

Australian Truffles: Growing, Harvesting and Value Adding



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ISS Institute/Italy (Veneto) Fellowship

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Executive Summary

A truffle is the powerfully aromatic edible fruiting body of an ectomycorrhizal fungus species.

The Australian Truffle Industry is still in its infancy. The first trees were planted in 1993 and the first truffle produced in 1999 at Mole Creek, Tasmania. The industry's steady growth path has accelerated significantly over the past five years as more truffieries have reached production maturity. This trend has coincided with an increase in public awareness of this intriguing new industry.

As the Australian industry moves forward however, it is obvious to all involved that there is still much to learn about the successful, sustainable and profitable cultivation of truffles. In the past three years alone (since the Fellow's involvement began in the industry) the range of advice and methodologies proffered by long-term participants has changed dramatically. There remains worldwide a steep learning curve about reliable truffle cultivation.

There are many areas of uncertainty surrounding cultural practices, management and maintenance of plantations, correct irrigation techniques and the life cycle of the truffle itself. There are also opportunities to develop beneficial seasonal metropolitan and regional events based around the industry and the manufacture of distinctly Australian 'value added' truffle products.

The purpose of this Fellowship was to gain new knowledge and insights from European experts in truffle research and relate this specifically to the issues identified in the skills deficiencies section of this report.

The truffle industry is unique. Even though the truffle itself, together with the technique(s) involved in truffle cultivation have been studied by scientists and field researchers for decades, there still remain a number of 'unknowns'. The Fellowship visits resulted in questions outnumbering the answers.

The findings of this report relate mainly to benchmarking the Australian industry against the European industry. In particular, the report identified the need to overcome existing shortcomings in relation to the production and appropriate certification of well mycorrhized trees. Implementing a robust set of regulations and industry protocols to protect the Australian industry against the importation of unwanted species is crucial to the industry's ongoing development.

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Definitions

- 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.
- Skills deficiency A skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas.

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 IP to themselves; and over time they retire and pass away. Firms likewise come and go.
Reference: 'Directory of Opportunities. Specialised Courses with Italy. Part 1: Veneto Region', ISS Institute, 1991.
- Sustainability The ISS Institute follows the United Nations NGO 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

Acknowledgments

Noel Fitzpatrick 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)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

The International Specialised Skills Institute Inc (ISS Institute) is an independent, national organisation, which has a record of nearly twenty years of working with Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management. The Institute has worked extensively with Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions.

The Patron in Chief is Sir James Gobbo AC, CVO. The ISS Institute Board of Management is Chaired by Noel Waite AO. The Board comprises Franco Fiorentini, John Iacovangelo, Lady Primrose Potter AC and David Wittner.

Through its CEO, Carolynne Bourne AM, the ISS Institute identifies and researches skill deficiencies and then meets the deficiency needs through its *Overseas Skill Acquisition Plan (Fellowship Program)*, its education and training activities, professional development events and consultancy services.

Under the Overseas Skill Acquisition Plan (Fellowship Program) Australians travel overseas or international experts travel to Australia. Participants then pass on what they have learnt through reports, education and training activities such as workshops, conferences, lectures, forums, seminars and events, therein ensuring that for each Fellowship undertaken many benefit.

As an outcome of its work, ISS Institute has gained a deep understanding of the nature and scope of a number of issues. Four clearly defined economic forces have emerged out of our nearly twenty years of research. The drivers have arisen out of research that has been induced rather than deduced and innovative, practical solutions created - it is about thinking and working differently.

A Global Perspective. 'Skills Deficiencies' + 'Skills Shortages'

Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass away. Firms likewise come and go. If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible trans-generationally through nationally accredited courses and not be reliant on individuals.

Our international competitors have these capabilities as well as the education and training infrastructure to underpin them.

Addressing skill shortages, however, is merely delivering more of what we already know and can do to meet current market demands. Australia needs to address the **dual** challenge – skill deficiencies and skill shortages.

Acknowledgments

Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors that are at risk of disappearing, not being developed or leaving our shores to be taken up by our competitors. The only prudent option is to achieve a high skill, high value-added economy in order to build a significant future in the local and international marketplace.

The Trades

The ISS Institute views the trades as the backbone of our economy. Yet, they are often unseen and, in the main, have no direct voice as to issues which are in their domain of expertise. The trades are equal, but different to professions.

The ISS Institute has the way forward through its 'Master Artisan Framework for Excellence. A New Model for Skilling the Trades', December 2004. The Federal Government, DEEWR commissioned ISS Institute to write an Australian Master Artisan School, Feasibility Plan.

In 2006, the ISS Institute established an advisory body, the **Trades Advisory Council**. The members are Ivan Deveson AO; Martin Ferguson AM, MP, Federal Labor Member for Batman; Geoff Masters, CEO, Australian Council of Educational Research; Simon McKeon, Executive Chairman, Macquarie Bank, Melbourne Office, and Julius Roe, National President Australian Manufacturing Workers' Union. ISS Institute also puts on record its gratitude to the former Chairman of Visy Industries, the late Richard Pratt, for his contribution as a member of the Trades Advisory Council.

Think and Work in an Holistic Approach along the Supply Chain - Collaboration and Communication

Our experience has shown that most perceive that lack of skills is the principal factor related to quality and productivity. We believe that attitudes are often the constraint to turning ideas into product and a successful business; the ability to think laterally, to work and communicate across disciplines and industry sectors, to be able to take risks and think outside the familiar, to share – to turn competitors into partners.

Australia needs to change to thinking and working holistically along the entire Supply Chain; to collaborate and communicate across industries and occupations - designers with master artisans, trades men and women, Government agencies, manufacturers, engineers, farmers, retailers, suppliers to name a few in the Chain.

'Design' has to be seen as more than 'Art' discipline – it is a fundamental economic and business tool for the 21st Century

Design is crucial to the economic future of our nation. Australia needs to understand and learn the value of design, the benefits of good design and for it to become part of everyday language, decision making and choice.

Design is as important to the child exploring the possibilities of the world, as it is to the architect developing new concepts, and as it is to the electrician placing power points or the furniture designer working with a cabinet-maker and manufacturer. As such, design is vested in every member of our community and touches every aspect of our lives.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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Fellowship Sponsor

The Victorian Government, Skills Victoria is responsible for the administration and coordination of programs for the provision of training and further education, adult community education and employment services in Victoria and is a valued sponsor of the ISS Institute. Fitzpatrick would like to thank them for providing funding support for this Fellowship.

Supporters

- Australian Truffle Growers Association
- Department of Horticulture and Environment, Swinburne University TAFE Division
- Rural Industries Research and Development Corporation

Those Involved in the Development of the Overseas Program

In Italy

- Danilo Bernardini – Raggi Vivai, Cesena, Italy
- Le Occare – Veneto Region, Italy
- Paolo Bonamico – Veneto Region, Italy
- Prof Alessandra Zambonelli – University of Bologna, Italy

In France

- Pierre Sourzat – Cahors, France

In Spain

- Christine Fischer – Lleida, Spain

Those involved in the Fellowship Submission

- AgriFood Skills Australia
- Australian Culinary Federation
- Australian Truffle Growers Association
- Regional Development Victoria, Victorian Government
- Rural Industries Research and Development Corporation
- School of Arts, Hospitality and Sciences, Swinburne University
- Stefano de Pieri

Australian Organisations Impacted by the Truffle Industry

Government

- AgriFood Skills Australia
- CSIRO
- Department of Agriculture
- Local Government
- Regional Development Victoria
- Rural Industries Research and Development Corporation
- Tourism Australia

Acknowledgments

Industry/Business

- Restaurants
- Speciality food shops
- Truffle farmers

Professional Associations

- Australian Culinary Federation
- Australian Truffle Growers Association
- Metropolitan and Regional Wine and Food Associations
- Nursery and Garden Industry Australia

Education and Training

- ISS Institute
- Technical and Further Education – particularly horticultural departments
- Registered Training Organisations

About The Fellow

Name: Noel Fitzpatrick

Qualifications

- Certificate IV in Horticulture, Burnley College, Melbourne Victoria, 1989
- Certificate IV in Landscape Technology, Burnley College, Melbourne Victoria, 1989
- Certificate IV in Assessment and Workplace Training, Sunraysia College of TAFE, Mildura, Victoria, 2004

Memberships

- Fellow, International Specialised Skills Institute Inc.
- Executive Committee, Australian Truffle Industry Association

Fitzpatrick is a founding member of the Australian Truffle Industry Association and sits on its Executive Committee of management. The Fellow is an active and passionate advocate for the truffle industry in Australia.

Fitzpatrick has represented the Australian Truffle Industry and presented at conferences and industry events in Australia, USA and New Zealand.

Fitzpatrick is developing an agritourism business in south west Gippsland based on the French black truffle growing industry. This business embodies many of the elements of horticulture, education, hospitality and business management expertise developed over his career to date.

Fitzpatrick's career to date has included positions of business and personnel management in the hospitality and horticultural industries as well as in the retail marketing and educational sectors.

The Fellow is currently employed as the Skills for Growth, Project Manager for Chisholm Institute of TAFE in Victoria.

Aims of the Fellowship Program

The vision/purpose of this Fellowship is to enhance the Australian truffle growing industry's capacity to:

- Acquire the necessary knowledge to address the identified skills deficiencies.
- Contribute to resources for delivery in specialised courses in higher education, particularly TAFE institutions.
- Develop information resources for the benefit of all industry stakeholders.
- Identify early on and plan for future challenges and opportunities for the industry.
- Build relationships for the future development of a robust export trade and information exchange.
- Assist the industry in developing 'world best practice' methods of production and further processing of the product.
- Facilitate the efficient growth and development of regional truffle related agribusiness and agritourism ventures.
- Ensure the steady growth of a viable, sustainable and profitable industry.

