry, other agencies and the community in support of the Government's objectives. DEEWR aims to touch the lives of all Australians in a positive way, working towards a vision of creating a productive and inclusive Australia. Richard Exley would like to thank them for providing funding support for this Fellowship.

Supporters

- Bakto Flavors LLC
Professor Daphna Havkin-Frenkel
- Department of Business and Employment, Northern Territory Government
Neil Almond, Director, Investment Services
Murray Hird, Director, Industry Development
- Department of Regional Development, Primary Industry, Fisheries and Resources, Northern Territory Government
Matt Darcey, Director – Crops, Forestry and Horticulture Division
Mark Traynor, Technical Officer, Horticulture Division
- Northern Territory Government
The Hon Paul Henderson MLA, Chief Minister
- Rutgers University, New Jersey USA
Professor Chaim Frenkel, Department of Plant Biology and Pathology, Cook College

Individuals and Organisations Impacted by the Fellowship

- Adelaide Hills Gourmet Food
- AgriFood Skills Australia
- Broken Nose Vanilla, Queensland
- Daintree Spice & Vanilla, Queensland
- Department of Agriculture Fisheries and Forestry (DAFF), Australian Government
– Crops, Horticulture, Irrigation and Wine Branch
– Food Branch
- Department of Resources – Primary Industry, Northern Territory Government
- Murray Hird, Frangipani Bay Consulting, Darwin
- Northern Territory Horticultural Association
- Queen Fine Foods
- Australian Vanilla Plantations – Queensland

About the Fellow

Name: Richard Exley

Employment

- Vanilla Grower (Research)/Project Manager

Qualifications

- Certificate of Technology Civil Design Drafting, Royal Melbourne Institute of Technology (RMIT), 1987
- Graduate Certificate of Engineering (Professional Development), Engineers Education Australia (Project Management and Evaluation), 1998

Memberships

- Officer Fellow, Institution of Engineers, Australia

The Fellow has had a successful career in project management, contract administration and extensive experience in the civil and structural design drafting of infrastructure and building projects.

He has also recently been involved in feasibility studies for industrial infrastructure, one of which led to the establishment of the Common User Area in Darwin for the benefit of the metal fabrication industry.

Over the past six years the Fellow has worked towards the establishment of sustainable vanilla cultivation and processing in the Northern Territory.

Aims of the Fellowship Program

This Fellowship sought to improve knowledge and understanding of the vanilla industry in order to progress the development over time of a vertically integrated, sustainable Australian vanilla industry.

By visiting overseas growers and markets to observe and learn from experienced industry practitioners, the Fellow sought to address the following specific objectives:

- To become more skilled in the art of vanilla pollination.
- To become more skilled in the practice of curing, handling and storing vanilla beans after harvest.
- To establish a greater understanding of the international vanilla bean market and the products derived from them.

The Australian Context

Vanilla cultivation and processing is very much a fledgling industry in Australia. In the 1920s trials were conducted in Far North Queensland to determine the suitability of the region for vanilla cultivation. While apparently they met with some success, attention turned to other more fashionable crops and vanilla was forgotten. In the 1980s officers of the Northern Territory Department of Primary Industry conducted research including successful plantings on the Coastal Plains Research Station. At that time the mango industry was beginning to grow strongly in northern Australia and vanilla was again forgotten. Unfortunately no data from this research program is available.

Although there are a small number of vanilla growers in Far North Queensland and the Northern Territory, no critical mass of knowledge exists, particularly in the area of cultivation and post harvest vanilla production.

An Overview of Vanilla

The climbing perennial orchid, *Vanilla planifolia*, originated in Mexico and Central America and grows naturally in the region's tropical and subtropical forests. The principal source of *Vanilla planifolia* today is Madagascar and the Reunion, Comoros and Mayotte islands. Vanilla beans from this region are known as bourbon vanilla. Indonesia is also a significant supplier of vanilla beans.

