FINAL REPORT
PROJECT NUMBER – VG07074

EUROPEAN GREENHOUSE STUDY TOUR - OCTOBER 2007

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VG07074 – *European Greenhouse Study Tour - October 2007*

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Purpose: The purpose of the project was to assess existing, new and emerging greenhouse technologies and how they may be integrated in existing systems in Australia

Government Priority: Maintaining and Improving Confidence in the Integrity of Australian Agriculture, Food, Fish & Forestry Products

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Contents

Tour Participants

Leigh Taig – GOTafe – Shepparton VIC
Frank Donato – Mornington Peninsular Hydroponics – Patterson Lakes VIC
Rick Donnan – Growool Horticultural Systems – Kurmond NSW
Will Millis – Flavorite Tomatoes - Warragul VIC
Dr Johann van Dijk Joubert – New Life Industries – Devonport TAS
Johann van Dijk Joubert (Jr) – New Life Industries – Devonport TAS
Ronald David van Leerdam – New Life Industries – Devonport TAS
Jonathon David van Leerdam – New Life Industries – Devonport TAS
Greg Dell – Freshzest – Leongatha South VIC
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Ian Lines – Holla-Fresh – Tantanoola SA
Susan Lines – Holla-Fresh – Tantanoola SA
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Susan Shannon – Shannon Roses – Burpengary QLD
Paul Mifsud – Paulmar Hydroponic – Wallington VIC
Graeme Smith – AHGA – Woodend VIC

Summary

This study tour allowed us to view firsthand the highly efficient Dutch growing methods and glasshouse systems that have been developed over more than 30 years. The Australian protected cropping industry largely emulates the Dutch model in growing techniques and technology, therefore we assessed their approach to environmental management and plant physiology, with particular emphasis on their growing techniques and their adoption of new & emerging technologies. The industry suffers an acute shortage of opportunities for professional training and education in a range of technologies that are unique to the industry.

A key study was their total uptake of closed systems (full recycling) with very low waste water. This method is strongly recommended by our national industry and will eventually become mandatory, therefore growers needed to study the correct techniques. Professional training was received at a 5-day intensive course at Holland's main horticultural training institution, PTC+, studying a comprehensive range of greenhouse subjects that are currently not available in Australia.

Industry benefits are that skills training at all levels is necessary to underpin industry development & growth. Production and quality increases are necessary to meet the increasing demands of QA systems for both domestic and export markets. Industry skilling has the capacity to meet these needs and match the standards of the competitive imports/exports. Overseas study is mandatory if we are to match production standards with overseas competitors as well as up-skilling the industry resulting in enhanced productivity and farm viability

TOUR ITINERARY

Thursday 4th October
Arrive Schiphol Airport (Amsterdam) 08.50am
Travel to Delft to offload our bags at the Coen Hotel and have lunch in Delft Village
Travel to Honselersdijk to visit Metazet Demonstration Nursery (1.30 – 3.00pm)
Travel to meet Rijk Zwaan representative (3.30pm) in the Westlands
Inspect grower of Capsicums
Visit 'Royal Brinkman' shop - a supplier to the horticultural industry & established in 1885. Brinkman's customers include vegetable, flower, pot plant and tree nurseries with a product range of over 30,000 products.
Late afternoon – arrive Delft hotel

Friday 5th October
Travel to Bleiswijk to visit Greenhouse Improvement Centre (9.30 – 11.00am)
Trials they are doing at the moment are
- trying to get over 100 kg tomatoes per m2,
- combination of fish and tomato production, growing tomatoes in waste water from fish.
- trials with clear and diffuse light in tomatoes
Travel to Barendrecht to visit hydroponic lettuce grower (11.30 – 12.30)
Travel to Steenbergen to visit Rijk Zwaan Demonstration greenhouse (2.00pm - ?)

Saturday 6th October
Travel to Merle (Belgium) to meet Christien Sauviller at 09.00am
Inspect Belgium National Research Centre for Vegetable Production
(includes tomatoes under lights, capsicums & strayberries)
Lunch in Hoogstraten (Belgium)
Afternoon TBA

Sunday 7th October
Free morning in Delft
Travel to Hotel De Rehorst in Ede in afternoon.

Monday 8th October
1st training day at PTC+ in Ede

Tuesday 9th October
2nd training day at PTC+ in Ede
Travel to Crowne Plaza Hotel in Amsterdam in late afternoon

Wednesday 10th October
1st day at NTV (Hortifair)

Thursday 11th October
2nd day at NTV (Hortifair)

Friday 12th October
Visit Penning Freesias in Honselersdijk (Penning utilises a unique 'ground-loop' system to both heat and cool root-zones)
Visit Flamingo Van Der Meer in Monster that trades in refurbished second-hand technology for greenhouse projects. (this is essentially a large greenhouse 'supermarket')

Saturday 13th October
Private Priva Tour – Meet at Amsterdam Novotel at 09.00am, and return & 4.30pm.
Visit 'Themato' enterprise then travel to new Priva H/Q for lunch
Inspect Priva H/Q after lunch

Sunday 14th October
Free morning in Amsterdam
Travel to Ede in afternoon.