The Australian Context

Currently there are approximately 140-160 truffle growers in cooler climate zones across Australia and approximately 115,000 inoculated truffle host trees. The industry includes growers with varying sized plantations and production quality levels. The majority of growers (approximately 70 per cent) are small-scale operators working on less than five hectares. The remainder are mid sized (up to 10 hectares) and larger scale growers (over 10 hectares). The mid size and larger scale corporate or investment operations account for approximately 30 per cent of all trees planted.

It is generally acknowledged that areas in Australia predisposed to warm Summers, cool Winters and with high average annual rainfall are best suited to truffle production. Soil structure, drainage and water holding capacity are also important factors. Soils suitable for truffle production must have a relatively high pH (in the range of 7.5-8.1). It is usually necessary to raise the pH of soils in most areas so as to achieve conditions suitable for truffle growth. A large amount of agricultural lime is therefore added to soils in the months prior to planting to achieve desired pH levels.

Preferred site selection is on an open north facing area with excellent natural drainage and well-structured soil. Undulating land is an advantage in assisting drainage and a comprehensive irrigation system and ample water supply must be available to irrigate trees during the warmer months when the truffle (fruiting body) development is taking place underground.

To survive many natural stresses, such as low soil fertility, drought and temperature extremes, most plant species have established a symbiotic partnership with a unique group of soil organisms called mycorrhizal fungi. This family of fungi lives in and around the roots of 90 percent of the earth's plant species. In effect, they work as a secondary root system extending far out into the soil. Mycorrhizae extract mineral elements and water from soil for their host plant and, in turn, live off the plant's sugars. Trees and plants with thriving mycorrhizal root systems are better able to survive in stressful environments.

The name 'mycorrhiza' means fungus root and is derived from its close association with plant roots. There are four kinds of mycorrhizal fungi: Arbuscular, Ectomycorrhizal, Ericoid and Orchid.

Ectomycorrhizal fungi is one of the more unique groups of fungi in that they are largely external in nature. The fungi forms a symbiotic relationship with a plant by developing a sheath around the plant root tip. The fungus then sprouts an inward growth of hyphae (fungal cell growth form) that penetrates the plant root structure and facilitates a two-way transfer of nutrients and sugars.

In excess of 4,000 species of fungi form ectomycorrhizal associations, predominantly with woody plants including trees such as oaks, beeches, birch, eucalypts and poplars. While various tree species may form these mycorrhizal associations, oak and hazel are the most commonly used for truffle production.

Host trees in suitable forest environments form natural associations with the fungi, while trees used in cultivation require artificial inoculation with truffle spores.

A truffle is the powerfully aromatic edible fruiting body of an ectomycorrhizal fungus species.

Depending on the particular species, the truffle's biological cycle can be quite long. When the growth of the fruiting body (truffle) is triggered, it separates from the fungal mycelium and becomes independent from the host tree's root system as it develops underground.

The Australian Context

When mature, truffles are generally found close to the surface (5-25 centimetres deep). In some instances they break through the surface layer.

Generally a truffle is of a spherical shape. Inconsistencies in the soil profile such as stone deposits and root systems can, however, lead to the development of irregular and knobby shapes. Its outer membrane varies in colour and texture according to the species. Truffles also vary greatly in size and weight. The average truffle weight is in the 20-80 gram range. Occasionally however truffles of one kilo and higher have been found.

Species of Truffles

Hundreds of varieties of truffles can be found on all continents (with the exception of Antarctica), but only a handful of varieties have any significance in the culinary world. Two varieties stand head and shoulders above all others in value and interest: the *Tuber magnatum* (the Italian white) and *Tuber melanosporum* (Perigord black) of France. Despite several attempted plantings worldwide (including in Australia), the Italian white has yet to be grown successfully under cultivation. It is still only harvested from natural forests in parts of Italy, the south east of region of France and in Croatia.

It is mainly the French black truffle (*Tuber melanosporum*) that has been widely planted in cultivated truffieres in Australia and other locations worldwide.

Often referred to as the 'black diamond' this species has a black/brown skin covered with pyramidal shaped warts. The flesh is dark purple/black with fine white veins creating an intricate crazed pattern across the sliced surface. The powerful aroma attracts the animals that detect, dig and eat the truffle and then distribute millions of spores in their droppings. *Tuber melanosporum* is harvested through the Winter months.

Another species now starting to be planted in Australia – albeit in smaller quantities – is *Tuber aestivum*. This is known commonly as the 'burgundy' or 'Summer truffle'. It is similar in appearance to *Tuber melanosporum*, but generally larger. The aroma however is less intense. This particular species is harvested from early Summer through to Autumn. Planting this species in conjunction with *Tuber melanosporum* allows a grower to spread the yield of truffle over a much longer period.

As the industry continues to mature and expand, more truffle species will be experimented with in Australian growing conditions.

Australian Truffle Industry Association

The Australian Truffle Industry has grown dramatically over the past five years. However, great distances between growers, a lack of awareness of others, and concerns based around the security of plantations and privacy remain a potential barrier to further growth.

The formation of the Australian Truffle Industry Association in 2006 has gone some way to alleviate such barriers. The association now has approximately 60 grower members (some 40 percent of the estimated Australian network) and has helped to bring growers together to discuss the many issues facing the industry as it moves forward. The association has an informative website with a member's forum for open discussion. Annual General Meetings, grower workshops and truffle dinners for members and interested parties are held in various locations around Australia.

The Australian Context

The association will play an increasingly important role in the development of the industry, liaising with supporting government departments such as the Rural Industry Research and Development Corp (RIRDC).

Government Support

The RIRDC has supported research into the production of *Tuber melanosporum* under its New Plant Products Research Program. The research has highlighted important issues to be addressed in developing a strategy to produce and market French black truffles to Australian and international markets.

With the industry now entering a new phase of investment and growth, the RIRDC has conducted a comprehensive review of the status of the industry. The review includes an industry stock take, a detailed SWOT analysis and industry investment requirements and research support. The RIRDC review, 'Taking Stock of the Australian Truffle Industry', is available in hard copy or can be downloaded from the RIRDC website at www.rirdc.gov.au.

The RIRDC recently convened an Australian Truffle Industry Strategic Planning Day in Melbourne with the Australian Truffle Growers Association and industry participants from all states to formulate a five-year industry strategic plan.

Production

Since the harvest of Australia's first French black truffle in 1999, the annual volumetric production of truffles has increased gradually to an estimated 1,200 kilos in 2008. Some 300 kilograms from the 2008 harvest was exported to France by a Western Australian company. The remainder has been exported to the USA and Asia or consumed in Australia.¹

A newly planted truffiere may produce its first truffle in year five or six. A first yield is usually in the order one to two kilos per hectare. Production may increase year by year as the host trees develop and the mycorrhizae mature. Figures from overseas truffieres suggest that a harvest of 40–60 kilos per hectare is achievable by years 12-15.²

Australia is a relatively new frontier for truffle production and it is fortunate not to have endemic competing mycorrhizae in its soils.

Rather than having to respond to changing flora activity and soil balance that has occurred in parts of Europe, the industry in Australia is well positioned to create soil conditions favourable for *Tuber melanosporum* to flourish. With the number of trees currently planted in Australia exponentially increasing their yield and newer plantings reaching an age at which they are expected to start producing truffle, the annual Australian harvest by 2012 is estimated conservatively to be in the order of 3-5 tonnes.³

Export Markets

The industry is projected to experience a steady rate of growth over the next five years, increasing from estimated 250 hectares of developed truffle plantations to around 600 hectares by 2013. This represents an annual average rate of growth of over 20 percent per annum.⁴

¹ Barry Lee, *Taking Stock of the Australian Truffle Industry*, RIRDC Publication No. 08-124

² Pierre Sourzat, Technical Manager of the Station Trufficole Cahors-Le Montat.

³ Barry Lee, *Taking Stock of the Australian Truffle Industry*, RIRDC Publication No. 08-124

⁴ Ibid

The Australian Context

With this forecast for industry growth there is an urgent need for more export market research and development targeted to the Asian, American and European markets.

Industry Representation

As the recognised peak body, the Australian Truffle Industry Association will need to attract more grower members to assist with financing its representative, research and government lobbying activities.

Consumer Awareness

Educating Australian consumers about truffles and the Australian Truffle Industry is also an important challenge. A better educated Australian consumer is critical to the further growth of the Australian industry, particularly for locally grown and processed value-added truffle products that have the potential to be import replacements.

Recognising the Need for Additional Skills

Although there has been a substantial amount learnt about the business of growing truffles in Australia over the past fifteen years, much of the research and subsequent knowledge gained is contained within the larger commercial operations, and as such, is not available to non-commercial growers.

There is a need therefore, for the learning of additional skills that can be made available to the non-commercial grower component of the industry. As this sector currently represents approximately 70 percent of all growers, it is critical to industry as a whole for this knowledge to be accessible to all industry members.

The benefits of obtaining these skills will better equip more growers in creating sustainable and profitable businesses.

Education Pathway for Growers and New Entrants

Another major benefit to the industry resulting from this Fellowship is through the subsequent development of industry training resources not currently available in any form throughout Australia.

SWOT Analysis

Strengths

- Support from government
- Growing support/allied industries
- Growing support/media
- Favourable environmental and climatic conditions
- Excellent export opportunities
- Production in Australia when Europe is not in season
- Facilitates regional growth
- Small acreage development
- High value product that can only be grown in specific environments
- Proven production in many areas
- Australian Truffle Growers Association

The Australian Context

Weaknesses

- No training currently available
- No resources yet developed
- Lack of expertise/experience
- Secrecy in many quarters of industry
- Reluctance to share information
- Fragmentation of growers
- Lack of information regarding accurate numbers of growers
- Currently small numbers in the Australian Truffle Growers Association
- Lack of history and knowledge of this product in the Australian home

Opportunities

- Willingness of TAFE to develop resources and to deliver training
- Government support/resources
- Association to bring growers together for mutual benefit
- Export to Asia, USA and Europe
- Industry growth to provide a critical mass for reliable supply chain
- Regional development in areas of suitable climatic zones.
- 'Value added' industry
- Festivals, conferences
- Synergies with other industry (wine)
- Economic benefit for communities

Threats

- Lack of training/expertise available
- Lack of technology available
- Continued fragmentation of industry
- Slow growth of industry through lack of confidence in interested parties
- Perception that the industry is highly speculative

Identifying the Skills Deficiencies

Definition of Skills Deficiencies

As already established, skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire or pass away. Firms likewise come and go. If Australia is to create, build and sustain industries, knowledge/skills/understandings must be accessible trans-generally through nationally accredited courses and not be reliant on individuals.