The vanilla genus comprises about 100 species. However, only three varieties of commercial vanilla are grown for their fruit: *Vanilla planifolia*, *Vanilla tahitensis* and *Vanilla pompona*. *Vanilla planifolia* has the most commercial value of the vanilla varieties.

Like most orchids, vanilla is a shade-loving plant; it prefers 50 to 60 per cent shade and good to strong indirect light. They may also benefit from dappled light. While shade is necessary, it should not be too overbearing. An eastern exposure is the optimal direction.

The traditional growing method for cultivating vanilla is to grow it on a low-branching shrub or tree called the 'tutor'. The tutor supports the vine and provides the desired shade.

Left to grow on their own, the vines will climb directly up the support to which they are attached. However, to make it more accessible to pollinate and harvest the beans the plant needs to be trained to a height of not more than 1200 to 1350 millimetres with a maximum height of no more than 1500 millimetres. As the vines can grow up to 15 meters they are looped. This technique also helps to encourage flowering.

The cultivation, harvesting and curing of vanilla is a very labour-intensive process. The vines must be trained on their supports by hand and each flower must be hand pollinated. The vanilla beans are harvested by hand progressively as they ripen. Even most of the packaging is still done by hand.

In Mexico and Madagascar most of the vanilla is grown on trees in plantation forests or natural woodlands. While normally grown under a canopy of trees, a few trials using shade cloth are being undertaken with some success, proving that the vanilla plant is grown on timber supports in a shade house.

In Mexico Melipone bees pollinate the flowers. However, this natural pollination method is unreliable for commercial operations elsewhere, as this type of bee is only found in Mexico. Consequently, other regions find it necessary to develop a manual pollination method.

The Australian Context

The hand pollination method is still the only reliable method used to pollinate the flowers. This task is carried out each morning during the flowering season as the flowers open. It is essential that they be pollinated in the morning as the flowers last only a single day and will wilt and drop off if pollination is not carried out or is unsuccessful. Flowering may occur over a two to three month period.

Care must be taken not to over-pollinate the flowers as this can result in the beans failing to mature and the vine dying. In most regions only the flowers on the lower side of the raceme are pollinated. This allows the beans to hang straight down, aiding in the production of straight beans; a desirable trait in the premium vanilla bean market.

Harvesting is done some six to nine months after flowering and pollination, when the tips of the bean starts to turn yellow and the remainder of the bean takes on a less-green colour changing towards yellow. Late harvesting could lead to a high number of split beans, which lowers their value considerably. Harvesting too early could lead to a poor quality bean in terms of its aroma and flavour characteristics as the vanillin content—a key flavour component—is lower. Therefore, to maximise product quality beans should be pollinated progressively by hand as they ripen.

Critical to ensuring the best quality vanilla beans is the curing process. There are two principle methods for curing vanilla: the Bourbon method and the Mexican method. Correct curing maximises the unique flavour and aroma of the bean by encouraging the enzymatic reactions that produce vanillin. The appearance of a crust of fine white crystals on the cured vanilla beans is considered by some to be a sign of high vanillin content. The crust is crystallised vanillin. Other factors determining quality include general appearance, flexibility and length. The relative importance of these attributes depends upon the intended use of the cured beans. Traditionally, the appearance, flexibility and size characteristics have been important because there is a fairly close relationship between these factors and the aroma and flavour.

SWOT Analysis

Strengths

- No known vanilla viral diseases or pests in the region.
- Technical resources and capacity to adapt farming systems.
- Technical resources and capacity to adapt processing systems.
- Existing techniques are simple and readily transferred with no special equipment required for existing methods.
- Mechanisation, innovations in curing and processing.
- Large areas with suitable climate, soil, land and water combinations.

Weaknesses

- High labour costs in Australia.
- No previous commercial growing experience in the Northern Territory.
- No broad collection of *Vanilla planifolia* cultivar stock.
- No vanilla curing and processing facilities in Australia.

