International
Specialised
Skills
Institute Inc

Australian Government

Department of Education, Employment and Workplace Relations

SUSTAINABLE PRODUCTION TECHNOLOGIES FOR THE CUT FLOWER INDUSTRY

Brian Shannon

National ISS Institute Overseas Fellowship

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

ISS Institute Inc.
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Executive Summary

The Australian Cut Flower and Foliage Industry is a well established but fragmented industry. Presently it is divided into three sectors: the largest being the traditional flower sector (predominantly protected cropping), the Australian Native and Protea sector which involves predominately in-ground production, and a new tropical cut flower and foliage sector (North Queensland, Northern Territory and Northern Western Australia). The majority of growers involved in the protected cropping sector utilise hydroponics as a method of growing. Hydroponics production as a method of growing in itself is an efficient use of water in that the plants only use what they need. The waste nutrient mix can be collected, treated for pathogens and reused in the system. This creates a saving in the nutrients applied to the crop and the water used by the system.

There are two main areas in which significant skill and knowledge gaps exist which the National ISS Institute Overseas Fellowship training will assist in addressing:

- Improving water use efficiency and environmental sustainability
- Improving production management and profitability through innovative technologies

The aim of this Fellowship was to study the technologies of new and innovative water use efficiencies. Greenhouse automation techniques and technologies which have been developed at research and development facilities will be investigated to ascertain their uptake and implementation into the Cut Flower Industry at grower level. New efficiencies must be explored to ensure sustainability and growth within the Australian market.

Specific areas of study and development:

- Design and application of new water efficient irrigation technologies.
- Identification and evaluation of automated greenhouse systems.
- Energy savings from advanced ICT climate control systems.
- Methods of collection, disinfestation, recycling and reuse of run-off water.
- Information on improvements to labour and input efficiencies.
- Methods of improving product yield and quality from such technology.
- Improvements in workplace health and safety available from the application of automated systems and labour saving devices.

Leading the development of technologies which have significantly improved water use efficiencies while also improving production quality and reducing labour inputs, are Israel and a number of countries within Europe (particularly the Netherlands). This study tour provided Shannon with an opportunity to gain first hand experience in sustainable production technologies for the Cut Flower Industry. The Fellowship included site visits to Israel, Spain and the Netherlands.

Issues pertaining to export were also able to be addressed as a consequence of the Fellowship opportunity. There are a number of factors which have limited Australia's performance as an exporter of cut flowers and flower seeds. One of these is the high degree of fragmentation in the industry. The domestic industry is characterised by a large number of producers, without sufficient scale to market their product overseas. Another factor is the lack of understanding of costs and returns by industry producers, which has led Australia to be a relatively high cost producer.

Executive Summary

In 2004, the Rural Industries Research and Development Corporation published a study into benchmarking in the industry with the aim of improving profitability (Gerry Parlevliet, *Improving profit for the flower grower - a study using benchmarking,* August 2004, RIRDC Publication No 04/119 RIRDC Project No DAW-102A). Increased understanding of costs and efficiency in the industry could improve export potential.

The following report provides an overview of the Fellowship experience and suggestions for engaging in knowledge transfer activities. In addition, the report concludes with a series of recommendations for Government, industry, the business sector, professional associations, education and training providers, the community and the ISS Institute.

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Abbreviations and Acronyms

ACLH	Australian Centre for Lifestyle Horticulture
AHSC	Australian Horticulture Standing Committee
DEEWR	Department of Education, Employment and Workplace Relations
Ec	Electrical conductivity
EVAO	Estimated value of agricultural operations
FAQI	Flower Association of Queensland Incorporated
HAL	Horticulture Australia Limited
ICT	Information and communication technology
IDO	Industry Development Officer
ISS Institute	International Specialised Skills Institute
NPK	Nitrogen, Phosphorous, Potassium
PTC	Practical Training Centre
QFGA	Queensland Flower Growers Association
QRITC	Queensland Rural Industry Training Council
R and D	Research and Development
RTO	Registered Training Organisation
TAFE	Technical and Further Education

Acknowledgments

Brian Shannon 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 way. 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, ISS Institute Inc. set up a new ISS advisory body, the **Trades Advisory Council.** 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; Richard Pratt, Chairman, Visy Industries and Julius Roe, National President Australian Manufacturing Workers' Union.

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 Supporter

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

The Australian Government's Department of Education, Employment and Workplace Relations (DEEWR) implements Government policies and programs to provide education and training opportunities for all Australians, to increase employment participation and to ensure fair and productive workplaces. Education, training and workforce participation are central to our goal of building a productive and socially inclusive nation, one which values diversity and provides opportunities for all Australians to build rewarding social and economic lives. Brian Shannon would like to thank them for providing funding support for this Fellowship.

Supporters

In Australia

Flower Association of Queensland Inc.
- Denyse Corner, Industry Development Officer (IDO)
- Samuel Plant, IDO, Water South East Queensland Irrigation Futures
- Duncan McGregor, IDO, Water Rural Water Use Efficiency 3

Australian Flower Industry Magazine
- Publisher, Flower Association of Queensland Inc.
- Amanda McAuliffe, Editor

Department of Primary Industry and Fisheries (Queensland)
- Shane Holborn, Team Leader, Lifestyle Products & Services, Redlands Research Station

Department of Natural Resources and Water (Queensland)
- David Schmiede, Principal Project Officer, Rural Water Use Efficiency
- Karen Murday, Senior Project Officer, Rural Water Use Efficiency

TAFE Queensland
- Kerry Drinkwater, Leading Vocational Trainer in Horticulture (Floriculture), Brisbane North Institute of TAFE

Propagation Australia
- Ron Walker, Managing Director

Netafim Australia
- Sam Tidhar, National Sales Manager

Queensland Rural Industry Council
- Sheila Thompson, Chair

Australian Hydroponics and Greenhouse Association
- Graeme Smith, President

Flora International
- Carolyn Loos, Propagation Manager

Schreurs Australia Pty Ltd.
- Stuart Lowrie, Australian Agent

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In Israel

Ministry of Agriculture (MOAG)
- Duby Wolfsen, Senior Extension Officer
- Tamar Lahav, Floriculture Extension Specialist
- Yoram Eisenstadt, Floriculture Extension Specialist
- Ronny Scheyer, Floriculture Extension Specialist

Leaf-Sen Irrigation Systems
- Avner Frank, Managing Director
- Professor Ben-Ami Bravdo PhD, Professor of Horticulture and Viticulture, Hebrew University of Jerusalem

Netafim
- Itzik Inbar, Manager, Export Department
- Omry Eiger, Engineer, Greenhouse Division
- Yaron Katina, Crop Management Technologies, Technical and Services Support
- Moshe Lawrence, Engineer, Greenhouse Division
- Ortal Erez, Sales, Magal

In Spain

Selecta
- Richard Buis, Area Manager Spain, Flueralia

In the Netherlands

Schreurs Gerberas and Roses http://www.schreurs.nl/
- Edwin de Haze, Area Manager Asia
- Peter Wester and Lisette Nieuwendijk, Export Sales Support

Priva http://www.priva.nl/
- Anders Jorgensen, Account Manager Export

About The Fellow

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Qualifications

- Associate Diploma in Applied Science (Electronics) 1977, Telecom Australia, Technical Officer in Training Programme
- Associate Diploma in Applied Science (Horticulture) 1996, TAFE Queensland
- Advanced Diploma in Horticulture (Floriculture) 2001, Horticultural Training P/L
- Certificate 1V in Assessment and Workplace Training 2000, G Graham and Associates

Memberships

- **Flower Association of Queensland Inc**
  Joined 1993, Executive Committee member since 1995
  President 1999 to present
- **Australian Centre for Lifestyle Horticulture**
  Interim Chair 2005
  Vice Chair 2006 - present
  FAQI representative to ACLH Management Committee
- **Hydroponics Association of Queensland**
  President 1998 - 2006
- **Amenity Horticulture Standing Committee (QRITC)**
  Floriculture representative 1996 - present
  Chair 2002 - present
- **Steering Committee to Form National Flower Association**
  Queensland representative

Since leaving year 11 at Strathmont Boys Technical High School (Adelaide) in 1968 Shannon completed a five year Technician in Training course with the then PMG (now Telstra). Shannon worked for PMG/Telecom Australia for 12 years in South Australia installing telephone exchanges in country regions and eight years in Queensland testing the communications network throughout the state. This period with the PMG and Telstra instilled in Shannon the importance of training and improving skill levels because of the continuous change in technology within the communications industry.

Shannon entered the Cut Flower Industry in 1989 (specifically roses) with little training other than an Associated Diploma in Horticulture. To obtain the skills required to run a business involved in cut flower production he joined the then Queensland Flower Growers Association (QFGA) and started attending workshops, seminars and building the networks required to operate a profitable enterprise. He then joined the executive committee of QFGA in 1995 and was elected President in 2000. Among other initiatives he has been involved in developing (a) Strategic Planning (b) Training Planning and (c) Research and Development for the Queensland Floriculture industry.

Because of Shannon's belief in improving his own skills base as well as the members of QFGA, he was appointed Floriculture representative to the Amenity Horticulture Standing Committee (AHSC) in 1996. This committee was part of the Queensland Rural Industry Training Council (QRITC). He was also appointed Chair of the AHSC in 2002 and became the AHSC representative to QRITC in 2005 (both roles in which he is continuing).