The Skills and Knowledge Deficiencies

1. Collect, record and analyse environmental data from natural truffle growing forests.

Analyse the composition, structure, pH and water holding capacity of soils, the historical regional weather data such as temperature variations and rainfall averages, nuances in seasonal yields relative to particular local weather phenomena and natural distribution of both host species/competitors.

Aim: To become skilled in understanding the environmental conditions found in the natural forest ecosystems supporting truffle production.

2. Differentiate between the natural forests and cultivated growing environments.

Conduct analysis of the controllable environmental conditions in managed truffieries, such as soil amendments, irrigation regimes, tree density rates and host species used.

Determine the criteria used for local site selection of managed truffieries relative to the uncontrollable environmental elements of topography, weather and aspect.

Aim: To become skilled in site selection criteria and site adaptation techniques to provide the optimal environmental conditions for successful truffle production.

3. Harvest truffles with licensed operators in natural and cultivated environments.

Work with a licensed harvester in a natural forest ecosystem identifying fertile sites and mycorrhized host trees within that system. Learn animal training and handling techniques involved in the harvest process. Differentiate between unripe and ripe truffle by recognising correct aromatic intensity of truffle before digging. Determine correct digging and handling techniques to maintain the truffle in peak condition. Apply correct method of reconstitution of soil after digging. Repeat this process within cultivated truffieries.

Aim: To become skilled in the identification of fertile host trees within natural systems, and to establish a fundamental understanding in all aspects of the truffle harvest.

Identifying the Skills Deficiencies

4. Record seasonal maintenance and irrigation operations in cultivated truffieres.

Conduct interviews and collect data relating to specific maintenance and irrigation operations carried out on a season-by-season basis.

Aim: To determine current best practice maintenance techniques used in the management of cultivated truffieres.

5. Differentiate methods of processing in relation to the production of value-added truffle products.

Analyse recorded information sourced from on site visits. Through observation and face-to-face interviews learn techniques and processes associated with regional food value adding operations. Determine European methods of truffle infusion and incorporation into compatible and complimentary foods, condiments and oil products.

Aim: To gain an understanding of traditional and current methods of the blending of truffle and complimentary food products. To inspire innovation in relation to the development of unique Australian 'value added' truffle products.

6. Identify European methods of grading product/quality control.

Participate in local market and dedicated seasonal festival activities. Observe and apply grading, quality, handling and storage techniques used. Conduct interviews with industry agents about marketing, quality control and the expectations of international markets. Determine packaging and shipping methods.

Aim: To become skilled in determining the grading, quality and handling and shipping of truffle. To learn European marketing techniques and festival activities so as to foster innovation in our own regional agritourism activities. To gain an understanding of overseas trading and the expectation of international markets.

7. Identify factors related to building and sustaining financially viable businesses – agritourism and regionalism in relation to the truffle industry.

Inspect an established agritourism business specialising in truffle related industry.

Aim: To learn about the evolution, growth and methods of operation of regional agritourism.

Benefits to Australia of Developing Skills in These Areas

The development of training and education models in this subject will benefit Australia substantially. Skilling sectors of our workforce in truffle culture will:

- Accelerate the growth of an economically important new and emerging industry.
- Ensure that new entrants into the industry will gain a fundamental understanding of the critical requirements to develop a viable and profitable operation.
- Open pathways for innovation within the industry as courses evolve and the experience and diversity of operators increases.
- Assist regional development in agritourism with inherent benefits for regional economies such as employment, accommodation, hospitality and retail.

The International Experience

Brief History

The history of truffles in Europe is a long one, with anecdotal evidence of many edible varieties and their use going back hundreds of years. In earlier times when the truffle was harvested annually and in relative abundance from the natural forests it was regarded primarily as peasant food. It was not until the 14th century when the aristocracy began to procure and use large amounts of the truffle that this mysterious tuber began its elevation in interest, value and status in the culinary world.

The annual yields from the natural truffle forests of Southern France and various locations in Italy and Northern Spain have declined significantly over the past 100 years. Annual *Tuber melanosporum* production in Europe in the early 1900s was estimated to be in the vicinity of 800-1,000 tons. A century later annual production of *Tuber melanosporum* in these regions has fallen to 12-15 tons.⁵

This has created a situation where supply can no longer meet demand. Consequently, the price for fresh truffles has risen steeply. In response to the steady decline in natural production, people have been attempting to discover the methods of producing truffles successfully and consistently under cultivation.

Between the science of mycology and trial and error efforts by those willing to invest land, time and money, some progress has been made in understanding the truffle's unique cultivation requirements. Despite extensive research, there is still much to be learnt about many issues that are critical to successful cultivation. Many unknowns remain about effective inoculation of host trees, the variable parameters of suitable climatic conditions, and the consistent triggering and formation of the fruiting body (truffle) of the fungi.

The Fellowship

The Fellowship research tour commenced in the Veneto Region of Italy. The Fellow then visited the south of France and Spain. Appointments were arranged with key individuals and companies in all three countries. The Italian sector of the study tour included attendance at 'Tuber 2008' – the third Spoleto International Truffle Congress held in Spoleto, Perugia. The Fellow also participated the post conference excursion.

Truffle Cultivation in the Veneto Region

The Veneto Region of Italy is situated on the north shore of the Adriatic Sea and northeast of the Po River. It extends northward through the mountains to a short border with Austria.

Historically the Veneto had been a poor agricultural region. Since the 1970s however, the region has experienced a renaissance. Thanks to concerted local entrepreneurial initiative and various financial incentives provided by government, primary producer associations and tourism bodies, the Veneto Region is now among the most productive agricultural areas in Italy, specialising in food crops, market gardening, fruit, vines and agritourism.

The revitalisation of the broad acre agricultural and small farm industries in the Veneto has seen the landscape change within many of its forest areas which were once natural truffle grounds. Vast areas of land have been cleared over time for conventional crop farming.

⁵ Pierre Sourzat – Technical Manager of the Station Trufficole Cahors-Le Montat.

The International Experience

Certain parts of the Veneto Region were once productive areas for the truffle, particularly for the species *Tuber magnatum*. There are still many areas such as the hills around Lake Garda, Lessini, Berici, and Treviso, as well as on the higher Venetian Plain where experienced truffle harvesters search the natural terrain for both *Tuber melanosporum* and *Tuber magnatum*.

Restoration of the Truffle Industry in the Veneto

Legislation was passed to restore and protect these natural truffle areas. The Regional Forest Service of Padua and Rovigo have established a new experimental centre of mycorrhization, and production of young mycorrhized plants in Rovigo. The centre produces, sells and uses the plants in reforestation areas to encourage a wider distribution of trees associated with commercial truffle species in the Veneto region. This is seen as vitally important both for ecological and environmental improvement and for the regional economy due to the potential profits derived from the truffle plantations.

Cultivated Truffle Plantations

Cultivated truffle plantations in the Veneto are not as numerous as in many other regions of Italy. Veneto farmers focus on non-truffle produce. The visit to the Venetian province of Rovigo was hosted by Paolo Bonamico, a truffle grower, grower consultant and regional agent for the Raggi Vivai company in Cesena that grows mycorrhized host trees.

Soils in this region generally have a natural pH of between 7-7.5. A small addition of lime is required during preparation for a new plantation to raise pH to the required level of 8. The soils in the two plantations visited were slightly heavy, with clay content in the range of 30-35 percent. Both had been deep ripped and lightly limed prior to planting. The trees were planted on a six metre grid pattern which appears to be one of the more common layouts used in Italy, Spain and many areas of France.

There were differences observed in the management of the two plantations. The first plantation (pictured left on the following page) is not cultivated in the burnt zone areas around the trees, but is occasionally undertaken in the rows between. This ceases as the burnt zones advance. The practice of aeration, or light cultivation around the trees, had not been carried out during the early establishment phase, nor had irrigation been supplied to this plantation. The trees had only been lightly pruned to form central leaders in the early stage of development and had not been trimmed again since. This plantation was ten years old and planted with a mix of *Q. Ilex*, *Q. Pubescens* and *Q. Robur* inoculated with *Tuber melanosporum*. The lateral branching of the trees (particularly *Q. Robur*) was well developed while the burnt zones were not obvious or well developed. No fertiliser was used and production had not really begun in any significant manner.

The second plantation (pictured right on following page with Bonamico in the foreground) had a ten year old blend of *Q. robur*, *Q. Ilex* and *C. avellana* that had been cultivated annually for the first five seasons only. The trees were trained initially to central leaders. Since then the plantation had been left very much to its own devices. No further cultivation had taken place, trees had not been pruned and no irrigation had been installed. The burnt zones however were highly visible, well established and generally developed to the drip line of the trees. No fertiliser had been used. Nevertheless, it has been reasonably productive for the past two years. As it was the start of the *Tuber melanosporum* season collections on the day of the Fellow's visit was restricted to a handful of immature specimens.

The International Experience

This approach of low intensity management is similar to the Tanguy system used by some growers in France. While it is a lower cost model, results can take much longer and are far less uniform than systems such as the Pallier, where higher maintenance regimes and associated costs can, on average, produce results in year five or six.

It was interesting to note that the second plantation, which was cultivated for the first five years, was more advanced than the first in terms of burnt zone visibility and production.