The Australian Context

Opportunities

- Large base of horticultural growers with broad experience looking for new opportunities.
- Safe clean, and quality image of Australian produce.
- Selective breeding to increase yield and vanillin content.
- Vertical integration of industry. Further develop processing to produce essences and extracts for the fragrance and flavouring markets. Develop premium gourmet brand beans for retail and hospitality markets.

Threats

- Moulds (Penicillium and Aspergillus) potentially destroying the vanilla.
- The lack of vineyard and processing facility hygiene.
- The risk of mite infestation.
- Possible inadequate quarantine procedures.
- Inadequate information on global market trends, production levels and prices.

Identifying the Skills Deficiencies

Addressing the following skill deficiencies will assist in the establishment of the fledgling Australian vanilla-growing industry through:

- An improved understanding of the climatic conditions suitable for vanilla cultivation.
- The adoption of new techniques to provide optimal environmental conditions for successful vanilla production.
- Adopting world-best-practice sorting and grading practices.
- Improved packaging and responsiveness to changing market trends.

The skill deficiencies identified and proposed action to address them are as follows:

1. Environmental conditions found in other vanilla producing regions.

Action:

- Collect record and analyse environmental data from established vanilla growing regions.
- Analyse the composition, structure, pH and water holding capacity of soils; the historical regional weather data such as max/min temperatures, humidity levels and rainfall averages.

2. Site selection criteria, site adaptation techniques and optimal environmental conditions necessary for successful vanilla production.

Action:

- Identify controllable environmental conditions in established 'cultivation' systems.
- Analyse controllable environmental conditions in established plantation systems such as soil amendments, irrigation regimes, planting density, support (eg trellis) and shade systems used.
- Determine the criteria used for local site selection of vanilla plantations relative to the uncontrollable environmental elements of topography, weather and aspect. Identify critical plantation design criteria for reducing disease/fungi/mould occurrence and optimising operation and yields.

3. Current international best-practice operation and maintenance techniques for the management of cultivated vanilla plantations.

Action:

- Observe and record seasonal maintenance and irrigation operations in vanilla plantations.
- Visit working farms and conduct interviews and record data relating to specific maintenance and irrigation operations carried out on a season-by-season basis including:
 - Cultivation of plant.
 - Plant pollination techniques.
 - Harvesting of ripe beans, including the correct identification of ripe vanilla beans.
 - Storage and handling of harvested beans.
 - Curing of harvested beans.
 - Observe and analyse traditional methods.

Identifying the Skills Deficiencies

- Bourbon method used in the Indian Ocean.
- Mexican method used.
- Identify innovative curing techniques and understand the advantages and disadvantages of each technique.

4. World-best-practice in grading, handling and shipping vanilla beans. Understanding of international market trends.

Action:

- Identify international methods of grading product, quality control and marketing strategies for national and international markets.
- Engage with experienced growers to observe and apply grading, quality, handling and storage techniques. Conduct interviews with European industry agents about marketing, quality control and marketing.
- Learn latest storage, packaging and shipping methods.

5. Building and sustaining financially viable vanilla agri-tourism businesses.

Action:

- Inspect properties, interview proprietors of agri-businesses specialising in value-added products.

6. Traditional and contemporary uses of vanilla including the development of value-added products.

Action:

- Identify the markets and traditional uses of vanilla in both the European and USA markets and their key differences.
- Learn marketing techniques and packaging preferences in the key vanilla markets of Europe and the United States of America (USA).

The International Experience

The Fellowship program included attendance at the biennial Vanilla 2009 conference in New Jersey USA, visiting a major European vanilla importer in Germany, a government research station and a commercial farm on Reunion Island in the Indian Ocean.

There is widespread concern among international vanilla traders and buyers about the recent decline in production in Indonesia and Papua New Guinea, the failure of intensive plantations in China and increasing instances of plant disease in Madagascar. Production in the Madagascan vanilla industry has fallen sharply recently. A continuation of this trend could have major implications on world vanilla supplies and price.