The Fellowship Program

The purpose of the Fellowship was to undertake an overseas study tour to Israel, Spain and the Netherlands, to gain a comprehensive understanding of new and innovative water use efficiencies and greenhouse automation techniques and technologies as applied within intensive horticultural and protected cropping enterprises (floriculture).

Aim of the Fellowship

The aim of this Fellowship was to study the technologies of new and innovative water use efficiencies. Greenhouse automation techniques and technologies, which have been developed at research and development facilities were investigated to ascertain their uptake and implementation into the Cut Flower Industry at grower level. New efficiencies were explored to ensure sustainability and growth within the Australian market.

Specific Areas of Study and Development

- Design and application of new water efficient irrigation technologies.
- Identification and evaluation of automated greenhouse systems.
- Energy savings from advanced ICT climate control systems.
- Methods of collection, disinfestation, recycling and reuse of run-off water.
- Information on improvements to labour and input efficiencies.
- Methods of improving product yield and quality from such technology.
- Improvements in workplace health and safety available from the application of automated systems and labour saving devices.

The Skills/Knowledge Gaps

There are two main areas in which significant skill and knowledge gaps exist which the National ISS Institute Overseas Fellowship training will assist in addressing.

Improving Water Use Efficiency and Environmental Sustainability

Water use efficiency is an area of the highest priority for all primary production sectors including cut flower and foliage enterprises. There is significant opportunity to increase the efficient use of water through the application of sophisticated irrigation scheduling tools and techniques as those being developed and used in Israel and Europe. These technologies can “take the guesswork” out of crop irrigation by moving the irrigation scheduling decisions from timed irrigation to automatic irrigation on demand based on continuous monitoring of plant/substrate/water relationships and environmental conditions within the growing area.

Israel is also leading the world in its application of these water use efficiency measures to its production areas such as greenhouse design and automation, irrigation scheduling as well as the use of lesser quality, recycled and marginal water in cut flower growing. Effectively applying these technologies and techniques provides not only significant water savings potential but can also improve plant quality, crop yield and of course profitability.

Improving Production Management and Profitability Through Innovative Technologies

This is done by incorporating the most efficient production techniques into a cut flower enterprise which is the key to continued profitability and business growth. There are a limited number of innovative technologies and systems (techniques) that have been developed in Australia to assist growers in increasing yields or efficiencies, with the majority of these developments originating from Europe and North America. In contrast to the Australian

experience, growers from both of these continents have been able to successfully devise and incorporate technologies and systems that have allowed them to continue and expand their enterprises' profitability in the face of increasing global competition.

Moreover, they have acquired knowledge and skills through this process and through their experiences that will be essential for Australian cut flower enterprises to continue to remain viable in the future. This includes employing communication and information technologies to automate growing, harvesting and grading product as well as sophisticated traceability systems. These systems improve customer satisfaction (they receive a better product) as well as increasing profitability for the grower through increased efficiencies.

Overall the aim is to help develop a farm management system which incorporates water use efficiency, environmental sustainability and cost saving technologies to increase profitability and financial sustainability suitable for the Cut Flower and Foliage Industry in Australia.

Current Education and Training

The Floriculture Industry

The Floriculture Industry is found in all states and territories across Australia. There is a wide diversity in commodity areas and enterprises across the floriculture sector.

The work undertaken by those employed in the floriculture sector can comprise the following:

- Growing and harvesting commercial flowers, flower seed, foliage and essential oil crops
- Management and maintenance of field and controlled growing environments
- Post harvest treatments and production of plant products
- Wild harvesting and processing of commercial flowers, flower seed, foliage and essential oil crops

The industry is expanding with the impact of greater mechanisation, improved marketing, and advances in plant breeding.

The Amenity Horticulture Training Package RTF03 covers the training requirements of floriculture and was developed by the Agri-Food Industry Skills Council. This training package is provided by both private RTO's and the TAFE system.

- RTF30303 Certificate III in Horticulture (Floriculture)
- RTF40303 Certificate IV in Horticulture (Floriculture)
- RTF50303 Diploma of Horticulture (Floriculture)

Contact for the Agri-Food Industry Skills Council: Arthur Blewitt, Chief Executive Officer

The Australian Context

The Australian Cut Flower and Foliage Industry is a well established, but fragmented industry. At the moment it is divided into three sectors: the largest being the traditional flower sector (predominantly protected cropping), the Australian Native and Protea sector which is predominately in-ground production, and a new tropical cut flower and foliage sector (North Queensland, Northern Territory and Northern Western Australia).

This Fellowship is aimed towards the largest sector – the protected cropping sector, which is worth approximately $600 million (farm gate) to the domestic markets (estimated farm gate value with data supplied by State Grower organisations).

The industry has state peak body associations in Queensland, New South Wales and Victoria. There is no peak state organisation in Tasmania, South Australia and Western Australia.

At present there is a push to reform the national body with a steering committee formed in November 2006 to investigate the structure.

At a national conference held at the Gold Coast in August 2006 the main outcomes were that a national marketing campaign be investigated to double flower sales in a five year period and that quality control standards be investigated so that an accreditation scheme could be implemented.

The majority of growers involved in the protected cropping sector use hydroponics as a method of growing. Hydroponics production as a method of growing in itself is an efficient use of water in that the plants only use what they need. The waste nutrient mix can be collected, treated for pathogens and reused in the system. This creates a saving in the nutrients applied to the crop and the water used by the system.

However, new developments in irrigation delivery and scheduling have been commercialised in many countries. Israel and Europe (particularly the Netherlands) lead the development of technologies which have significantly improved water use efficiencies while also improving production quality and reducing labour inputs.

Industry Definition

The Cut Flower and Foliage Industry in Australia is part of the agricultural sector and engages in growing flowers and foliage for cutting and display. This typically includes traditional flowers (roses, gerberas, carnations and chrysanthemums), other exotic flowers, wildflowers or Australian native flowers. This industry does not include organisations involved in the growing of seedlings or ornamental plants (including flowers) for sale.

The Australian Context

Key Statistics (Cut Flower Growing in Australia 2008)

Source: IBISWorld Industry Report, 18 February 2008, Cut Flower Growing in Australia: A0112

	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	
Industry Revenue	*289.9	*294.5	*301.8	*309.9	*319.3	$Mill
Industry Gross Product	*173.7	*177.0	*181.6	*186.6	*175.4	$Mill
Number of Establishments	833	*685	*778	787	*778	Units
Number of Enterprises	*677	*557	*633	*635	*627	Units
Employment	*2,982	*2,986	*2,934	*2,972	*2,925	Units
Exports	27.2	19.8	21.6	18.1	15.2	$Mill
Imports	15.8	16.0	15.7	15.9	14.0	$Mill
Total Wages	*104.4	*106.0	*105.6	*108.5	*108.2	$Mill
Domestic Demand	*278.5	*290.7	*295.9	*307.8	*318.1	$Mill

Real Growth

Source: IBISWorld Industry Report, 18 February 2008, Cut Flower Growing in Australia: A0112

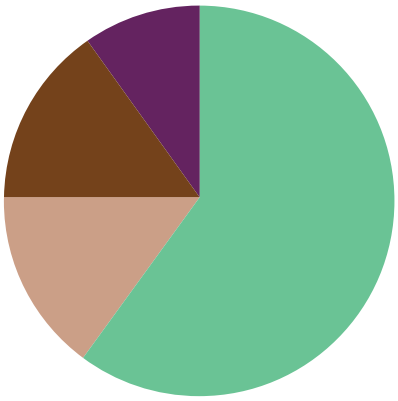
	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Industry Revenue	*-1.6%	*-1.6%	*2.5%	*2.7%	*3.0%
Industry Gross Product	*-0.4%	*1.9%	*2.6%	*2.8%	*-6.0%
Number of Establishments	-11.9%	*-17.8%	*13.6%	1.2%	*-1.1%
Number of Enterprises	*-13.3%	*-17.7%	*13.6%	*0.3%	*-1.3%
Employment	*-6.4%	*0.1%	*-1.7%	*1.3%	*-1.6%
Exports	-18.4%	-27.3%	9.1%	-16.3%	-15.7%
Imports	-5.0%	1.6%	-2.2%	1.4%	-11.9%
Total Wages	*-4.2%	*1.5%	*-0.4%	*2.7%	*-0.3%
Domestic Demand	NC	*4.4 %	*1.8%	*4.0%	*3.4%

Note: *Unless specified, an asterisk (*) associated with a number in a table indicates an IBISWorld estimate and references to dollars are to Australian dollars.*

The Australian Context

Products and Service Segmentation

Source: IBISWorld Industry Report, 18 February 2008, Cut Flower Growing in Australia: A0112

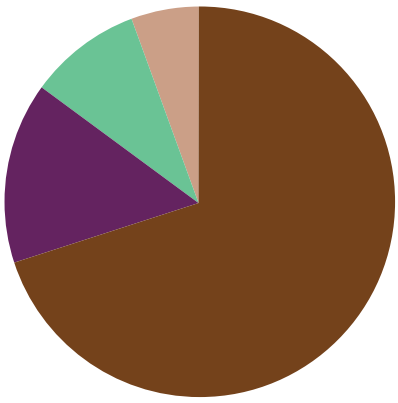


Product/Services	Share
Traditional flowers	60.0%
Exotic flowers	15.0%
Seed growing	15.0%
Native flowers	10.0%

- This industry consists of a number of different segments based on different types of flowers.
- These segments include traditional flowers (eg roses, carnations and chrysanthemums), other exotic flowers, native flowers (eg Banksia and Protea), and flower seed growing.
- The largest segment is traditional flowers (estimated at 60% of revenue) but the fastest growing segment is native flowers (estimated at 10% of revenue). Seed growing accounts for around 15% of revenue.
- 'Wildflowers' include Australian native flowers and other exotic flowers. These account for 90% of the industry's exports. Despite there being over 600 different species and dominating exports, the wildflowers category is still in its early stages of development but has strong potential. It is estimated that bush picking, as apposed to use of commercial crops, accounts for around 16% of all wildflower sales.