Ten year old productive plantation with clearly visible burnt zones



Ten year old plantation with no distinct burnt zones

The Truffle Collector

The truffle collector who assisted on the day was Sandro Mazzini and his expert truffle dog, Jack. Mazzini is a professional collector who spends his days during the harvest season searching the natural areas of which he has great knowledge. Truffle collecting in Europe is a licensed profession. Harvesting period for each species are clearly defined and generally adhered to. Mazzini's bond with his truffle dog is strong. Mazzini trained his dog from 12 months of age. The dog works off the leash and is free to roam through both plantation or forest.



Mazzini and Jack at work

Mazzini believes that this approach is more time efficient than moving down rows in a regimented manner. If the dog is well trained it will generally only be drawn toward the mature truffles. Jack is rewarded with praise and a food treat when he locates a truffle.

It was interesting to note that while most truffle collectors used different breeds of dog, the owners with the closest relationship with their dog appeared to achieve the best results.

Le Occare, a Truffle Agriturismo in the Veneto Region

This visit enabled Fitzpatrick to identify factors that contributed to building and sustaining financially viable agriturismo businesses associated with the truffle industry.

The Le Occare guest house is a fully restored 260 year-old farmhouse. The main building is on a working property situated in a secluded countryside location a few kilometres south of the Po River.

The International Experience

The hosts and property owners, Giovanni Tosti and Christina Maresi, are fourth generation descendants of the original owners and builders of the property. When it was first established in the mid 1700s, it covered 500 hectares and farmed tobacco, hemp, corn, wheat and cattle. Today the property is much smaller and more manageable at 64 hectares. Annual crops grown include soya, wheat, maize and three species of truffle planted adjacent to the farmhouse.



Le Occare successfully markets its unique proposition



The truffle plantation at Le Occare is well managed and productive

The agriturismo enterprise concept was born from a genuine desire to share the large and beautiful home with other people. However, it is the proprietors' efforts to ensure the comfort of their guests, their passion for truffles and Maresi's love of cooking which truly defines the experience at Le Occare and creates the all important 'point of difference' in what is a highly competitive tourism market.

The proprietors received government funding which is available for the development of agriturismo businesses in Italy. They then renovated the old farmhouse, being very careful to retain its original design elements to increase its marketing appeal.

The farmhouse now has three well-appointed guest accommodation rooms, an excellent library, a small swimming pool and an exquisite four table restaurant featuring truffles on the menu year round. Surrounding the farmhouse is a large woodland, populated with abundant bird life.

The Le Occare restaurant has become an icon business in the region. It is open between Wednesday and Sunday and is generally always booked out either with guests, locals or other visitors prepared to travel lengthy distances to experience the specialised truffle cuisine.



Most ingredients are grown and prepared at Le Occare's restaurant



Le Occare's four table restaurant

The International Experience

On reading the Le Occare guest book one immediately notes two important points. First, the marketing of the business is obviously very successful. Second, the expectations of Le Occare guests appear to be exceeded consistently.

Truffles are used in a variety of menu dishes including pasta, risotto, seafood and desserts. Different species of truffle are also used including *Tuber melanosporum*, *Tuber aestivum*, *Tuber magnatum* and *Tuber borchii*, depending on seasonality and availability.

Truffles are also used in different ways in cooking depending on the species and its tolerances to heat and cooking processes. The Italian white truffle, *Tuber magnatum*, does not tolerate heat well and is generally used as a garnish to flavour a meal, often simply being grated or sliced over a simple dish. The French black truffle, *Tuber melanosporum*, however is more robust and able to be incorporated into the cooking process and is generally used in a greater range of dishes.

Government Support

The Italian Government provides substantial (dependant on the scope of a project) funding for the development of agriturismo business enterprises. A proposal submitted for government funding must meet certain strict criteria, including a commitment to using a large percentage of the product grown on the property as part of the enterprise's daily activities. Assistance is in the form of a grant which does not require repayment if the enterprise carries on an agriturismo business under the prescribed guidelines for an agreed length of time (usually ten years).

This funding program has helped facilitate rapid growth of the agriturismo over the past ten years. The initiative is designed to keep people gainfully employed on their properties (often their principal place of residence) and to build the tourism industry in regional Italy.

In an industry where competition is fierce, the owners of Le Occare recognise the importance of a business providing a real 'point of difference'. The points of difference include high levels of service, attention to detail, unique restaurant experiences, a relaxing environment and quality accommodation.

Marketing

Initial marketing for Le Occare relied on the recommendations from the local and regional tourism bureau as well as promotional literature. This delivered slow and irregular results.

The Le Occare website was subsequently developed. Within 12 months enquiries from potential clients worldwide had increased dramatically. The website enabled the proprietors to showcase the house, accommodation, restaurant and truffle plantation, providing an interactive online experience of Le Occare.

The Raggi Vivai Company, Cesena, Italy

The purpose of this visit was to learn about nursery standards and the certification of mycorrhized trees.

Raggi Vivai is a leading Italian company in the production of mycorrhized truffle plants. It commenced producing trees in the 1980s, initially inoculating host plants with *Tuber melanosporum* (the French black truffle) and *Tuber magnatum* (the Italian white truffle).

The International Experience

In the 1990s Raggi Vivai added *Tuber uncinatum* (Scorzzone), *Tuber aestivum* (Summer truffle), and *Tuber borchii* (Bianchetto) to their range. The company is also a leader in the production of strawberry plants (in particular hybridising new certified varieties) as well as being the license holder for the production of a range of vegetables. The company's other specialty products include asparagus crowns, potato seeds and soft fruit trees. It employs up to 120 people during its busiest times, and operates with a staff of 22 during quieter times.

Staff engage in a range of activities, including open field work for strawberry plants and other specialised production, nursery operations for truffle and fruit tree production, laboratory research, sales and marketing, collection, despatch and delivery, office duties and management.

The truffle plant side of the business has grown steadily over the past 15 years. This is in response to the decline in natural forest harvests throughout Italy and the increasing demand for truffle in the culinary world. According to Raggi Vivai's manager, Danilo Bernardini, some 60 percent of all *Tuber melanosporum* harvested in Italy today is from cultivated plantations.

Mycorrhized plants are produced in accord with strict nursery protocols. Prior to inoculation, young plants produced either by seed or cutting are prepared in a sterile environment to prevent infection of plant material by other undesirable fungi. The potting medium used to grow the plants on following mycorrhization is a blend of friable clay loam soil and substrate (1-3mm stone) and after mixing, is steam sterilised before use.



Thousands of mycorrhized trees in production



Quality is constantly monitored at Raggi Vivai

The truffles purchased by Raggi Vivai for the production of inoculum for mycorrhizing host trees are always of the highest quality available, as per the European Grading Standards (see Attachment). Bernardini considers that this a vital factor in producing quality trees. The truffles are then identified to verify that they are the correct species. Mycorrhization is then carried out in Spring in the Raggi Vivai laboratory, according to strict regulatory procedures.

The plants produced are monitored by the company's technical staff in order to obtain well mycorrhized plants of even growth and quality without pests or disease. The monitoring is carried out both visually in the growing nursery and also in the laboratory where the root systems of random samples are analysed under a microscope. The plants are also independently monitored for all aspects of quality by staff of the University of Aquila's Department of Environmental Science and the Department of Vegetable Science and Agro-Environmental Biotechnology at the University of Perugia.

The International Experience

The involvement of the two universities is part of a voluntary and rigorous quality control program concerning the size and uniformity of plants, pest and disease control and acceptable mycorrhization levels established by Raggi Vivai. When the plants are ready for sale they are checked for mycorrhization independently by both of the universities. If they meet the required criteria they are certified as satisfactorily mycorrhized (50% of root system) with the correct species of truffle and only then made available for sale.

Bernardini is convinced the company's rigorous approach to ensuring only well grown, well mycorrhized plants leave the nursery has been the cornerstone of their business success.

Host plants and the mycorrhizal combinations used by the nursery include:

Quercus pubescens (Oak) – mycorrhized with *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum*, *Tuber borchii*, *Tuber uncinatum* and *Tuber brumale*.

Quercus robur (Oak) – mycorrhized with *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum*, *Tuber borchii* and *Tuber uncinatum*.

Quercus cerris (Oak) – mycorrhized with *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum*, *Tuber borchii* and *Tuber uncinatum*.

Quercus ilex (Oak) – mycorrhized with *Tuber melanosporum*, *Tuber aestivum* and *Tuber uncinatum*.

Corylus avallana (Hazel) – mycorrhized with *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum*, *Tuber borchii*, *Tuber uncinatum* and *Tuber brumale*.

Ostrya carpinifolia (Carpinus) – mycorrhized with *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum* and *Tuber uncinatum*.

Tilia cordata (Linden) – mycorrhized with *Tuber magnatum*, *Tuber aestivum* and *Tuber uncinatum*.

Pinus pinea (Pine) – mycorrhized with *Tuber borchii*.



Range of truffle digging tools



Mycorrhized trees ready for sale

The International Experience

The Oak varieties, in particular *Quercus pubescens*, are in most demand by the industry in Italy. Oak is the preferred species due to ease of tree management and longevity of truffle production.

As of November 2008, the price for a Raggi Vivai certified mycorrhized host tree was the equivalent of \$AU14.00 per tree for orders of 50 trees or more.

Time was spent at the Raggi Vivai facility discussing the industry in Italy and Europe and learning about the different stages and processes of nursery production. This company focuses heavily on producing high quality plants and only employs highly skilled and experienced staff.

Nursery Management

The Raggi Vivai nursery is operated under sound nursery management practices such as maintaining modern and well designed infrastructure, observing and running a strict nursery hygiene program, using only the best quality materials available and employing only qualified staff.

Nursery hygiene standards at Raggi Vivai is of the highest quality. Regular cleaning and sterilisation of infrastructure such as growing benches, floors and other equipment help ensure fungal outbreaks are prevented.