The Vanilla 2009 conference was therefore a unique opportunity for industry participants to meet and assess the future prospects for this industry.

Vanilla 2009, New Jersey, USA²

The Vanilla 2009 conference was held in November 2009 in Monroe, New Jersey. Bakto Flavors LLC and Rutgers University jointly sponsored the conference. Bakto Flavors is a company based in New Jersey that specialises in top quality vanilla and natural flavours.

The theme of the conference was Vanilla Disease. This was a timely issue for the conference to consider given the rapid emergence of Fusarium disease in Madagascar, the world's largest vanilla producer.

Below is a summary of the relevant presentations given at the Vanilla 2009 conference:

Vanilla's Achilles' Heel: Fusarium³

Presenter: Hank Kaestner, Consultant, Dammann and Co

Hank Kaestner is a consultant with over 30 years experience in the vanilla industry. He noted that all intensive cropping attempts with vanilla have failed due to Fusarium. Symptoms of the disease include root rot, yellowing of the leaves and aerial roots going into the mulch.

Kaestner cited the causes of Fusarium in intensive cultivation to be plant stress caused by drought, extreme variations in climatic conditions including cyclones and high winds, over-pollination, trampling of the roots, poor maintenance due to grower inexperience and chemical infestation, such as salt from sea spray blown inland by cyclonic winds.

Kaestner was of the view that Fusarium can only be overcome through a return to traditional forest-based and mixed agriculture vanilla farming methods and inter-cropping.

² <http://www.vanilla2009.com/Vanilla2009.com/Home.html>

³ <http://www.dammannvanilla.com>

The International Experience

Is Another Vanilla Crisis Inevitable?⁴

Presenter: Rick Brownell, Vice President Vanilla Products, Virginia Dare Co

Rick Brownell led discussion at the conference beyond Fusarium disease to an examination of other issues confronting the vanilla industry internationally including root damage, poor drainage systems, limited genetic diversity, storage problems and over-cultivation.

He made the point that vanilla is not a free market due to unreliable information about pricing, market manipulation and political corruption. To overcome these challenges and ensure the survival of the vanilla industry worldwide Brownell proposed nine strategies:

- 1) Seek government intervention to price support for vanilla farmers.
- 2) Increase public and private research efforts into the causes and treatments of vine disease.
- 3) Through an extensive effort at identification, collection and cross breeding, expand and diversify the vanilla gene pool with wild vanilla varieties.
- 4) Expand the identification standards to include *Vanilla pompona* and other vanilla species.
- 5) Undertake a concerted effort to improve farmer education in cultivation and curing.
- 6) Promote a return to traditional cultivation.
- 7) Improve the level of collaboration between the vanilla industry and universities; museums; government agencies; non-government organisations; seed, fungicide and pesticide manufacturers; and food and beverage manufacturers.
- 8) Use growing global interest in sustainability to promote traditional vanilla farming methods.
- 9) Utilise modern communications technologies to share information between and across vanilla growing regions.

High Costs and Fluctuation Prices: Major Impediments to the Growth of Vanilla in Mexico⁵

Presenter: Juan Hernandez, Vanilla Specialist, National Institute of Forests, Agriculture and Fisheries (INIFAP), Mexico

Mexico is the original home of vanilla and to this day Mexican vanilla rivals the best Bourbon vanilla from Madagascar. However, price fluctuations and the relatively high land and labour costs compared to Asia and Africa continue to impede the growth of Mexico's vanilla industry.

Hernandez's presentation reinforced comments made by previous presenters that Fusarium disease can only be eradicated by having well drained planting beds, using healthy cuttings, protecting roots with mulch, ensuring plantations have good ventilation and avoiding plant stress caused by excessive pollination.

Hernandez then went on to outline Mexican curing methodologies including killing in ovens, successive sunning and sweating, shade drying, and conditioning in wooden boxes.