Major Market Segments

Source: IBISWorld Industry Report, 18 February 2008, Cut Flower Growing in Australia: A0112



Market Segment	Share
Wholesalers	70.0%
Supermarkets	15.0%
Other retailers	9.4%
Export markets	5.6%

- Wholesalers form the main market segment for this industry. They on-sell mainly to florists and supermarkets. These are estimated to account for around 70% of industry revenue.
- Sales directly to supermarkets account for an estimated 15% of industry revenue. This has been an increasing market segment, as large supermarket chains are increasingly sourcing products directly from growers to minimise costs.
- An estimated 5.6% of industry revenue is sourced from export markets. The level of exports depends on a range of factors, including world economic conditions, exchange rates and transport costs. However, the perishable nature of cut flowers and the long distance to major international markets restrict export opportunities.
- Other markets include florists and online retailers that purchase directly from growers.

An important aspect of the industry supply chain is the role of fresh produce market places such as the Sydney Flower Market and the National Flower Centre in Footscray (Victoria). In Brisbane there is a Christensen Flower Auction located in the Rocklea Flower Markets. At the Sydney Flower Market, stallholders are both cut flower producers and cut flower wholesalers. These represent a prominent supply mechanism, with differing relevance for different producers. In Sydney, florists readily source flowers from the market, which represents an opportunity to cut wholesalers out of the supply chain. In Melbourne, the markets are less important with a smaller proportion of florists sourcing their product at markets, usually on the basis that wholesalers have a better presented product.

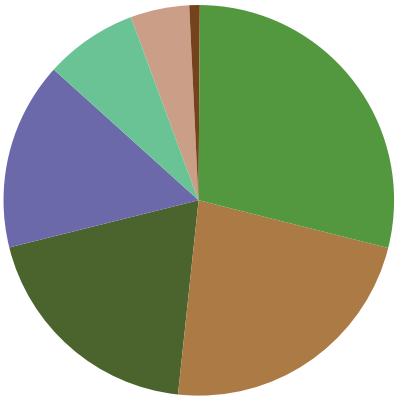
Industry Concentration

The level of industry concentration is low:

- The industry is mainly comprised of small enterprises and many farms are less than five hectares in area.
- Around 37% of establishments have an estimated value of agricultural operations (EVAO) of less than $50,000, and 23% have an EVAO of between $50,000 and $100,000. The proportion of small establishments in this industry has fallen, either by exiting the industry or increasing in size *(Source: ABS cat. 7121.0).*
- Low levels of industry concentration have been identified as a barrier to industry growth.

Geographic Spread. Year: 2007 Location of Establishments (percent)

Source: IBISWorld Industry Report, 18 February 2008, Cut Flower Growing in Australia: A0112



Region	Percentage
NSW	28.9
VIC	22.8
QLD	19.4
WA	15.6
SA	7.8
TAS	4.7
NT	0.8
ACT	0.0

The Australian Context

- The distribution of cut flower and seed growing establishments is shown above. This indicates that the industry is concentrated in Victoria, New South Wales and Queensland. There has been little variation in this concentration over the current period.
- Western Australia accounts for an estimated 22.2% of revenue in the Cut Flower Industry at grower level, but accounts for around half Australia's flower exports (in both volume and value). This is followed by Victoria and New South Wales. The proportion of establishments in WA has grown by around 2% over the current period.

Production Areas (Hectares) of Cut Flowers

Source: ABS. Note: Additional Source - The Australian Horticultural Statistics Handbook 2004

State	Percentage Production
ACT	0
NSW	12.0
NT	0.4
QLD	19.1
SA	8.6
TAS	1.6
VIC	35.7
WA	22.7

- According to the Australian Flower Export Council, Australia has at least ten geographic regions and varied climatic conditions which enables the production of a vast range of traditional, exotic and native flowers.
- The majority of traditional flowers are grown in Victoria, New South Wales, Queensland and Tasmania. Exotic flower production is concentrated in Queensland and the Northern Territory, whilst native flower growing is located in Western Australia, South Australia, Victoria, New South Wales and Queensland. There is increasing effort being made to promote native flower growing by Wildflowers Australia (National Body) in all states. Queensland has recently proposed a floriculture precinct around the new Traveston dam near Gympie.
- Within New South Wales, the traditional flower industry is based mainly in the Sydney region, extending through the Central to South Coast and west to the Blue Mountains. This is because the climate allows for year-round production.
- Native flower growers in NSW typically locate themselves along the coastal strip from the North Coast to the Far South Coast and Southern Tablelands region. They are also located further inland such as the Central West region. Most growers in this region produce exclusively for the international market, although there are others that produce for the domestic market as well *(Source: NSW Department of Primary Industries)*.
- Native flower growers in Queensland are situated mainly around the South East section of Queensland.

Market Characteristics

Market Size

IBISWorld expects that in 2007-08 the cut flower and flower seed growing industry will record (all figures in constant 2006-7 dollars):

- Revenue of $326 million, a 2.7% increase from the previous year. This represents around 0.6% of total agriculture, forestry and fishing sector revenue.
- Value added of $180.8 million, a 3.1% increase from the previous year.
- Domestic demand of $325.7 million.
- Total establishments of 735, operated by 588 enterprises.
- Total employment of approximately 2,839 staff and total wages and salaries of $107.9 million. This industry uses a large number of part-time employees.

Although the Cut Flower and Foliage Industry is in a growth phase of its life cycle, a high level of fragmentation has limited the rate of growth. However, further growth is expected over the outlook period due to potential high growth in demand from Asia. There are also opportunities for growth in per capita consumption of cut flowers domestically.

Domestic and International Markets Analysis

Domestic Market

Expenditure on cut flowers in Australia is low by world standards. Per capita consumption of cut flowers averages around $25 in Australia compared with $36 in the US and $61 in the Netherlands. Generally, this difference in per capita expenditure is attributed to amenity horticulture (that is, public parks and gardens), and the significance of home gardening. Purchases of cut flowers peak on holiday occasions, particularly Valentines Day, Mothers Day, and to a lesser extent Christmas. Commercial success in production of cut flowers depends on (amongst other things) being able to bring the product to the market during these peak periods.

Historically, the main end users of cut flower have been households where consumers will purchase flowers based on traditions, culture and lifestyle. While some people habitually purchase cut flowers, for the most part they are a luxury or gift purchase and often compete with products such as confectionery or alcohol for 'special occasion' purchases. Commercial use of floriculture products (such as flower displays in office foyers) has been growing. This segment is price sensitive and requires a product with consistent quality.

International Market

There are a number of factors which have limited Australia's performance as an exporter of cut flowers and flower seeds. One of these is the high degree of fragmentation in the industry. The domestic industry is characterised by a large number of producers, without sufficient scale to market their product overseas. Another factor is the lack of understanding of costs and returns by industry producers, which has led Australia to be a relatively high cost producer.

In 2004, the Rural Industries Research and Development Corporation published a study into benchmarking in the industry with the aim of improving profitability (Gerry Parlevliet, *Improving profit for the flower grower - a study using benchmarking*, August 2004, RIRDC Publication No 04/119 RIRDC Project No DAW-102A). Increased understanding of costs and efficiency in the industry could improve export potential.

In 2006-07, exports of cut flowers and foliage were valued at $15.22 million. The main destinations for these exports were Japan, USA and the Netherlands. The perishable nature of cut flowers has limited the extent of international trade, particularly as the Australian industry is distant from the major consumer markets in Japan, Europe and North America. The Netherlands is also a prominent destination, due to the presence of the world's largest cut flower markets, which accounts for around one seventh of world trade in cut flowers. It is estimated that exports will remain steady in 2007-08 at $15.2 million.

Export Destinations 2006-07

Source: ABS - Unpublished data

	Thousand Dollars Exports	Percent Total
Japan	6433.74	42.2%
USA	3673.20	24.1%
Netherlands	1579.82	10.4%
Germany	1037.53	6.8%
Canada	891.73	5.9%
Other	1613.84	10.6%

In 2006-07, imports of cut flowers and foliage were valued at $14.0 million. These imports were mainly sourced from Singapore, Kenya and the US. Imports from Kenya have been increasing in prominence over recent years. In 2004-05 it was the 5th most significant import origin; behind Singapore, the US, Netherlands and India. Since then the value of imports has grown at an annualised real rate of 12.2% over the past two years. Imports are expected to increase marginally in 2007-08 to $13.9 million. With the improvement of the Chinese economy, floriculture exports have increased to Australia over the last three years competing with Australian grown product.