Accreditation and Certification of Plants

Raggi Vivai is an accredited wholesale nursery business. The company sets high quality assurance standards and voluntarily engages independent external experts from universities (as previously mentioned) to check and certify that the stock meets all quality requirements. This ensures only well grown and well mycorrhized host plants are supplied to the industry. This is not only critical for the integrity of the business itself, but also to the growers within the industry.

It is universally acknowledged that for a cultivated truffle plantation to have any chance for successful truffle production it must start with properly certified, well mycorrhized host plants. The rigorous scrutiny of plants and adherence to sound nursery management practices of the type followed by Raggi Vivia is not, however, always the norm across within the industry.

Complete Service to Growers

Raggi Vivai provides a complete service to the European truffle industry including:

- The production of certified mycorrhized truffle plants
- Contract growing
- Soil analysis
- Research and development
- Truffle growing education for its client base

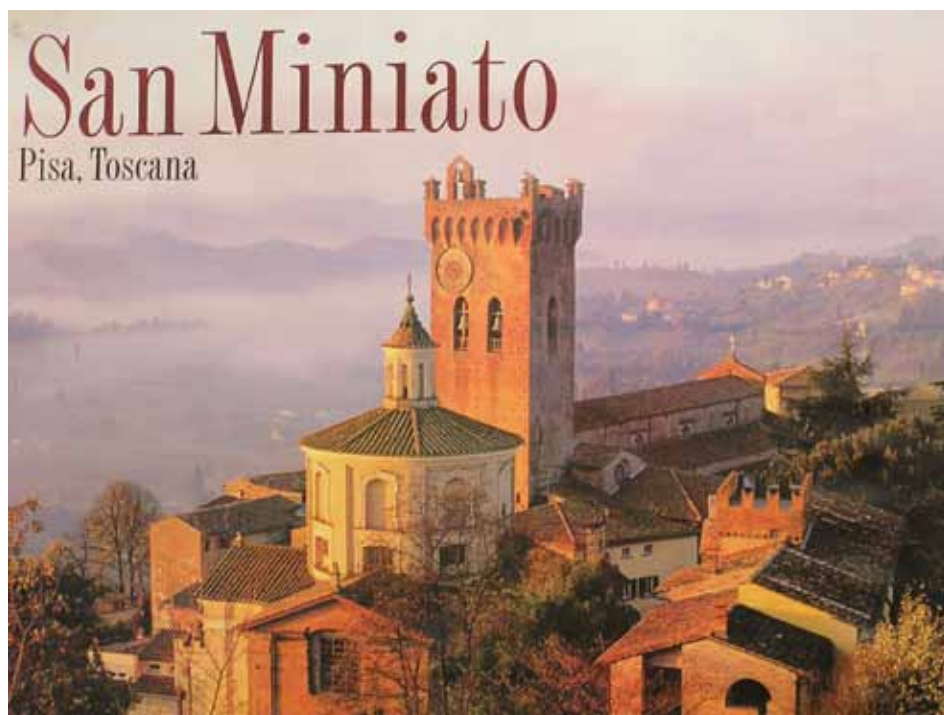
The International Experience

San Miniato Truffle Festival, Italy

The ancient town of San Miniato is located on a hilltop in the stunning Tuscan countryside. Like so many other historic walled towns, the site was chosen to more effectively defend itself from enemy attack.

The San Miniato Truffle Festival (Del Tartufo Bianco Di San Miniato) is held over the last three weekends in November every year. The town is transformed to celebrate the truffle season.

The region is a natural environment for Italy's famous and highly prized white truffle. The area claims to produce 25 percent of all *Tuber magnatum* harvested in Italy.



San Miniato comes alive with displays, theatre performances, fine dining in homes and restaurants, marching bands, and a huge street market with over two hundred stalls selling all manner of Tuscany's finest produce, including wines, cheese, bread, prosciutto, olive oil, salami, and three species of fresh truffle (*Tuber magnatum*, *Tuber melanosporum* and *Tuber aestivum*).

Festival food outlets all feature truffle dishes for tasting including pasta, risotto, omelette and pizza. Truffle infused products included meats, bread, cheese, honey, pate, oils and many and varied jars or tins of truffled produce.

Tourism

The impact of tourism on San Miniato during the truffle festival is immediately obvious as thousands of people visit the town over the festival period. According to the local tourism authority, San Miniato Promozione, the local economy is boosted significantly in terms of revenues from accommodation, hospitality and retail sales.

The International Experience



Organisation

The co-ordination of this three consecutive weekend event is a huge task and planning takes most of the preceding year. The result is a smooth, seamless festival. Activities are varied, interesting and relevant to tradition. The sense of tradition is accentuated by the sense of history emanating from every original stone and paved narrow roadways.

There are numerous truffle festivals held throughout Italy, France and Spain over the designated truffle seasons. These festivals have become major fixtures on tourism calendars.

Tuber 2008 – International Truffle Congress, Spoleto, Italy

The Spoleto Truffle Congress is the most important conference for the international truffle industry. 'Tuber 2008', the third International Truffle Congress was held from the 25-28 November. It attracted truffle scientists, growers, truffle enthusiasts and journalists, with representation from approximately 39 countries.

The four-day conference comprised a comprehensive program of local and international speakers who covered a wide range of truffle-related topics (refer to abstracts).

Please note: the full conference speakers list including complete papers is included on the disc attached to this report.

The International Experience

History of the Congress

The first International Truffle Congress was held in Spoleto, Italy in 1968. Spoleto's second International Truffle Congress took place 20 years later in 1988, and was hailed as a milestone in truffle cultivation research. The data that emerged at the second conference is still of current value and used by researchers all over the world today. The second congress is regarded as marking the beginning of modern truffle cultivation.

Importance of the Congress

Scientific research on the truffle and its cultivation has developed significantly over the past decade (refer to Attachment for detail).

- Truffle cultivation is developing and evolving continuously, particularly as farmers are interested in ecologically sustainable farming practices.
- The congress in Spoleto provided an opportunity to present new scientific research, engage scientists and growers in discussions, and update all those interested and involved in truffles and their cultivation.

The Congress Program

The Congress had an intense and fast moving program that covered topics dealing with all aspects of truffle science, research, cultivation techniques and trials.

After the formal opening of the congress Dr Bruno Granetti of the University of Perugia spoke about the main areas of truffle research since the previous major conference in Aix-en-Provence in 1988. Dr Granetti highlighted improvements in new mycorrhizing techniques, molecular analysis and the identification of truffle species, studies in truffle physiology in all of the life cycle phases, and the recently completed successful sequencing of the Tuber genome as significant works.

Participants from a variety of countries presented papers on topics relating to research, ecology, biology, mycorrhization, identification, cultivation, harvesting, handling, marketing and packaging of truffle.

Day One

- Reports were given on truffle research and development in the regions of China, North America and Europe
- Balance of the day focused on a genomic and cell biology session

Day Two

- Ecology and population biology session
- Taxonomy, biology and ectomycorrhizae session

Day Three

- Conservation, commerce and valorisation session
- Cultivation session

Day Four

- Cultivation and discussion sessions

The International Experience

To provide details of speakers addresses and information learnt, the full set of conference abstracts are attached to this report as a disc.

The Spoleto Truffle Congress is the most important conference for the international truffle community.

Historically, the congress has been heavily weighted toward the scientific research of truffle biology and ecology. In 2008 a concerted effort was made to focus equally on science and field research in cultivation.

There has been a welcome realisation recently that the areas of science and field research experimentation should be more closely aligned as the two spheres have much to learn from one another. Remarkably this beneficial symbiotic relationship has been ignored in the past.

There was a strong sense from conference delegates that the Congress should be held at five year intervals as research is expected to advance quickly as an increasing number of researchers from many different environments get involved in the industry.

International Network

The networking benefits associated with attending this conference were immeasurable. Professional relationships and new friendships alike were formed, thereby strengthening the international information sharing experience.

Delegates were interested to learn about the development of the industry in Australia and asked to be kept informed about progress. Many delegates expressed an interest in visiting Australia for an international conference, should one be held in the future.

Urbani Tartufi (Urbani Truffles), Italy

Urbani Tartufi is the world's largest buyer and exporter of truffle products. The visit to the Urbani company provided the Fellow with an opportunity to learn how a major industry player receives, stores, cleans, handles and packs fresh truffles.

Urbani methods of blending of truffles and complimentary food products were closely guarded and not able to be shared.

Urbani – Past and Present

The Urbani family have a long tradition in the truffle industry dating back to the 1850s. Urbani Tartufi is an international business run by brothers Paolo and Bruno Urbani. The Urbani brothers are proud descendants of the founder, Carlo Urbani. Other Urbani family members also play a role in the business.

Head office is in Umbria where a 5,000 square metre state-of-the-art processing plant has been completed recently. Urbani has offices and representatives in a number of cities around the world and is the parent company of businesses such as Tartufitalia, a gourmet retail outlet chain, and Agricoltura, which produces mycorrhized trees.

The International Experience



Inside the Urbani Tartufi processing plant at the head office in Umbria, Italy

Fresh Truffles

Urbani processes on average 100 tons of fresh truffles annually. Truffle varieties processed include *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum*, *Tuber uncinatum* and *Tuber borchii*. Truffles are received at the processing plant daily throughout the relevant season for each species and immediately refrigerated at 3 degrees Celsius. Processing usually commences the day the truffles are received.

Truffles are soaked in room temperature water to loosen any attached soil and then brushed lightly by hand to remove the soil. After soaking, the truffles are then placed in a tub of sand to absorb excess moisture from the truffle surface. The sand's slight abrasiveness also assists in removing any residual particles of soil as the sand is brushed from the truffle.



Truffles are inspected for grading



Tuber magnatum are brushed with fine sand

Truffles are then sorted for identification and grading using the European Grading Standards. Although care is taken on receipt of truffles to ensure that the species are correct, initial assessments can on occasions be inaccurate. Identification issues such as some species looking alike, poor aroma (particularly earlier in the season) and embedded soil can make identification in the first instance unreliable.