⁴ <http://www.virginiadare.com>

⁵ http://www.inifap.gob.mx/ingles/index_ingles.htm

The International Experience

He also outlined the traditional vanilla packing procedures used in Mexico involving bulk wrapping in wax paper and packing in cardboard boxes. While these traditional packing methods are still in use in some places, packing in vacuum-sealed plastic bags is becoming increasingly the norm.

Vanilla Intensified Cultivation Program in French Polynesia: Diseases Management Strategy and Breeding Program

Presenter: Sandra Leepers-Andrezejewski, Virologist, Etablissement Vanille de Tahiti⁶

Leepers-Andrezejewski led a wide-ranging discussion on the disease management strategies developed for intensive cultivation of vanilla in French Polynesia. Promoting intensive cultivation in shade houses has reinvigorated vanilla production in that country.

Shade houses are monitored closely to detect and identify any virus because many pathogens thrive under intensive cultivation. Stringent procedures are followed to prevent plant disease. These include making sure that cuttings are free of any virus, frequent washing of hands and tools, weed removal, the use of insect-proof netting to cover shade houses and the removal and burning of infected plants.

While fungal diseases have also occurred in French Polynesia, they are more difficult to control. The identified causes of fungal disease include intensive cultivation, inadequate mulching, poor drainage and insufficient ventilation.

Phytosanitary Constraints on Bourbon Vanilla; Past and Present Situations and Perspectives for Control

Presenter: Dr Michel Grisoni, Plant Virologist, CIRAD (A French research centre that works with developing countries to tackle international agricultural and development issues), UMR-PVBMT (Joint Research Unit – Plant Communities and Biological Invaders in Tropical Environments), La Reunion, France⁷

Dr Grisoni provided the conference with an overview of vanilla production in the South-West Indian Ocean region. While the region is responsible for 70 per cent of the world's vanilla production, it comes from a narrow genetic base. Most vanilla in the region is grown on semi-intensive plantations. This is particularly the case in Madagascar and Comoros. Reunion Island on the other hand uses intensive plantations and shade houses.

CIRAD has been conducting field studies since 1997 into pests and diseases impacting on the development of the vanilla industry in this region. The research has noted an increased incidence of *Fusarium* due possibly to poor plant management and extended periods of dry soil. The symptoms of *Fusarium* include yellowing of the leaves, root and stem rot and growth of adventitious roots from the stem downward into the soil in search of nutrients no longer supplied by the infected root system. Suggestions for control included inter-cropping with plants that are known to suppress *Fusarium*, such as tomatoes; crop rotation; avoiding over-intensive planting, biological agents; and selective breeding for genetic resistance, all of which hold significant promise.

⁶ <http://www.vanilledetahiti.pt/>

⁷ <http://umr-pvbmt.cirad.fr/en/news>

The International Experience

Dr Grisoni also discussed other plant pathogens such as the Cymbidium mosaic virus (CymMV) that is widespread in Madagascar. While not considered harmful to vanilla in itself, it can make vines more susceptible to harmful diseases like Fusarium. Identifying and selecting virus-free plants for new cuttings may effectively control CymMV.

What Will the Flavour Industry Do Without Vanilla?

Presenter: Aaron Isaacson, Owner, Mr Recipe Premium Pure Vanilla Products, New York

Vanilla is the pre-eminent flavour enhancer. It can be used in savoury dishes as a backdrop as well as in desserts or drinks as a complementary or primary flavour.

Isaacson's presentation focussed on the end use and users of vanilla: homes and restaurants, chefs, gourmet food retailers and general food outlets such as ice creameries and bakeries.

He emphasised the importance for the vanilla industry to increase its efforts in reaching food industry practitioners through industry associations and culinary education institutes.

Also, a priority for the vanilla industry is to become more involved in the development of value-added products such as paste, powder, extract, infused oils, syrups and other products.