Import Origins 2006-07

Source: ABS - Unpublished data

	Thousand Dollars Imports	Percent Total
Singapore	5917.85	42.3%
Kenya	1601.77	11.4%
USA	1221.56	8.7%
Thailand	1012.94	7.2%
China	751.37	5.4%
Other	3499.95	25.0%

Industry Conditions

Barriers to Entry

- There are some barriers to entry into this industry. However, even for small enterprises these are not insurmountable.
- There is a barrier into the segment of the industry that involves the gathering of native wildflowers and seed collecting from native species. This takes the form of the need to obtain a Government licence.
- Again in the case of native flowers there is a significant lag between planting and flower production. This can be as much as five years, but can be overcome by planting in conjunction with faster flowering species.
- Economies of scale are important in the modern industry, which requires relatively high fixed costs on infrastructure. However, this is not a significant barrier to entry, although it may be a deterrent.
- Necessary inputs are readily available. Often entry is via some other agricultural activity, or is complementary to some other activity.
- Although purchasing land outright is a high cost, leased property is available at rates which are not prohibitive to flower growers.
- Low barriers to entry has been cited by industry participants as a factor which undermines profitability within the industry.

International Context

This study tour provided Shannon with an opportunity to gain first hand experience in sustainable production technologies for the Cut Flower Industry. It allowed Shannon to visit Israel, Spain and the Netherlands to assess specific areas of interest:

- Design and application of new water efficient technologies (in-ground and hydroponic)
- Identification and evaluation of automated greenhouse systems
- Energy savings from advanced ICT climate control systems
- Methods of collection, disinfestation, recycling and reuse of run-off water
- Information on improvements to labour and input efficiencies
- Methods of improving product yield and quality from such technology
- Improvements in workplace health and safety available from the application of automated systems and labour saving devices.

Tour Itinerary

Israel

- HaBesor Research and Development Farm
  Tour by Eli Matan, Director of the farm
- Netafim at Hatzerim Kibbutz
  Production factory tour by Itzik Inbar, Export Department
- Netafim at Kibbutz Magal
  Met with Netafim Crop Technology Division
- Leaf-Sen in Tel Aviv
  Met with Professor Ben-Ami Bravdo, PhD, Professor of Horticulture and Viticulture, Hebrew University of Jerusalem and Avner Frank, Managing Director of Leaf-Sen.
- Mazor Kfar Hess
  Travelled to the farm Mazor Kfar Hess and viewed Leaf-Sen in use. It is being trialled to irrigate roses.
- Israel Ministry of Agriculture (MOAG)
  Dr Jorge Tarchitzky PhD, Director of Irrigation and Soil Division
  Elisha Kenig MSc, State Extension Specialist for Irrigation Technology
  Abi-Bar Yosef, Director of Floriculture Department
  Duby Wolfsen, Senior Extension Officer
- Cohen Propagation Nursery
- Straschnow Rose Farm
  Met with Yinon and Ester Straschnow
- Afikey Emek Hefer Association
  Met with Tamar Lahav, Floriculture Extension Specialist, MOAG
  Tour by Miriam Bialik, re water management in Hefer Valley
- Visited growers of ‘Australian native’ plants in ground, Hefer Valley
- Milchan Brothers Ltd.
  Yitzak (Isaac) Shor, Agricultural Department. Discussion on post harvest treatment of roses. Accompanied by Yoram Eisenstadt and Ronny Scheyer, Floriculture Extension Specialists, MOAG.

International Context

- Ziv Roses, rose farm at Moshav Hayogev
  Met with Dov Ziv
- Eitan Bar Hadas Rose Farm at Moshav Magen Shaul

Spain

- Selecta
  Richard Buis, Area Manager
- Sierra Flor S.L.
- Elig Flor
  Tour by Rafael Obiol Navarro
- S.A.T. Los Ritas
  Met with Jose M.y Angel

The Netherlands

- FloraHolland Dutch Flower Auctions
  Accompanied by Peter Wester from Schreurs Gerberas and Roses
- Schreurs Gerberas and Roses
  Tour by Peter Wester and Lisette Nieuwendijk, Export Sales Support
- Metazet Demonstration Nursery in Honselersdijk
- Met with a Rijk Zwaan representative in the Westlands. Inspected grower of capsicums.
- Greenhouse Improvement Centre in Bleiswijk
  Trials they are doing at the moment are:
  – trying to get over 100 kg tomatoes per m^2,
  – combination of fish and tomato production, growing tomatoes in waste water from fish
  – trials with clear and diffuse light in tomatoes
- Visited a hydroponic lettuce grower in Barendrecht
- Rijk Zwaan demonstration greenhouse in Steenbergen
- Belgium National Research Centre for Strawberries
  Met Christien Sauviller in Merle (Belgium). Included tomatoes under lights and capsicums.
- Training at PTC+ in Ede
- Horti Fair NTV
- Penning Freesias in Honselersdijk
  Penning utilises a unique ‘ground-loop’ system to both heat and cool root-zones).
- Matazet Demonstration Nursery
- Flamingo van Der Meer in Monster
  This company trades in refurbished second-hand technology for greenhouse projects (this is essentially a large greenhouse ‘supermarket’).
- Private tour of Priva – visited ‘tomato’ enterprise

International Context

Israel

Israel has a total area of 2,700 hectares of land for flower and pot plant production. 1,700 hectares is for protected cropping and 1,000 hectares for open (in-ground) production. The value of this production is Euro 205 million from 1,100 properties *(International statistics flowers and plants, 2007).*

HaBesor Research Station http://www.mopdarom.org.il

Shannon undertook a tour of the research station by the Director, Eli Matan.

The research station is situated in the south west of Israel about 45 minutes drive from Be'er Sheba. The Kibbutz is situated in the Negev desert with an annual rainfall of just 200mm.

The R and D facility is funded from three sources:

- The Jewish agency
- Government funding
- Levies placed on growers

The main source of water is from the Jordan River which is very high in Sodium Chloride (200ppm).

The main role of the R and D facility is to develop new crops. This involves determining the best method of production by identifying the irrigation, nutrient requirements and canopy management of the crop before the grower is involved. These trials can take up to three years.

Until recently all crops were grown in the soil, but due to the phase-out of methyl bromide in 2005 growers are moving across to hydroponic production. Methyl bromide was used as a broad based soil fumigant, but nematodes returned fairly quickly. There is a resistance to change because growers are used to in-ground production.

Trials conducted at the research station have seen a reduction of up to 50% in water use and 70% in chemical fertiliser use when hydroponic production is used over ground grown crops *(Source: Eli Matan, M. Sc. Agr. Director R and D Western Negev Network, Israel).*

Re-use of waste water from hydroponic production is limited, because of the high level of sodium chloride in the water supply. It was indicated that the waste water could be used on other in-ground crops.

The main substrate used was a volcanic ash called 'tuff', although hydroponic trials are carried out using perlite, because it does not react with the nutrient solution.

The use of 'Australian native' plants in Israel was discussed. The two main crops grown were Geraldton wax and grevillea spp.

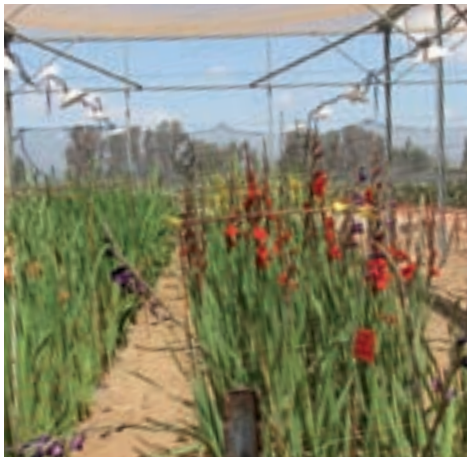
Flowering of Geraldton wax was controlled by inducing short day length of early season varieties with crops being brought on 4-5 weeks earlier than normal. This increases the season for product and can also lead to an increase in price for early seasonal product. Approximately 70 million stems of Geraldton wax are sent to the European Market each year *(Source: Eli Matan, M. Sc. Agr. Director R and D Western Negev Network, Israel).*

International Context

Greenhouse structures for trials

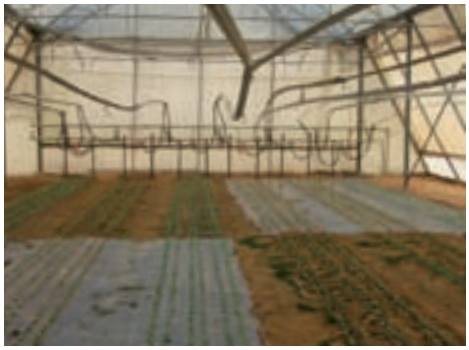
Trials of in ground crops

Eli Matan with progress results of crop trials



In ground trial, gladioli area

Nursery trials, pelargonium



Plastic used to reduce fungal diseases during plant establishment

Netafim at Hatzerim Kibbutz

Netafim Israel: http://www.netafim.com/ Netafim Australia: http://www.netafim.com.au/

Shannon was given a tour of the Netafim factory and 'Drip Training Centre' by Itzik Inbar, Netafim Export Department. Netafim's goal is to provide solutions to problems and provide information on growing systems.