The International Experience

After identification and grading, the truffles considered suitable for the fresh market are separated and again refrigerated in readiness for secondary grading, packaging and transporting. The truffles are refrigerated for no longer than two days if they are to be dispatched as fresh produce.

Fresh truffles for immediate sale are selected for size requirements as per the order and wrapped individually in a moisture absorbent cotton cloth. They are then placed in a foam container with freezer blocks to maintain a low temperature of approximately 4 degrees Celsius during the transport process.



Freezer blocks maintain cool temperature in transit Foam transport containers

Larger quantities of truffles are usually sent to distributors, who, in turn, fill their own smaller orders from a batch. Distributors may purchase different grades of truffle or truffle pieces, depending on customer demand.

Frozen Truffles

A substantial part of the Urbani business now involves the supply of frozen truffles year round to the world market. A quantity of first grade truffles are kept for this purpose, and after being soaked again and washed a second time using a specific truffle washing machine, are then snap frozen.

The snap freezing process involves freezing the truffles at minus 75 degrees Celsius for fifteen minutes. They are then stored at a holding temperature of minus 15 degrees Celsius. Truffles may be kept in this condition for up to six months prior to use. Transportation of frozen truffles is by priority shipping in freezers.

Urbani recommends using the truffle in its frozen state and allowing the final thawing to take place during the cooking process.

It is widely considered that the aroma and taste of the truffle is diminished when it is preserved in this manner, yet the price is only marginally less than the fresh product.

Fitzpatrick consumed meals produced with frozen truffles whilst on this trip and he concurs with the widely held view that aroma and flavour is less.

Preserved Truffle and Value Added Products

Incorporating truffles with other foods covers a comprehensive range of combinations, many of which the Urbani organisation claims to have pioneered. Not surprisingly, their expertise and knowledge in this area is a closely guarded secret.

The International Experience

While the processes involved in receiving, cleaning, grading, storing and transporting fresh and frozen truffles is logical and rudimentary, this is not the case when it comes to the recipes and skills involved in preserving truffles successfully and producing value added products to create a year round commodity.

Questions asked by the Fellow about truffle processing were generally met with either no response or a very firm *"I'm sorry but we are unable to share that information with you"*. This response was not exclusive to Urbani – other organisations responded similarly.

Despite their interest in truffle growing in Australia, our counter-cyclical harvest season and geographical disadvantages in providing fresh truffle products to the European market, European producers are not willing (at this stage at least) to provide any overt assistance to any potential Australian competitors.



Processing plant operators

Cahors, France

Cahors (pronounced Ka'or), is a lightly populated area in South West Central France and part of the Midi-Pyrénées region of which Toulouse is the capital. Quercy, the area around Cahors, is home to the Périgord black truffle.

The visit to Cahors was hosted by Pierre Sourzat, technical manager of the Station Trufficole, Cahors – Le Montat. Sourzat is a truffle scientist and author of many highly regarded books and papers truffle cultivation.

Understanding the Past

Once a thriving natural environment for *Tuber melanosporum*, the oak forests around Cahors have suffered a similar fate as many other formerly prolific truffle producing regions of Southern France, Northern Spain and Italy – all have experienced diminishing annual yields.

The International Experience

Historically the country areas in France were much more heavily populated, with people living as subsistence farmers who grazed their sheep in the forests, gathered fallen timber from the forests for heating and cooking, and removed trees for building purposes.

The forests were very active environments, with both man and animal involved in a constant cleaning process by virtue of their use of the land and its flora. These activities kept the forest floor relatively clean, open to available sunlight and stimulated biodiversity in the soils. The prevailing conditions were favourable to the life cycle requirements of *Tuber melanosporum*. Early records indicate annual yields up to 1,000 tons in France alone.

Today it is a very different picture. A smaller rural population and restricted forest access imposed by local authorities has resulted in forest canopies becoming increasingly closed and ground cover vegetation remaining uncontrolled. Although the changed forest environment is proving less and less suitable for *Tuber melanosporum*, it has become more suitable for other opportunistic and less desirable species of tuber such as *Tuber brumale*, *Tuber rufum* and *Tuber mesentericum*.

There is a correlation between the decline in population in rural areas, land use restrictions within the oak forests and a miniscule annual yield of truffle (28 tons in 2006/07).

Other Issues

Other factors have had an impact on the decline of *Tuber melanosporum* production in France's natural forest environments.

Changed farming practices saw vast areas of forest clean felled in the mid 1900s for more conventional cropping. Urban sprawl during the last century resulted in more land clearing for homes, roads, industrial and commercial infrastructure. Tracts of land now in different use were once part of the equation when factoring in annual harvests. The two world wars were also an important factor. Many knowledgeable men and women from farming communities were killed or displaced permanently from their farms and from rural areas. Furthermore, the two major wars of the twentieth century irretrievably damaged forest and farming landscapes.

Although there are still many natural areas of forest in France today, the annual yield from these environments continues to decline due to changed conditions that now favour the more competitive tuber species.

Truffle Plantations

Since the early 1970s thousands of trees mycorrhized with *Tuber melanosporum* have been planted in truffieres (cultivated plantations) in France. These plantings however, have had no real positive impact on production. The steady decline in the national yield has not been reversed.

A high percentage newer plantings have failed to meet expectations, many of which have not produced any *Tuber melanosporum*. Instead, yields have been dominated by species such as *Tuber aestivum* or other less desirable species. While some plantations in France are producing reasonably well, these are the exception rather than the rule.

There has been a change in the soil profile in response to what has happened above the surface over the past century. As a consequence there has been a shift in the balance of soil mycorrhizal species, and the once prevalent *Tuber melanosporum* has lost its position of dominance.

The International Experience

Competing mycorrhizae now dominate the soil profile. These quickly colonise host trees in plantations even when mycorrhized with *Tuber melanosporum* prior to planting out. This phenomenon is now the main barrier to improved *Tuber melanosporum* production in France, in both cultivated truffieres and the natural forest environments.

French truffle scientists and growers now accept that as the cultural and physical changes that have taken place over time cannot be reversed, the natural forest environments conducive to the production of *Tuber melanosporum* will continue to decline.

Nevertheless, mycorrhized trees continue to be planted annually and mycologists and growers still remain focussed on learning how to create the conditions where *Tuber melanosporum* can compete with other soil occupying mycorrhizae.

Cultural Notes

According to Sourzat, new plantings will invariably be the *Quercus* species and must be perfectly mycorrhized plants. The use of Hazelnuts ceased some time ago as they were considered inferior host trees to the oak species, because they do not produce truffle with the same longevity and management of the trees requires more time.

Findings

Methods to enhance production in truffieres include:

- Using only certified inoculated plants.
- Light cultivation techniques which respect biodiversity of soils.
- Cultivating once in early Spring to a depth of 5-10cm
- Avoid working the soil within the burnt zone.
- Utilising only light machinery in plantation.
- Planting in open, lightly wooded areas.
- Upkeep of the soil to maintain biodiversity.
- Maintaining irrigation practices at critical intervals through Summer.
- Irrigation regime of 20mm every 10-15 days in Summer (if no rain).
- Pruning trees to allow burnt zone exposure to the sun.

Possible barriers to truffle production in truffieres are:

- Land that has been previously intensively cultivated using chemical products (pesticides).
- Poor management of growth and density of mycorrhized trees in plantations.
- Working soils with heavy machinery, thus creating compaction.
- Using herbicides that may decrease soil bio diversity.

The International Experience



A small truffle was found inside this potted *Q. ilex* Large brule under *Q. ilex* in cultivated truffiere

Truffle in a Pot

While the Fellow was being shown around the Station Trufficole in Cahors a small *Tuber melanosporum* was found in a potted *Quercus ilex* (*Q. ilex*). These dozen potted trees were an abandoned experiment that had been relegated to the rear of a glasshouse. A large burnt zone was visible around the base of the collection of pots, indicating that the roots had moved into the soil and the mycorrhizae is still present. The small truffle was just below the surface and adjacent to the trunk. It was found by the Legotto truffle dog that was accompanying Sourzat and the Fellow on the tour of the facility.

Harvesting in the Natural Forests

Harvesting in the natural forests of France is not the experience it once was. Even people with years of experience like Sourzat lament the fact that areas regarded historically as reliable harvesting grounds now yield very little *Tuber melanosporum*.

Soils and Vegetation

The soils in the natural areas visited were free draining calcareous loamy soils between 350mm and 400mm deep with a pH range of 7.6-7.9 overlying a consistent limestone base. The main host plants in the area were *Quercus*, interspersed with shrubby *Juniperus* species, various ground covering plants and grasses.

Burnt Zone (Brule)

Notwithstanding local knowledge of likely areas within the woodlands to search for truffles, the real indicators of subterranean fungal activity are the pronounced areas where ground covering vegetation has died back. This is commonly known as the 'burnt zone', 'burn' or 'brule'. In the forests near Cahors the burnt zones were variable in size, ranging from a small blemish in an otherwise grassy area to extremely large and easily recognisable patches of cleared ground, often characterised with some patchy moss growing around the perimeter and within the area.

The burnt zones were not always around the perimeter of a host tree, but often found in isolation several metres from the base of the host. It was often difficult to tell which tree was indeed the host. In areas where the woodland bordered more open-grassed paddocks, small burnt zones were often isolated several metres out into the grassed area. Sourzat identified these zones as being particularly productive. This proved to be true during the subsequent search for truffles.

The International Experience

Harvesting

Sourzat's truffle dog, Pierre, is a labrador with a few years experience in truffle hunting. Best results are achieved when only one dog is taken on the hunt. This ensures the dog maintains focus on the job at hand. When a truffle is located the dog is rewarded with a treat. Sourzat prefers to allow his dog to roam freely through a patch of trees either in a forest or cultivated truffiere.