Vanilla: It's All a Matter of Taste

Presenter: Patrick J. Dunphy, Flavour and Vanilla Consultant, United Kingdom

Patrick Dunphy has over 35 years experience in the flavour industry. He pointed out that, despite the fact that vanilla extract contains more than 250 individual compounds, little is still known about the contribution each compound makes to the overall taste and aroma of vanilla. For example, very little is known about divanillin: a compound that contributes a creamy, fatty character to certain flavours and mouth-feel to some foods.

Dunphy pointed to research that promises great opportunities for flavour development in vanilla beans and extract. When the key flavour and aroma compounds are identified and the associated enzymatic pathways that lead to their creation during the curing process are properly understood, growers will be in a position to adapt the curing process to produce targeted individual compounds, thereby improving the flavour profile of the vanilla beans.

Vanilla in Australia

Presenter: Richard Exley, Fellow – International ISS Institute/DEEWR Trades Fellowship, Australian Vanilla Bean, Darwin, Australia.

Richard Exley provided an overview of the vanilla industry in Australia, outlining the two suitable growing regions, Darwin (Top End), Northern Territory and Far North Queensland. Exley also discussed the benefits of Australian vanilla, a clean, green agricultural image and security of supply. As a new industry it is unhindered by traditional structures and practices, this allows Australian growers to establish vertically integrated businesses to capture the maximum value of the crop.

Exley also discussed the potential to optimise shade house design to improve the control of growing conditions and mimicry of natural/traditional growing conditions.

The International Experience

This could be achieved by using shade cloth with aluminium foil woven into it, with further benefits potentially gained by implementing an adjustable twin layer system.

Exley noted that the way forward for the Australian vanilla industry was vertical integration of growing, curing and value-added product development.

Gebruder Wollenhaupt GmbH, Reinbek, Germany⁸

Contact: Nils Bohla, Manager Vanilla Division

The meeting with Nils Bohla provided the Fellow with a different perspective on international production and supply trends in vanilla. Bohla noted that while there is much talk about recent falls in production in Madagascar, this should be seen as normal variation in the context of long-term production trends. Further, Bohla stated Madagascan production has always ranged between 900 and 1200 tonnes per annum. While the last 15 years has seen nations such as Indonesia, India, Papua New Guinea and others emerge as significant producers. The key difference is these nations have seen a steady (and significant) decline in production year on year over the past few years. This, Bohla feels, is the real underlying reason for current forecasts of lower global production.

Current bulk trade prices are in the range of US\$20–25. This makes vanilla unattractive to growers even in Indonesia and Madagascar. Consequently, some growers are switching to alternative crops. Falls in production can also be attributed to unfavourable weather in some of the key vanilla-growing regions. Prices are, however, expected to rise over the next couple of years and are predicted to then settle the US\$60–80 range. There is also the possibility of higher, short-term price spikes up to US\$250–350.

Reunion Island

Temperatures on Reunion range between 14 and 28 degrees Celsius in the lower parts of the island. The eastern side of the island is favoured for vanilla because of its more reliable and evenly spread rainfall and light breezes throughout the year. Humidity levels generally range between 60 and 80 per cent throughout the year.

Roulof Vanilla

Contact: M Roulof, Owner, Saint Andre, Reunion Island

Roulof Vanilla has approximately three-and-a-half hectares of vanilla plants and operates two shade houses that are each around 2000 square metres with roof heights of 2.4 and three meters respectively. Each shade house contains about 450 plants. Plants are spaced a metre apart with around two metres separating the rows. Shade is provided by green 50 per cent shade cloth. A three-meter roof height is preferred as it improves air circulation.

Treated pine poles are used to support the 1.8 to two-metre high vines, together with an 800-millimetre long half-round cross piece on top and a 300 to 400-millimetre long treated pine cross piece mid way up. Both cross pieces are orientated parallel to the mulch bed. The shade house planting beds are between one and 1.2 metres wide and edged with timber or concrete.