The visit to the Netafim production factory included a tour of the emitter production area and pipe manufacturing plant. No photographs were allowed in this facility.

International Context

Netafim's Technology Training Centre at Kibbutz Hatzerim

This training centre takes one on a journey through the history of drip irrigation and provides a vivid introduction to Netafim's products, with the emphasis on making the perfect match between them and each culture and growing method.

The following information provides background material regarding the development of drip technology at the Kibbutz *(Source: http://www.netafim.com/netafim-history).*

> *"It took an Israeli water engineer Simcha Blass to revolutionise irrigation. Simcha Blass noticed a hedge with one shrub noticeably healthier and taller than the others. Digging below the apparently dry surface of the soil, he discovered why: water from a leaking coupling was causing a small wet area on the surface, while an expanding onion shaped area of underground water was reaching the roots of this particular tree – and not the others. The drip irrigation concept was born and experiments that followed led Blass to create an irrigation device that used friction and water pressure loss to leak drops of water at regular intervals. Recognising the high potential of his discovery, he began to look for ways to turn his idea into a product."*
>
> *"For the desert-based Kibbutz Hatzerim looking to expand its activities beyond agriculture, Simcha Blass's invention opened up a world of possibilities - the kibbutz could go into manufacturing yet still keep its traditional links with agriculture and irrigation. Blass and Kibbutz Hatzerim signed a contract and 1965 saw Netafim's first production facility erected among the kibbutz fields."*

Irrigation Agro-Technology, Research and Training Park at Kibbutz Magal

Focus: on permanent display – irrigation products, peripheral equipment, work stations, greenhouses and small holdings.

International Context

The visit to the Netafim Research and Training Park involved several meetings and site visits.

Omry Eiger, Engineer, Greenhouse Division

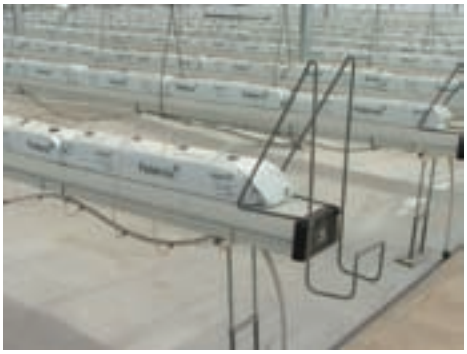
Presentation on greenhouse technology and areas where Netafim are working in the world.

Yaron Katina, Crop Management Technologies, Technical and Services Support

Presentation on crop monitoring and management systems supplied by Netafim.

Moshe Lawrence, Greenhouse Division

Tour of demonstration greenhouse area with explanation of the different types of greenhouse construction and crop management systems for different climatic locations.



Netafim Greenhouse Park, Magal

Netafim Greenhouse Park, Magal

Netafim Greenhouse Park rose trial area

Leaf-Sen Irrigation Systems www.leafsen.com

Shannon met with Avner Frank, Managing Director of Leaf-Sen and Professor Ben-Ami Bravdo, to discuss the Leaf-Sen unit. Leaf-Sen Irrigation Systems Limited has developed an innovative irrigation controller, triggered by a unique leaf-thickness-sensor that accurately and continuously assesses leaf turgor. This information is monitored and processed by the irrigation controller, and translated into an irrigation regime that applies water as a real time reaction to incipient water stress. A significant difference in the Leaf-Sen product, as opposed to other irrigation control systems, which at best utilise sensors that are able to sense variables external to the plant, is the use of the leaf thickness sensor. External indicators provide only delayed, indirect estimates of plant water status. Using real time information from the plant ensures a rapid response to incipient stress. The control module is designed to connect to existing standard irrigation controllers, and impose upon them the Leaf-Sen irrigation regime.

A site visit was organised to a farm that uses Leaf-Sen technology to enable observation of Leaf-Sen 'on the ground'. Mazor Kfar Hess, a foliage and leaf specialist grows Aralia as a leaf crop for the European market. The main method of transport is by container, but high quality product is delivered by airfreight.

Shannon discussed the advantages of using Leaf-Sen as an irrigation tool with owner Oren Mazor. Oren indicated a reduction of 50% in water use and 65% reduction in fertiliser use since the introduction of the Leaf-Sen controlling unit. There has also been a marked improvement in the quality of the crop by the reduction of moisture in the ground and humidity around the leaves.

Leaf-Sen controller box with solar cell charging unit

International Context

Leaf-Sen sensor on Aralia leaf

Aralia grown under 90% knitted black shade cloth

Aralia leaf sorted and graded. The workers are Thailand guest workers

Aralia grading chart

Israel Ministry of Agriculture (MOAG)

Shannon met with Dr Jorge Tarchitzky PhD, Director of Irrigation and Soil Division and Elisha Kenig MSc, State Extension Specialist for Irrigation Technology. Discussion took place regarding how the adoption of new technology had improved the efficiency and productivity of flower farms in Israel.

Shannon then met Abi-Bar Yosef, Director of the Floriculture Department, and had general discussions on flowers grown in Israel. Discussion included how the area of roses grown in Israel had decreased by 60% over the last five years because of competition with roses grown in Africa. It is estimated that there has been a reduction in land producing roses from 120 hectares to 60-70 hectares (40-50%). Africa can grow and export roses to the European economic community at a lower cost than the roses grown in Israel. The amount of roses exported out of Israel is approximately 45 million stems per year to the European market.

The Government, through the Ministry of Agriculture (MOAG), supports the Floriculture Industry in Israel by providing extension officers and ongoing R and D support.

The quality of 'Australian native' plants that are grown in Israel and the areas in which they are grown was also discussed. Shannon has sent information to Israel on new varietal types that are available in Australia.

International Context

Cohen Propagation Nursery Kfar Hanagid, Israel

Nir Chen Greenhouse

Nir Chen is an area consisting of ten greenhouses, covering an area of 63,000sqm (6.3 hectares). The annual rainfall is 200mm.

Shannon talked with a senior agronomist at the Cohen Nursery about reuse of waste water from the nursery.

Water is obtained from three sources:

- Rainwater is collected from roofs of growing structures and stored in a dam that is lined and covered to stop evaporation. There is capacity to store 7,000 cubic metres of water.
- Fresh water from Mekorot's national water system. This is problematic in so far that the water can vary in Ec (electrical conductivity) from 0.6 to 1.4 mS/cm during a 24 hour period. Ec is the measurement of total dissolved salts in solution.
- Wastewater is collected from growing structures and mixed with fresh water to give an Ec of 0.5. It is treated by injecting sodium hypochlorite (NaOCl) directly into the line; the chlorine level is monitored at 2%. This gives an effective level of chlorination. When asked why other forms of water treatment was not used ie ultraviolet light, the response was that this was determined by issues of reliability and cost. When the water is used from the Merkorot national water system it is treated first by passing through a reverse osmosis system to reduce sodium chloride levels then mixed with waste water collected from the nursery and then treated by injecting sodium hypochlorite.

International Context

Cutting material propagation area

Mixing tanks dam water and waste water from the nursery

Reverse osmosis equipment

Reverse osmosis equipment

Straschnow Rose Farm Nar Banim, Israel. Owners Yinon and Ester Straschnow

Yinon and Ester Straschnow run a rose and gerbera farm in Israel. They cultivate 14,000 sqm of roses at 5.6 rose plants/sqm and 1,000sqm of gerberas at 7 plants/sqm.

Up until recently they used a locally produced substrate called 'tuff', a volcanic ash produced in Israel. It was indicated that they have moved production over to a cocoa peat substrate. The reason for this move was the ban on methyl bromide as a fumigant. Tuff is a multi cycle substrate, but needs disinfestation between cycles. The Straschnows have found that cocoa peat is better than tuff as a substrate. The roses and gerberas establish at a faster rate than when planted in tuff.

The water supply is from the national water system. The Ec can be as high as 1.2 with a pH of 7.5. Another source of water is the desalinisation of sea water. The Ec is better at 0.3 with a pH of 7. The water source has to be monitored, because it can change from desalinated water to dam water during the day.

The Straschnows have added an irrigation computer system that monitors the Ec and pH of the source water and adjusts the nutrient feed accordingly. They allow 40-50% runoff from irrigation cycles to keep the level of sodium chloride low in substrate.

Waste water from the greenhouses is not re-used back in the system because of the high sodium chloride level. Waste water is used to irrigate vegetable crops such as parsley, dill, coriander, tomato, cabbage, solidago and eustoma.

International Context

In most cases the concentration of the nutrients (mainly NPK) is high for the crops in the soil so it is diluted with fresh water. Because of high summer temperatures, pad and fan cooling systems are used with thermal screens to reduce the temperatures in the cropping areas. Waste nutrient solution instead of water is used in the pads to aid cooling.

Rose packing shed with Thailand guest workers

Roses grown under thermal screens

Bunched roses ready for local market

Rose growing beds covered to reduce weeds.