When a truffle is located Pierre determines the maturity of the truffle by smelling the surrounding soil for the intensity of aroma prior to digging. While many truffles were found during the forest visits, approximately only 15 percent were *Tuber melanosporum*. Other species located included *Tuber rufum*, *Tuber brumale*, *Tuber aestivum* and *Tuber mesentericum*.



Large, well defined burnt zone at a distance from the host oak tree

Lalbenque Truffle Market

A visit was arranged to the Lalbenque truffle market. The market operates on an annual basis, commencing on the first Tuesday in December and then on every Tuesday through to mid-March. The market is held in the main street of Lalbenque, appropriately called 'la rue du Marché aux Truffes.'

The decline in the number of truffle markets in France parallel the decline in production which started at the beginning of the 20th century. As many as 50 weekly markets operated in their heyday. Only about ten remain today. The markets are still run in the traditional way they were a century ago. While appearing to be somewhat haphazard, the markets are tightly controlled. Sellers display the harvested truffles in small baskets for buyers and brokers. Selling and buying rules vary slightly from market to market.

The International Experience



Buyers jostle for position before the horn blows to start the market (sellers on the left, buyers on the right)



A buyer with his purchase



Lalbenque Truffle Market



The buyer weighs and buys the truffles from the sellers.

At Lalbenque buyers and sellers take their place on either side of a row of benches on which the truffle baskets are placed. At a given signal, the market is opened and the dealing begins. Each buyer (or representative) writes the price he is prepared to pay on a small piece of paper, and if the seller keeps the paper it means that the price is accepted and the deal done.

At the end of the market, the sellers bring the truffles out to an open area in the car park. Truffles are weighed by the buyer on roman scales prior to payment. Variations in prices from one year to the next at such markets are determined solely on the quantities supplied. A bad harvest year may result in prices doubling.

The International Experience

SA Pebeyre Truffle Traders, France

SA Pebeyre was founded by Pierre Pebeyre in 1897. Four generations of Pebeyre later, it remains the sole French company specialising exclusively in the truffle trade. The company is a leading player in the global truffle market. Alain Pebeyre took over the management of the business in 1920, increasing the company's focus on truffle specialisation and national reputation. Today his grandson, Jacques, (who joined the business in 1949), and great grandson Pierre-Jean Pebeyre continue the long family tradition in truffles.

Industry Challenges

SA Pebeyre sell fresh and preserved truffle products to a global market. Both Jacques and Pierre-Jean Pebeyre acknowledge they are operating in a market of rapid change. In the past decade alone they have seen market demand for preserved and fresh truffles change from a 60:40 ratio respectively to the complete reverse. This has required greater emphasis on obtaining more first quality stock in a very competitive marketplace.

Obtaining good quantities of A-grade fresh truffles is becoming increasingly difficult as yields decline in the natural forests and as more reliance is placed on alternative sources such as cultivated truffieres and imports (predominantly from Spain). Local truffle collectors tend to sell the best truffles privately to achieve the highest price and offer the secondary quality product to professional truffle traders like Pebeyre.

Today many sellers of truffles operate from the boot of their car. There are no fixed overheads associated with this selling practice. Companies like SA Pebeyre however, have substantial fixed costs. Consequently, profit margins for such companies are slim.

Another major issue for companies such as SA Pebeyre is that top grade product may constitute only 50 percent of the truffles purchased at local markets. As the truffles are sold in 'lots' (and usually in a flurry of activity with no real time to investigate fully the contents until it is sorted at the factory) it is not uncommon to find *Tuber brumale*, *Tuber mesentericum*, *Tuber rufum* and *Tuber aestivum* mixed in with the *Tuber melanosporum*, the latter possibly being in various stages of quality and maturity. Much of what they buy at local markets may, therefore, be unsuitable to their customers. Costs associated with this occupational hazard then have to be built in to margins. Other challenges include ever-increasing competition, variable loyalty by truffle collectors and fewer and/or poorer quality truffles at higher prices.

Pricing

At the time of the Fellow's visit to SA Pebeyre the wholesale price for A-grade truffles was €420-440 per kg (\$AU840-880 per kg). Pebeyre's on-sale price for the product was €800 per kg (\$AU1,600.00 per kg).



Tuber melanosporum in various stages of maturity



Tuber brumale (left) mixed in with *Tuber melanosporum* (right) purchased in the same lot

The International Experience

Truffle Products

Truffles are bought at markets, or offered for sale at the factory with the soil still attached. This increases the shelf life, but also hides imperfections and in some cases, the true identity of the truffle.

The truffles are then carefully washed and brushed before being sorted and correctly identified, usually by taking a small slice off the peridium to expose the characteristics of the flesh. During the process of cleaning truffles generally lose 15-20 percent of their weight. The truffles are then refrigerated at 4 degrees Celsius until further processing.

Fresh truffles purchased between November and March are processed quickly as their shelf life is only 10-14 days.

Fresh

SA Pebevre sell fresh truffles in five categories:

1. *Hand-Peeled Truffles*
High quality, as the skin cannot hide any possible internal defects. Truffles are a regular shape after peeling.
2. *Brushed Truffles*
Whole truffles of excellent quality and regular shape.
3. *Brushed Truffles (First Choice)*
Whole truffles of good quality with irregular shape.
4. *Truffle Pieces*
Pieces from whole truffles of good quality, but partly damaged by frost, drought or poor handling at harvest.
5. *Truffle Peelings*
Mixed skin from peeled truffles.

Preserved

Tinned (variable weight)

A process where the truffle is tinned while fresh, followed then by a sterilisation procedure. This first sterilisation makes it lose about 25 percent of its solid bulk, which becomes a liquid referred to as truffle juice. Variable loss of bulk weight does not allow for accurate net weight labelling. Sales tend to be limited to professional buyers.

Tinned (retail product)

The truffle undergoes two sterilisations. The first is carried out in large cans that boil off the truffle juice. The second sterilisation takes place when the truffles are sorted and packaged in small tins. At this stage part of the juice lost in the first cooking is added back to the truffle with any leftovers sold as truffle juice. This double operation ensures tins can be labelled with an accurate net weight.

The International Experience

Findings

As noted previously, companies such as SA Pebeyre face many challenges getting an A-grade product to the global market in a sustainable and profitable way. These challenges are not going to abate. Both Jacques and Pierre-Jean Pebeyre remain pessimistic about the future of the industry in France.

On the other hand the Australian Truffle Industry does not face the same issues and challenges as those confronting the French industry. Australia does not have the tradition of natural forest truffle harvesting, nor do we have to deal with the vagaries of small town markets as primary sales points. We have the opportunity to build an industry that can address supply and demand issues in a sustainable and profitable way.

Lleida, Spain

The visit to Lleida was hosted by Christine Fischer. Fischer is a truffle scientist at the Centre Tecnologic Forestal de Catalunya in Solsona Spain. She and her husband, Carlos Colinas, head up the truffle research at the centre.

History

Truffles occur naturally in many areas of Spain, but forest yields have long been in a similar pattern of decline as those in France and Italy. There are similar cultural reasons for the decline, as well as decreasing Summer rainfall patterns, increasing numbers of wild boar, and over exploitation of forests by truffle hunters, many of whom are inexperienced. There are more than 100,000 people currently registered in Spain as truffle hunters.



Typical natural truffle grounds in Spain

The International Experience

Truffle Plantations

The growth of the cultivated truffle industry in Spain was driven initially by provincial government subsidies. These subsidies were provided with the intention of benefiting rural economies while also endeavouring to conserve biodiversity through the expansion of oak woodlands. These government subsidies have supported oak reforestation and truffle cultivation since the mid 1980s.

Today the Spanish cultivated truffle industry is quite large and relatively successful. It is supported by government-funded research. New entrants to the industry receive a subsidy to plant mycorrhized trees on a per hectare basis. This research and subsidy strategy has contributed to rapid industry growth in recent years.

Associations of truffle growers and collectors have emerged in key regions and have been instrumental in the development of the industry. One of the larger associations, the Truffle Cultivators' and Collectors' Association of the Province of Teruel, was founded in 1997 by 12 people. Since then membership has grown to 530.

Cultural Notes

Soils

The Fellow visited a small, highly productive truffle plantation near the village of Cabo located to the north of Lleida. The soils in this region are typical of many productive areas of Spain – gritty open sandy loams with a clay content ranging between 15-30 percent, very low organic matter readings at > 8%, a high content of broken rock and a natural pH of 7.5-8.2.

Fischer's research indicates that *Tuber melanosporum* mycelium can survive and grow in soil pH as low as 6.5. This pH level, however, will not produce truffle until pH is in the range of 7.5-8.2. According to Fischer the higher the pH the better.

Fischer also pointed out that soil compaction is a major reason that many properties do not produce truffles. This suggests that machinery or animals should not be used on or around the plantation when soils are wet as this promotes soil compaction. Cultivation of soils is more important in soils with higher clay contents, but again this should only be carried out when soils are not too wet.

Truffle Rot

The main contributor to truffle rot in Spain is environmental. A combination of warmer Winters than usual (above 4 degrees celcius), wetter than normal conditions, and poor drainage result in rotting truffles at harvest. Fischer considers dry, cold Winters deliver the best harvest results.

Weed Control

Effective weed control is important in Spanish plantations. The absence of weeds when the plants are young enables easier establishment. For older plants effective weed control lessens the competition for moisture in the harsh Spanish Summers. Weed removal around the trees – particularly in the burnt zone – (considered to be competition to the mycorrhizae) is carried out either by hand or with a rake to both loosen and cultivate the soil at the same time. Herbicides are only used at a distance from the trees and not in the burnt zone itself.

The International Experience

Mulch

Rocks and tree branches are used for moisture retention as mulch in the harsh Summer conditions.

Rainfall and Irrigation

As the first stage of truffle development (known as the primordial) initiates in mid to late Spring, the availability of ample moisture (preferably rain) is critical during this period. Summer rains are also critical. Too much rain can increase soil humidity and either impede the development of the truffle, or cause an early onset of rot.