⁸ <http://www.vanilledetahiti.pf/>

The International Experience

The beds are constructed by placing down weed mat, then 50 millimetres of gravel and, on top of that, a 100 to 150-millimetre mulch bed of sugar cane leaf or bagasse. As a result of raised mulch beds being used, soil composition and pH have little bearing on vanilla quality. The shade houses are irrigated by overhead misting to help maintain humidity in dry periods as well as soak the vines and beds.

Planting is done primarily using the traditional system with mature *Dracaena marginata* (commonly known as the Madagascar Dragon Tree or Red Edged Dracaena) as shade and support. Native to Madagascar, it is a slow-growing shrub or small tree, eventually reaching heights of three to five metres. A benefit of using *Dracaena marginata* is that virtually no pruning is required. Shade and support shrubs are planted two to 2.5 metres between rows, with 1.5 to two metres between plants within a row. Mounding sugar cane mulch around the base of the trees creates planting beds. When mature, the Dracaena trees form a broad shade canopy that allows dappled light to penetrate to the vines. The only fertiliser used is sugar cane mulch or bagasse, as alternative fertilisers have not delivered superior results.

Yields vary seasonally but average between 400 and 600 grams (dried) per vine. A good year can deliver 1000 grams and an exceptionally good year can result in a 2000-gram yield. Between 50 and 100 grams in the yield is a bad year. M Roulof noted that an exceptional year is nearly always followed by a poor year, or at best an average crop.

The vanilla is cured using the traditional Bourbon method. At different times M Roulof has tried alternative methods, such as freezing, instead of hot water scalding, and placing the beans in a plastic bag on the roof to cure.

In order to keep the business viable, Roulof runs plantation tours at his Saint Andre plantation that has a mix of shade house and traditional growing systems. By running the tours three times a day, six days a week during the tourist season, he gains a secondary income and is able to sell most of his vanilla directly to tourists at full retail price.

CIRAD, UMR-PVBMT⁹

Contact: Dr Michel Grisoni, Plant Virologist, Reunion Island

CIRAD maintains a non-commercial collection of vanilla varieties from around the world in two shade houses similar in design to those at Roulof Vanilla. The facility studies the properties of existing commercial and non-commercial varieties to identify traits that may improve the properties of *Vanilla planifolia* including yield, length and thickness of beans and disease resistance.

Other Vanilla Related Businesses

A family owned beverage manufacturer on Reunion Island is producing a range of traditional fruit and spice flavoured punches, rums and liqueurs for the local and export markets. It has been owned and operated by the same family since its establishment in 1907. Locally sourced Bourbon vanilla is used to manufacture vanilla extract for the many punch blends and vanilla flavoured products. All recipes are a closely guarded family secret.

The products demonstrate the potential for value-adding and new product development in other sectors of the food and beverage industry that can be opened up by the presence of a regional vanilla industry.

⁹ <http://umr-pvbmt.cirad.fr/en/news>

Knowledge Transfer: Applying the Outcomes

Applicability of Australian Conditions for Vanilla Growing

Establishing a sustainable vanilla industry in the Australian Top End poses substantial challenges. For example, most of Darwin's rainfall occurs between December and April. Darwin's flat scrubby woodlands also experience greater variation in humidity levels, high summer temperatures and an extended dry period. These conditions are not generally favourable for vanilla growing. However, these difficulties may be readily overcome by improvements in plantation and shade house design and appropriate watering systems.

Improvements in shade house design are achievable by using cloths inter woven with foil to reduce the heat gain experienced under standard cloths. This approach mimics the benefits of a foliage canopy. Other design advances include the use of twin layers to allow the manipulation of light levels. A saw-tooth roof pattern opening to the south or leeward side of the prevailing breeze would deliver improved ventilation.

Tropical North Queensland, with its rain more evenly spread throughout the year, milder summer and tropical forests, is more closely aligned to optimal conditions needed for vanilla growing.

Cultivation and Harvesting Techniques

Vanilla beans should only be harvested as the tips begin to yellow. This requires the crop to be harvested progressively as they ripen. The crop must be checked on a daily basis.