Straschnow Farm Greenhouse structures

Pad and fan cooling system

Sodium hyperchlorite treatment

Lettuce seedlings for in ground production

In ground celery irrigated with waste water from rose farm

Harvested celery

Afikey Emek Hefer Association

Shannon then travelled by train north to Hadera and was met by Tamar Lahav, Floriculture Extension Specialist, MOAG.

Shannon first visited the Afikey Emek Hefer Association Water Management Project in Hefer Valley. He was shown around the facility by Miriam Bialik.

The region covers a total area of 13,000 hectares. The total agricultural land of Hefer Valley is 8,000 hectares. The agricultural land of those who participated in the modernisation project is 6,500 hectares of which 4,500 hectares is irrigated land. In 1984 most of the land

Tertiary treatment of water

Tertiary treatment of water

was irrigated with fresh water. Gradually the fresh water was replaced with reclaimed water as part of the modernisation process. In 2002, 75% of the land was irrigated with reclaimed water. Secondary treated sewage is pumped from the township of Netanya to the Hefer treatment plant so that it can be further treated and then pumped for use in horticulture in the Hefer Valley. 25 million cubic metres of waste water is treated at the plant each year. In addition, tertiary treated sewage is mixed with water from the Alexander River, a source that collects the runoff from the Samarian Mountains.

Hefer Association Water Management Facility

Growers Gilad Calve, Jacob Iahav and Ilan Lamdany

Shannon then visited growers Gilad Calve and Jacob Iahav at Kefar Cholga. He observed sorting of crop for the European market with 'Kalikarpa gerald' leaves being stripped and stems sent with fruit on. This crop is produced once a year.

Shannon then travelled to Kefar Chaim where he met with grower Ilan Lamdany. Shannon inspected rice flower, Geraldton wax, Leucadendron 'safari sunset', grevillea 'misty pink' 'misty red' and 'Ivanhoe' for foliage. Grevillea spp had been grafted onto grevillea robusta (silky oak) to improve disease and nematode resistance. Nematodes and soil borne diseases are similar problems faced within the Australian industry.

Water application processes involved above ground dripper systems. The amount of water applied was determined by the evapo-transpiration rate of area. The wax flower had 2.5 litres per plant per day applied, at a rate of 6 to 7 cubic metres per dunam (1,000sqm) and Leucodendron was irrigated at 3 cubic metres per dunam.

International Context

The following table outlines growing ratios. Plantings are denser than in Australia with row widths of 2 metres and 1 metre between plants in row.

	Distance between Rows (meters)	Distance between Plants (meters)	Water quantity per day. Cubic meters/dunam (1Kl /1,000sqm)
Wax flower	2	1	2.5
Rice flower	1.5	1	2
Leucadendron safari sunset	2	1	3
Grevillea spp	2.5	1	1

Grevillea ‘spiderman’ suffers from distorted growth to new tips and flowers poorly. Growers are looking for new varieties to trial in Israel.

Below is a table that shows the ‘Australian native plants’ grown in Israel.

	Leucodendron	Wax flower	Grevillea	Protea	Kangaroo paw
Area under Production (dunam)	2200 dunam (220 Hectares)	2500 dunam (250 Hectares)	600 dunam (60 Hectares)	100 dunam (10 Hectares)	130 dunam (13 Hectares undercover)
Amount harvested (stems)	22,000,000	80,000,000	12,000,000	20 – 30,000	15,000,00
Post harvest treatment	Bacteriozid (tog3) + sugar	Bacteriozid (tog3) + sugar	Bacteriozid (tog3) + sugar	Bacteriozid (tog3) + sugar	Bacteriozid (tog3) + sugar
Markets	Europe and the USA	Local market and Europe	Local market and Europe	Local market and Europe	Local market and Europe
Transport	Sea (containers)	Sea and air	Mostly air	Air	Air
Size of bunches	Stems/bunch	Stems/bunch and weight	Stems/bunch	Stems/bunch	Stems/bunch
Stems/ bunch	5 and 10	5	5	5	5 and 10
Region	Golan, Galilee and Central region	Central, Lachish in the south	Galilee, Central and Negev	Golan, Galilee and high mountains	Central Lachish and Negev

International Context

Milchan Brothers Ltd www.tog4flowers.com

Shannon met with Yitzhak (Isaac) Shor, an agronomist from Milchan Brothers Ltd.

Flower treatment and products supplied by Milchan Brothers for cut flowers were discussed. Information was obtained regarding a new product not yet released to market, that increases head size and stem length of roses during the warmer months of the year. This product may have a place in the crop management system of roses in the warmer growing areas of Australia.

Shannon discussed the rose industry in Israel and compared it to Australia. All roses grown in Australia are grown for the domestic market whereas in Israel they are grown for export. Shannon also discussed the difference in climate between Israel and Australia.

Ziv Roses

Shannon then met with Dov Ziv of Ziv Roses at Moshav Hayogev. Ziv gave Shannon a tour of the rose farm. The farm has growing structures that cover 1.8 hectares and has 130,000 rose plants in production.

Ziv does reuse waste water from the production area, but has to be very careful about levels of sodium chloride in nutrient solution. Waste water is treated with sodium hyperchlorite to remove any pathogens from solution.

These photos show sodium chloride toxicity on the leaves of the rose plants. The nutrient has to be managed very carefully to prevent this from happening. This is one reason that many rose growers in Israel do not reuse waste nutrient solution on roses.

Yoram Eisenstadt with fertiliser injection equipment

Rose plants with fan and pad ventilation system

Rose leaves showing salt toxicity

Rose plants showing heating systems

Waste water pond

Sodium hyperchlorite injection system

Eitan Bar Hadas Rose Farm

The next place visited was Eitan Bar Hadas Rose Farm at Moshav Magen Shaul. The farm covers 1.5 hectare and has about 105,000 plants in production. As with other rose production the quality of the water from the town water supply varies so Eitan collects all the rain water for use on the farm. This water is mixed with the town water to reduce the Ec (electrical conductivity) to a manageable level.

Rose buds with webbed protection for transport

Rose buds with webbed protection for transport

Rose production area

Rainwater collected from growing structures

Fertigation equipment

Roses grown in coir peat substrate

Spain

Spain has a total area of 6,140 hectares of land for flower and pot plant production. 2,456 hectares is for protected cropping and 3,684 hectares for open (in ground) production. The value of this production is Euro 1757 million from 5,454 properties.[1]

Richard Buis, Area Manager of Selecta Spain introduced the Fellow to three flower growers in the Alicante region of Spain. Buis acted as an interpreter during the visits to all farms. All the farms visited used automated irrigation systems with nutrients being injected into the irrigation systems.

Sierra Flor S.L.

The first flower farm visited was Sierra Flor S.L, Calle Mar 1 3195 El Altet (Alicante). The farm is three hectares in size (one hectare not in production) with the main crops being anthurium and gerberas. The annual rainfall for the region is 200mm. The water source is either (a) sub surface or (b) water from the central Spain that is moved down to the south through canals. Both of these water sources have high sodium chloride levels and any waste water is not reused in the crop. This farm is investigating the use of waste water from flower production on in ground crops.

The one hectare that is not in production had roses in it. However, because of competition from South America and Africa it has become uneconomic to grow roses. This area will be planted up with gerbera and anthurium. The crops are grown in a perlite substrate.

The growing sheds are heated by natural gas in winter to increase production. Pad and fan cooling systems and thermal screens are used to reduce summer temperatures in the cropping areas.

Protected cropping area

Water storage for heating system

Anthurium in coir peat beds using polystyrene boxes.

Gerberas with thermal screens

Production area ready for planting showing gas heating system

Elig Flor

The next site Shannon visited was Elig Flor. A tour of the farm was offered by Rafael Obiol Navarro. Elig Flor is 6.5 hectares in size with an annual production of 6.5 million roses. Navarro indicated that the amount of roses under production in Alicante were being reduced and moved to Catahana at an elevation of 700 metres. The climate gave a better quality to help compete with African and South American imports into the European Economic Community.

Water sources were the same as the previous farm visited. If well water is used it is processed through reverse osmosis to remove excess salts and then added to water from the town.

Waste water from the flower production area is used to water palms and lawns around the production area. No waste water is reused on the crop. Pad and fan cooling is used to keep crops cool in summer. Because of the width of the sheds some problems occur with the anthurium due to poor ventilation in the middle of the sheds. It was suggested that extra air movement fans be installed to aid in air movement.

There is no Government legislation in Spain on re-use or disposal of waste water from the flower production area. This has led to an increase of nutrients in the water table.

International Context

Growing sheds

Roses with sticky traps for thrip control

Anthurium grown in perlite substrate

Anthurium with solar screens to reduce light and temperature

Anthurium for leaf as foliage

Anthurium flowers

S.A.T. Los Ritas Calle Matamoros 9, 03190 Pilar de la Horadada (Alicante)

Shannon met with Jose M.y Angel. This farm has 12 hectares of greenhouses growing anthurium, roses, gerbera, gypsophila and gladioli. S.A.T. Los Ritas is the largest flower grower in Spain. The farm sells locally to small wholesalers and local florists as well as transporting product into Europe.