Controlled irrigation techniques are used in years of light Summer rainfall. Trees are watered every 10 to 14 days during the warmer months. This is continued through to mid-Autumn if Summer rainfall has been insufficient. Summer watering is restricted to the cooler times of the day to avoid excessive build up in soil humidity.

Production Enhancement

At the completion of the harvest season a series of holes approximately 250mm wide and 300mm deep are dug around trees slightly inside the edge of the burnt zone. Organic matter is incorporated into the soil dug up before the holes are refilled. Growers report that truffles form regularly in these pockets of soil in the following season. The process is repeated in subsequent post-harvest periods with a larger hole circumference being dug each time.



Cultivated truffle plantation in Cabo, regional Spain



Large irrigated plantation planted on a 6x6m grid



Unearthing another Tuber melanosporum



Soils are open, gritty and extremely low in organic matter

The International Experience

Associations

The truffle grower and collector associations in Spain have remained united and proactive in their lobbying efforts and representations on behalf of their memberships to governments and associated agencies. They help members apply for government subsidies and negotiate with government and other authorities on regulations concerning the collecting and marketing of truffles. Other activities organised by truffle associations include meetings, lectures, and events designed to share scientific and technical information.

Government Subsidies

Government subsidies and favourable tax legislation has assisted the growth and development of the cultivated truffle industry in Spain. At the time of the Fellow's visit, subsidies for establishing truffle plantations in Spain were €2,300 per hectare (approximately \$AU4,500.00). Plantations installed via government reforestation subsidies must by law remain in the soil for at least 20 years irrespective of whether any truffles are produced.

Research and Development

The Spanish Government views the cultivated truffle industry as a viable alternative crop. They back this up with research and development funding. Communication between scientists and growers is strong. The excellent relationship between the two sectors is valued highly as an important factor in ensuring the further growth of the industry in Spain.

Knowledge Transfer: Applying the Outcomes

The outcomes of the Fellowship will be beneficial to the Australian Truffle Industry as it establishes itself and continues to experiment with geographical locations, climatic conditions, cultural practices and marketing campaigns.

There remain many unanswered questions globally surrounding the cultivation of truffles and defining the parameters for ideal growing conditions may take many more years.

The fact that such a limited amount is known about the lifecycle of the truffle is the very reason for its scarcity, mystique and the price it commands. Herein lies a dilemma: If the secrets of the truffle are eventually unlocked and, truffle supply increases significantly, then prices and interest in this revered culinary commodity may decline to such an extent that current investment decisions underpinning the industry change somewhat.

Sharing the Information

Opportunities to share the knowledge and insights gained through this Fellowship experience will be provided through:

- Distribution of this report to industry stakeholders
- Access to this report electronically via the ISS Institute
- Access to this report electronically via the Australian Truffle Growers Association
- Presentation of findings to the annual Truffle Industry Conference
- Presentation of findings to interested industry gatherings
- Potential workshop through ISS Institute
- Development of a short course/workshop for inclusion in TAFE horticultural studies

Recommendations

Government

Federal and State Government

Even in its fledgling state the Australian industry faces the danger of competing mycorrhizae. Either through human error or via unscrupulous suppliers, undesirable and highly competitive species such as *Tuber brumale* and *Tuber indicum* (China truffle) can easily be bought into Australia when mixed with *Tuber melanosporum* imports. If such species are used inadvertently in inoculum for host tree mycorrhization their infiltration into Australian soils would be inevitable. Even small pieces of these species lodged in the peridium of a *Tuber melanosporum* could affect inoculum.

Following a vigorous lobbying effort by the industry Australian Quarantine and Inspection Service (AQIS) recently banned the importation of any tuber species other than *Tuber magnatum*, *Tuber melanosporum*, *Tuber aestivum* and *Tuber borchii*. While this is a very important and positive first step in protecting Australian soils from unwanted fungi, establishing appropriate protection protocols to support import regulations now need to be developed and implemented.

The Australian Truffle Association is the appropriate organisation to work with the AQIS in the development of these protocols. The experience and expertise across the membership base makes the association the best organisation to provide the necessary guidance and direction to the AQIS.

Rural Industries Research and Development Corporation (RIRDC)

The role of the RIRDC is to generate the knowledge for industry and government to achieve a more profitable, sustainable and dynamic rural sector.

Through its industry, scientific and research and development networks, together with its extensive advisory committee structure, RIRDC is able to identify the strategic knowledge needs of all stakeholders and select and manage the best research and development investments to meet those needs.

The RIRDC is highly supportive of the Australian Truffle Industry. It is imperative this relationship is maintained and developed further through regular meetings between industry representatives and the RIRDC and the free exchange of information including technical and market intelligence.

Local Government

Local Government economic development offices and local chambers of commerce should be encouraged to support the Australian Truffle Industry in the context of regionalism. Potential benefits for local communities include increased tourism activity resulting in benefits for hospitality, retail and real estate sales through the development of annual festivals, harvest activities and conferences.⁶ The industry also presents a potential alternative income source for farmers located in appropriate truffle growing regions who may be seeking to diversify.

⁶ In 2007, Pauline Porcaro, Senior Educator, Tourism, Kangan Batman TAFE, was awarded an ISS Institute/Italy (Veneto) Fellowship sponsored by the International Division, Victorian Government to research agritourism. In brief, her Fellowship focused on skill deficiencies related to • The Italian model of agritourism • Adding value to existing local industries • Marketing • Development of regional produce labels • Agritourism within farming communities • Quality management systems. Contact the ISS Institute for a copy of the report.

Recommendations

Industry

The industry faces many challenges going forward and issues such as methods of raising funds through the Australian Truffle Growers Association to secure 'dollar for dollar' research and development funding grants from the RIRDC need to be fully explored.

Options include raising membership fees from the very low current base of \$100.00 per annum and a possible form of industry levy. These and other options need to be considered by the industry to ensure ongoing development.

Another area emerging as a potential threat to the Australian Truffle Industry is lack of cohesion among the larger producers. The larger growers historically have not communicated effectively with each other on a raft of industry issues and this will be detrimental to industry development if not addressed. Effective and cohesive dialogue is especially important going forward on issues such as a unified export strategy, adherence to the quality standards and certification of mycorrhized trees.

Options such as a 'single desk' export approach should be examined. This option would allow for a unified approach to all issues relating exporting, quality and industry supply.

Given our location and production potential, the Australian Truffle Industry has the potential for significant local and export market growth. It is recommended that the larger industry players work with the Australian Truffle Growers Association toward a unified approach to address these issues.

The opportunity also exists to develop truffle tourism regions (as in the Yarra Valley for wine). Tourism based on truffle producing regions has the potential to boost local economies with consequent positive impacts on employment, land values and retail.

Other major opportunities include uniquely Australian value-added truffle products that may be sold year round to domestic and export markets.

Nurseries

Effective control against the entry and spread of undesirable species rests with those nurseries producing mycorrhized host trees. DNA testing of truffle species for correct identification is now possible and is highly recommended by European truffle scientists. Christine Fischer at the Centre Tecnologic Forestal de Catalunya in Spain believes that the only absolute way of determining contaminants in inoculum is to DNA test each batch of inoculum individually.

Fischer spends a great deal of time testing and certifying mycorrhized trees for Spanish growers for the presence of contaminants and acceptable levels of mycorrhization. She believes that testing batches of inoculum would result in cost savings to growers. The approximately 500 trees inoculated from the average batch would not have to be discarded if found to be contaminated.

No Australian certification standards exist for producers of mycorrhized host trees for the industry. This quality related issue should be addressed at this stage of development to ensure that new entrants to the industry have access to a certified product. This is standard practice for many companies in Europe who supply trees. The purchase of certified, well mycorrhized plants is paramount to the success of new truffle enterprises in Australia.

Recommendations

Professional Associations

The Australian Truffle Growers Association is working closely with the RIRDC to advance its profile as the peak body representing the Australian Truffle industry. This important developmental work should continue in conjunction with a strong focus on steadily increasing membership of the organisation.

Currently the membership of the organisation represents approximately 40-45 percent of growers in Australia. This impedes the unified approach required to develop necessary strategies for the future. Dealing with critical issues surrounding the development of overseas markets, competing local producers and research and development, are central to long term success of this industry.

The Australian Truffle Growers Association may also consider working closely with allied professional associations to educate sectors and promote the industry including:

- The Restaurant and Catering Industry Association of Australia
- The Australian Hotels Association
- Regional gourmet food associations
- The Australian Retailers Association
- Tourism Australia
- State and regional tourism associations

Education and Training – TAFE

A short course based on the history and principles of truffle growing could be developed and delivered either as a workshop or fee-for-service program.

ISS Institute Inc

The ISS Institute can assist in the sharing of the information by making it available to industry and other stakeholders electronically and on its website. The ISS Institute may also conduct a workshop for interested participants and relevant public speaking engagements.

The ISS Institute could possibly facilitate an overseas expert/s visit to Australia via an ISS Institute Fellowship. The type of expert could be related to study areas of priority as identified by the industry at a given time.

Further Skills Deficiencies

Further skills deficiencies have been identified and will be the subject of a subsequent Skills Victoria/ISS Institute TAFE Fellowship awarded to Colin Carter.⁷

⁷ In 2008 Colin Carter, Senior Educator, Swinburne University of Technology (TAFE), was awarded a Skills Victoria/ISS Institute TAFE Fellowship sponsored by Skills Victoria. His Fellowship researched skills deficiencies related to the cultivation of truffles in Italy, France and Spain. Carter focused on • The cultivation of black truffles • Identification of truffle species and audit and certification processes for inoculated seedlings, trees and truffles • Management and technical systems for truffles in Australian conditions. Contact the ISS Institute for a copy of the report.

References

Barry Lee, *Taking Stock of the Australian Truffle Industry*, RIRDC Publication No. 08-124

Attachments

Index to Attachments (See CD)

1. European Grading Standards
2. Tuber 2008, Spoleto Italy – discussion papers and speakers abstracts