While many newer techniques and systems are available for curing, such as freezing and placing in plastic bag on a hot roof, the traditional Bourbon method is still favoured by most producers in the main producer regions. The Mexican method, using an oven for killing instead of the Bourbon hot water scalding, produces a vanilla with a slightly creamier taste. None of the alternative curing methods appear to deliver a superior product compared to traditional curing methods.

At the Vanilla 2009 conference and during his time on Reunion Island the Fellow learnt the importance of clean equipment and hands in keeping plantations disease free, preventing the spread of a diseases outbreak and minimising the risk of moulds and fungus spoiling beans during the enzymatic curing process.

Grading

On Reunion Island and in Madagascar the vanilla bean is graded and sold according to the five categories set out below.

Grading Category	Description
Extra	Whole, thick, supple beans, with no splits, free from blemishes, possessing a uniform dark chocolate-brown colour, and an oily lustre. The aroma is clean and delicate.
First	Similar to Extra but not quite so thick. Poorer-quality appearance.
Second	Thinner beans with a chocolate-brown colour and a few skin blemishes. Good aroma.
Third	Thinner, more rigid beans with a slightly reddish chocolate-brown colour. Fair aroma.
Fourth	Rather dry beans with a reddish colour and numerous skin Blemishes. Ordinary aroma.

Knowledge Transfer: Applying the Outcomes

Both split beans and whole beans are sorted corresponding to these categories. The grades for whole and split beans are also subdivided by size.

Retail Packaging

The European market is very demanding in terms of packaging, with a strong preference for beans packaged in glass tubes. Plastic containers are shunned because they are said to taint the vanilla. Some of the high-end brands package the vanilla in aluminium tubes similar to cigar tubes with the beans wrapped in paper. This is considered superior as they are protected from light. Bulk vanilla consignments are usually packed in paper-lined airtight tins or paper-lined cardboard boxes.

The American retail market prefers vanilla extract, paste, powder and sugar instead of whole beans. Nevertheless, whole beans are gaining some ground due to their exposure on television cooking shows and contests. Whole beans sold in the USA retail market tended, however, to be of a lower grade compared to the European market. Packaging was also of a lower quality in the USA, where whole beans were bent in half and packed in jars or vacuum packed in plastic.

Product Value-adding and Agri-tourism

The high costs involved in producing vanilla has led growers on Reunion Island, such as M Roulof, to develop complementary agri-tourism ventures that offer plantation tours and direct on-plantation sales. Other business have established themselves to value-add to the vanilla bean by producing vanilla scented or flavoured products, such as soap, perfume and drinks. Similarly, the high running costs of vanilla growing in Australia will require prospective growers to look at complementary business ventures that can attract the agri-tourism customer.

Sharing the Knowledge and Skills Learnt through the Fellowship

Due to the very small and fragmented nature of the vanilla industry in Australia the principle method for utilising the outcomes flowing from this Fellowship will be sharing the report with those already in the industry, developing a dialogue using email and telephone for one-to-one discussions and the internet should also be utilised to encourage greater information sharing.

The Fellow will disseminate this report across the Australian vanilla industry, as well as to interested gourmet chefs and regional food producers.

Recommendations

Government

Recommendation

- That commonwealth, state and territory agriculture departments and related agencies undertake detailed market and business research to determine the long-term viability of an Australian vanilla industry.

Industry

Recommendations

- That Australian farming and horticultural industry associations and representative groups work with Australian Governments to examine the financial requirements needed to establish a sustainable vanilla industry in Australia.
- That consideration be given to forming a Vanilla Industry Association to act as a single voice for the industry and more importantly facilitate the sharing of information between growers and gourmet/regional food producers.

Community

Recommendations

- That growers promote the superiority and benefits of natural vanilla and natural vanilla flavoured products to the community, with a particular focus on chefs.
- The hospitality industry and general public be encouraged to support local industry development by buying locally grown vanilla where it is available and asking for it where it is not.

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