The water for this farm comes from three sources:

- Rainwater collected from rooftops of growing sheds
- Water from central Spain
- Water from wells on the property

Reverse osmosis is used to remove excess salts from well water and the water from central Spain. They are moving out of roses, because they cannot compete with the imported roses from Central America and Africa. Half of the farm is still planted in the ground. The removal of methyl bromide as a soil sterilant is a problem. They rotate crops to reduce the problems with soil pathogens.

The ground is solar heat treated prior to planting a new crop by adding cow manure to moisten the soil, then covering with clear plastic for one to two months. The sheds are closed and the soil is left to 'cook'.

Soil moisture sensors are used to vary irrigation times for crops. Waste water from the hydroponic system is not reused because of the problems with sodium chloride and pathogens. As already mentioned, there is no Government requirement to re-use waste water.

Roses

Anthurium

Ventilation fan (pad and fan cooling)

Dam for storing water off shed rooftops

In ground gerbera production

Rose production area using thermal screens for cooling

Gerberas

Perlite beds ready for planting gladioli

The Netherlands

The Netherlands has a total area of 8,149 hectares of land for flower and pot plant production. 5,365 hectares is for protected cropping and 2784 hectares for open (in-ground) production. The value of this production is Eur 3890 million from 6,807 properties.[1]

FloraHolland Dutch Flower Auctions

Shannon visited the FloraHolland Dutch Flower Auctions, accompanied by Peter Wester from Schreurs Gerberas and Roses.

The auction has always owed its strong position to the clock. This method of selling is known as the 'Dutch auction'. A very wide and deep assortment of flowers and plants is available through the FloraHolland auction clocks on a daily basis. Every day, 39 auction clocks are in operation at FloraHolland centres. This means 125,000 auction transactions occur every day. In other words, 12 billion cut flowers and over half a million plants a year.

FloraHolland offers dealers sophisticated facilities for online buying, such as 'remote buying' (KOA). With the help of services such as remote buying, FloraHolland is able to attract an increasing number of (international) buyers to the auction. The stronger the 'purchasing power', the more attractive it is for growers to trade their products through FloraHolland.

View of auction clock (roses)

View of flower buyers

International Context

Auction trolleys

Auction trolleys and clock

Roses in buckets

Rose variety vase life trials at auction

Schreurs Gerberas and Roses

Shannon then undertook a visit to Schreurs Gerberas and Roses. The Fellow had already met with Peter Wester, and was introduced to Lisette Nieuwendijk from Export Sales Support. Shannon was able to see where Schreurs' new varieties of roses and gerberas are trialled. Shannon observed the aids used in harvesting both roses and gerberas. A trolley system is set up for each row so harvested product can be pushed in front of the worker. This allows the person harvesting the crop to use both hands while picking. The nutrient tanks are placed inside glass houses to keep warm during winter.

Rose variety trial

Roses in rockwool cube and slab

International Context

Roses under growing lights

Gerbera's being harvested

Trolley with bunched gerberas

Gerberas in trolley

Susan Shannon with Peter Wester and Lisette Nieuwendijk

Roses using 'Dutch' bending method for canopy management

International Context

PTC+ (Practical Training Centre) Ede

The PTC+ is a well developed training centre for the horticultural sector in the Netherlands. They also provide training opportunities for other countries. While Shannon was there, Korean students were also participating in training courses.

The instructors for the course were Ben van Onna, Jules Pattiapon and Herman Eijkelboom from Greenhouse Consultancy, Wageningen.

PTC+ has training facilities that include classrooms connected to protected cropping areas (glass houses) for trials. This allows the training facility to immediately put the theory learnt into practice. The course is aimed at greenhouse consultants and managers.

The Australian Protected Cropping Industry needs a National Protected Cropping training facility like this to provide the same information to managers and consultants so the industry can grow in Australia. The facility, if developed in Australia, would be able to provide:

- Centralised training facilities that can deliver industry specific training.
- Dedicated research and development facilities where new technology can be tested. These R and D capabilities can be linked to research being done in other states.
- Demonstration facilities for companies to introduce and evaluate new technology.
- Demonstrations of new crop management and production systems to Australian growers.
- Assistance to develop business plans for specific crops.
- Demonstrations of new energy and water efficiency techniques.
- Further development of biological control techniques for insect pests and to develop spray management systems for use in greenhouse production.

Ben van Onna discussing ventilation systems

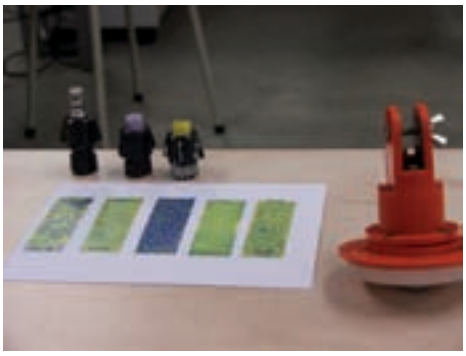
Greenhouse trial area at PTC+

International Context

Post harvest quality inspection of roses

One of eight glasshouse bays used for plant trials and training

Boom spray calibration



Spray droplet size trials

Horti Fair NTV Amsterdam RAI Exhibition Complex

This Expo is the worlds largest in the Protected Cropping Industry and showcases the latest (existing, new and emerging) technologies. The 2007 Horti Fair showcased almost 1,000 exhibitors from 51 countries occupying the entire 90,000 square metres of the Amsterdam RAI exhibition complex.

The exhibition was segmented into four sections that provided an accurate reflection of horticulture:

- Production
- Technology
- Supplies
- Trade/services

'Focus on water and energy' was the thought provoking theme of the fair. This theme is important for all cut flower producers, especially in Australia, because of the drought and increasing energy costs. The added benefits of the fair were the increased efficiency and improvements in the quality of horticultural products and services on display throughout the exhibition.

Shannon visited the Horti Fair over two days, the first day was to get a general overview of the products and services available. The second day was to visit the exhibitors of most interest.

International Context

Flower display Horti Fair

Gerbera grading and bunching machine

Schruers rose ball

Transport Trolley used on heating pipes

Glasshouse roof washing machine

Trolley elevated working platform used on heating pipes

Crop spray equipment

Bercomex bunching machine

Flower and Vegetable Glasshouse Producers

Shannon visited several flower and vegetable glasshouse producers and noticed that there were two main methods of treating waste nutrient solution:

- Heat treatment of the waste water. Because boilers are used to provide heat and CO_2 to the crop, there is an availability of heat to treat the waste nutrient solution.
- The most common method of treatment used by growers is currently ultraviolet radiation. The growers that used this method were very happy with the results.

Co-energy generation of power using natural gas was used by growers to provide heat, power and carbon dioxide (CO_2) to their businesses. Any extra power capacity was sold back to the grid to provide an extra income stream for the business. The CO_2 produced by the generation of power and heat was pumped back into the glasshouses to increase productivity. Maximum level of CO_2 injection into the glasshouse was at a rate of 1,500ppm.

The use of a 'ground loop' system used at Penning Freesias was also explored. This 3.7 hectare farm grows and breeds new varieties and has developed 30 new varieties over the last 30 years. Their aim is to develop two to three new varieties per year.

The ground loop system was installed a to both heat and cool the crop using two adjoining bores via a heat exchanger. One bore stores warm water and the other bore stores cool water. Shannon observed the addition of polystyrene beads to the growing beds to improve cooling in summer and heating in winter.

Freesias grown in soil with polystyrene beads to assist heating and cooling

Supplemental lighting

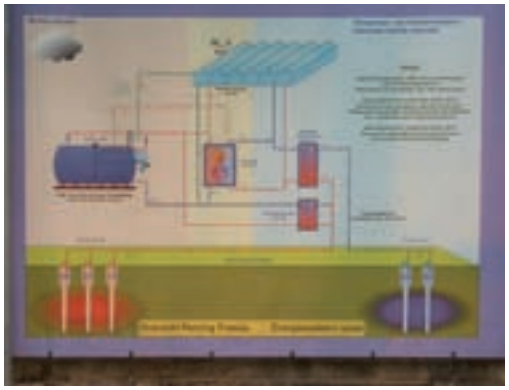


Diagram of 'ground 'loop' heating and cooling system

Freesia (Shannon)

Matazet Demonstration Nursery

At the Matazet Demonstration Nursery (no photos allowed) new production systems are designed and trialled for growers. These include various systems to improve harvesting, internal transport systems, plant lighting and cultivation techniques. Other labour saving systems observed included harvesting carts, climate control systems, hanging gutters, suspended chain rails, tube rail supports and travelling wire mesh benches. They had a travelling rose gutter system whereby the rose plants moved to the worker but this was not in operation at the time.

Flamingo Van Der Meer http://www.hortimat.com/

Flamingo van Der Meer has an area of more than 5000sqm of used horticultural materials and machinery. They deliver and install reconditioned equipment worldwide.

Tour Outcomes

Australia has a total area of 200 hectares of land for flower and pot plant production (protected cropping). The value of this production is estimated to be Euro 335 million (A$469M) from 3,046 properties.[1] These figures are from 1995/96. There needs to be an extensive survey conducted of the Cut Flower and Foliage Industry in Australia to determine the total area under cultivation and the Floriculture Industry's net worth to the Australian economy today.

The Floriculture Industry is technology driven. When travelling overseas one can observe a lot of new and emerging technologies and examples of how other growers tackle similar problems.

Climatic growing conditions in Australia vary greatly between states and Shannon believes that most growers in Australia do not fully comprehend the growing basics. He believes growers should concentrate on these basics and then apply technologies from overseas that will improve production, quality and efficiency in their business.

Growers are looking for information that can assist them in improving production. Growers should seek out the best climatic conditions that suit the growing conditions of the crop, or seek to grow crops which will cope well in their climatic conditions.

Shannon was fortunate to have a wide variety of experiences in a relatively short time frame in the three countries visited.

As established previously, the trip's main focus was to meet skill deficiencies in greenhouse management techniques, water management and labour efficiency.

In Israel and Spain all hydroponic crops observed were grown on the ground and predominantly in plastic tunnels. This changed in the Netherlands with crops grown in raised beds to increase efficiency in harvesting. The Netherlands were the leaders in using the latest technology.

The water quality varied greatly between countries, with Israel and Spain experiencing very poor water quality with high sodium chloride levels. Most growers used reverse osmosis machines to improve water quality and sodium hyperchlorite as a means of removing pathogens from the water supply. Where possible rain water was also collected and used.

Except for the Cohen Propagation Nursery, waste water from the system was not reused again, because of the high sodium chloride levels and subsequent crop problems that would arise if used.

In Israel, the waste water from sewage treatment plants was reused in agriculture as seen at the Hefer Association Water Management Facility. Waste water from Netanya is treated and then reused for agriculture in the Hefer Valley.

Pad and fan cooling systems and thermal screens are utilised to reduce the temperature in the greenhouse structures during the summer months.

The method of crop management and harvesting in Israel and Spain was very similar to Australia. Obtaining a skilled workforce in both countries was difficult. In Israel most horticultural workers used in the Cut Flower Industry were from Thailand. These workers had obtained a four year work visa to work in Israel. In Spain most of the flower workers were from Morocco.

In the Netherlands there was not a problem with the availability and quality of water. The most common treatment of water to remove pathogens was the use of ultraviolet light. Some businesses used heat treatment to remove pathogens. Waste runoff from the crop was reused on all farms (in accordance with Government legislation).

All crops were grown in glasshouses with a minimum gutter height of five to six metres; the minimum size of each property is usually four to six hectares. Shannon had discussions with two tomato growers at the Horti Fair whose glasshouse production was approximately 40 hectares.

The latest technology was used to maximise the crop output. This meant the use of internal lights to increase the day length to 18 hours. Thermal screens and heating systems were also used to increase crop yield during the winter months and involved the injection of CO_2 to improve crop growth.

Maximum use is made of mechanical equipment ie overhead trolleys, raised platforms and flower carts to reduce the number of workers required to harvest and maintain the crop. On the farms visited most of the workers were under contract.

Extensive use of biological control (integrated pest management) techniques were used to reduce the amount of spraying required.

Final observations:

- The visits to flower and vegetable growers, the Horti Fair (NTV) and the PTC+ training centre were unique experiences.
- Horti Fair is the world's largest expo in the Protected Cropping Industry and showcases the latest (existing, new and emerging) technologies. Shannon would recommend that all growers who have a chance to visit this expo do so. He has recommended that the Flower Association of Queensland investigate organising a tour to the Horti Fair in 2008 for their members.
- PTC+ (Practical Training Centre, Ede) was an intensive five day training course in greenhouse environmental management, irrigation and fertigation management, plant physiology, post harvest management, substrates and crop protection. On completion of the course Shannon was presented with a certificate: 'Advanced Greenhouse Management Course for Australian Greenhouse Growers'.
- The most valuable outcome was meeting industry and Government representatives in each country. These contacts will help the Fellow with information in the future and assist in improving the flow of information regarding new technology and production systems to growers in Australia.

Knowledge Transfer: Applying the Outcomes

Key Activities

- Shannon has already arranged articles for the Australian Flower Industry (AFI) magazine from a rose grower in Israel and from a integrated pest management company called Biobest NV.
- Shannon was invited to the NSW Wildflower Conference in Sydney on the 22nd and 23rd of February 2008 to give a presentation on 'Growing Australian Natives in Israel' and gave a similar presentation to the Flower Association of Queensland's Native Flower seminar in June 2008.
- Through the Flower Association of Queensland, Herman Eijkelboom from PTC+ was invited to provide a one day seminar on rose and gerbera production at Floranda Flowers on the 28th February 2008.
- In Israel, the contacts made within the Israel Ministry of Agriculture, Leaf-Sen P/L and Netafim will provide a wide source of information for Shannon and other growers in Australia. Four Leaf-Sen units have been purchased by the Flower Association of Queensland to trial in the protected cropping and in-ground (Australian native) areas to help improve water use efficiency.
- Shannon has invited one of the largest growers in Spain to write an article for the AFI magazine.

Recommendations

Government

- To provide resources (research, development and extension) to further develop the Floriculture Industry.
- To help apply and incorporate the results of research, development and extension into the farm management systems being developed by industry organisations.

Industry

Industry needs to lobby both State and Federal Governments about the importance of the Cut Flower and Foliage Industry in Australia. Information should include the size of the industry, the employment potential and export earnings.

To this end industry associations in Victoria, New South Wales and Queensland are negotiating with Professor Stuart Orr, Faculty of Business and Law, Deakin University to conduct the first national survey of the Cut Flower and Foliage Industry.

The results of this survey will help the Floriculture Industry determine research and development priorities, training requirements and professional development for industry.

Professional Associations

Professional associations need to develop projects in association with research and development organisations and Government funding bodies to identify technologies and techniques that:

- Identify sustainable production technologies and help floriculture operations incorporate these technologies into their farm management plan.
- Provide practical and affordable solutions for growers to reduce energy use in Australia's glasshouse horticulture industries.
- Improve profitability by offsetting rising fuel prices through energy savings.
- Identify techniques, technologies and future research, development and extension recommendations to inform further stages of a larger national energy efficiency initiative.
- Bring together industry leaders, including representatives from Horticulture Australia Limited, for high level discussions in order to engage all relevant stakeholders in the process of developing a longer term initiative for the provision of a sustainable Floriculture Industry.

This can be achieved initially with a review of national and international literature to identify techniques and technologies to identify sustainable production technologies and save energy in greenhouse horticulture. This could be developed into a freely available (probably downloadable) audit checklist for greenhouse growers, so that they can undertake production and energy audits of their business and identify potential areas for savings.

This review could also identify specific enterprises in Australia and overseas (Europe) who are leading the industry internationally in sustainable production technologies and energy utilisation. A number of field visits could be undertaken (at least two in Australia and one internationally – likely to be the Netherlands) to visit these enterprises and also attend the international Horti Fair in Amsterdam where new glasshouse technologies are showcased annually.

Recommendations

A parallel process of engaging industry leaders (ie senior departmental staff from State and Federal Government, industry association leaders and Horticulture Australia Limited representatives is also necessary. These people and their industry/organisations need to be engaged in the sustainable production and energy debate in an effort to mobilise investment, R and D effort and extension capacity nationally. This is likely to be in the form of a circulated discussion paper/survey.

The overall intention of this process is to identify priority issues for the future and also leaders that can drive this initiative within Australia into the future.

Education and Training

There needs to be a major investment in a National Protected Cropping training facility for protected cropping in Australia, similar to PTC+ in the Netherlands.

PTC+ is created from various agricultural educational institutions and is a modern practical training institution in the field of plant growth, animal breeding and technology.

With an institution similar to PTC+ located in Australia, the Floriculture Industry would have access to trained professionals to help build a stronger and more professional industry.

Suggestions for Future Study Tours to Meet Skill Deficiencies

In organising this study tour, Shannon approached organisations like Netafim Australia and Schreurs Australia, who are both suppliers to his business and the Floriculture Industry. These international companies had offices in the countries he wished to visit. He also talked to other flower growers and suppliers about people he could contact.

It was important for Shannon to contact the representatives of these companies in Australia and build a relationship with them to aid him in organising the visits in each country. Before he left Australia he had a tour itinerary organised. The contacts in each country had approached growers and Government officials on his behalf and planned his visits in each country. Shannon found that all the growers and Government officials visited were very happy to spend the time with him and discuss issues associated with the flower industry in each country.

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Websites

Schreurs rose growing book, *Cut Rose Cultivation – Around the World*
http://www.schreurs.nl/

Priva – Greenhouse Management Systems
http://www.priva.nl/smartsite.dws?setMarkt=1&id=1285

Netafim – Greenhouse Management Systems
http://www.netafim.com/

Attachments

Index to Attachments (Refer to CD)

Priva: ClimateOptimizer – 6 pages

Priva Diagram – 1 page

Priva, for a better quality of life – 22 pages

Priva: Optima greenhouse. The road to energy producing greenhouses – 23 pages

Priva Maximizer ’02 – 48 pages

Priva Vialux disinfection units – 26 pages

PrivAssist Including Smartline – 33 pages

TOG Paste leaflet – 2 pages

TOG Paste presentation, Milchan Bros Ltd – 26 pages

Disinfection of Drainage Water by Ultraviolet – 4 pages