Monday 15th October
3rd training day at PTC+ in Ede

Tuesday 16th October
4th training day at PTC+ in Ede

Wednesday 17th October
5th training day at PTC+ in Ede
Travel to Schiphol Airport (Amsterdam) following lunch ready to travel home. (depart 7.00pm)

Thursday 18th October
Lost in transit

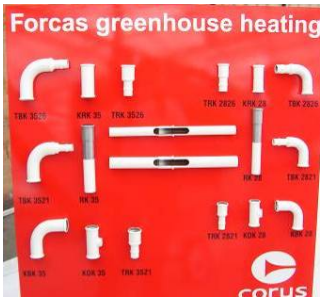
Friday 19th October
Arrive home early (04.45am)

Metazet Demo Nursery –(Honselersdijk)
(limited photos allowed due IP)
5,000m² (flowers, vegetables, pot-plants)
Various systems (harvesting, internal transport, cultivation, plant lighting, etc)
Wire mesh benches, chain path system, suspended chain rails, hanging plants, wire monorail systems, tube rail supports, harvesting carts, walking plant system, hanging gutters, pumps, paints, climate control, harvesting & processing, etc, etc

Form Flex - Supported and Hanging gutter systems

Train track system

- chain in steel track set into concrete path
- Front of trolleys has 'bar' that goes into slot & is picked up by the chain which is constantly moving.
- Safety stop bar on the front.



Metazet Trolley – high work trolley (www.metazet.com)

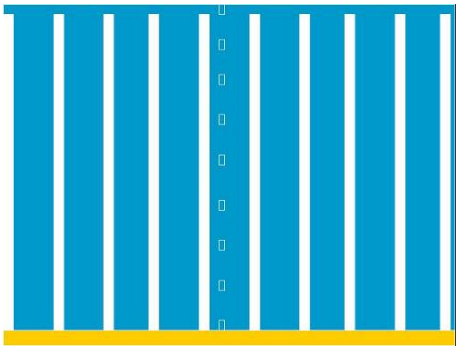
- Slotted steel with cross support bars
- Bars support platform but also form ladder for accessing platform..
- Tubular steel structure of platform sits over slotted steel
- Very simple – height variable to approx 20cm variations and can go quite low
- English brochures.

Crop Support Systems – ladder tape with metal clips attached with a 'gun'

Systems for **lifting pipe rails** when changing floors etc. Hooks under pipes to lift then wire and pulley system.

Pallet wrapping – easy wrappers, portable systems

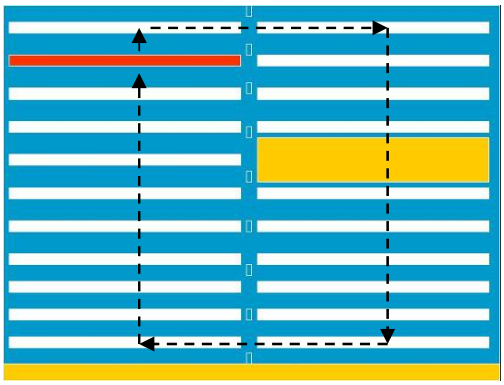
Rotating Gulley System
This innovative movable gutter system rotates around two glasshouse spans and allows greater use of production area by removing most human access aisles.



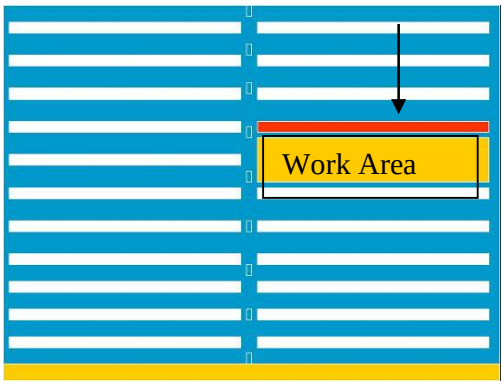
Plants rotate to designated work area where all crop work is completed (picking, twisting, de-leafing, etc)

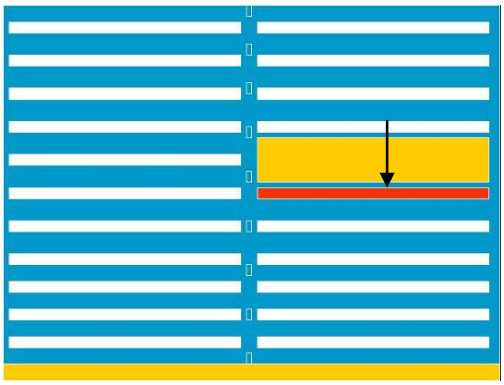
- Target – 100kg/m2 (with same labour as if producing only 60kg/m_2)
- Investment – Euro 35/m_2
- Euro 30/m_2 Lighting (@ 25kLux for 17 hours)
- Wide-span greenhouse – 12m
- Gulley length – 11.6m (run east/west)
- Variable gulley spacing to suit seasons

(above - conventional hanging gutter layout i.e north/south



Rotating Gulley System (rows east/west) rotate to work area when crop work required





National Research Station for Vegetable Production – (Meerle, Belgium)

Many types of growing systems including soil, glasshouse, haygrove tunnel, hanging gutter, etc

Total recirculation of all nutrients is required by law. Uses slow sand filter and UV.
Any drain water not used goes through reed bed and lava bed to reduce nitrates before it can be released into the sewer. Gov't checks and traces back to growers, penalties for growers who breach regulations.

- Specialist research centre for greenhouse & field strawberries
- Centre for breeders trials (tomato & capsicum)
- Centre for sustainable production
  (closed greenhouse system, slow biological and lava filters for waste water)
- Centre for technology trials (assimilation lighting, CHP)

The research centre is also used by the major European seed breeding companies to trial new varieties of both tomato and sweet pepper (capsicum) before final commercialisation.

Banker plants (ie wheat) are used at the end of growing rows to introduce beneficial insects (wheat quickly dies, insects move out to crop in search of food)

Assimilation & supplementary lighting is being trialled in tomato crops to increase photosynthesis (growth), with light ballasts separated from globes to introduce heat at fruit level and avoid natural light shading.

Practical Training Centre + (Ede)

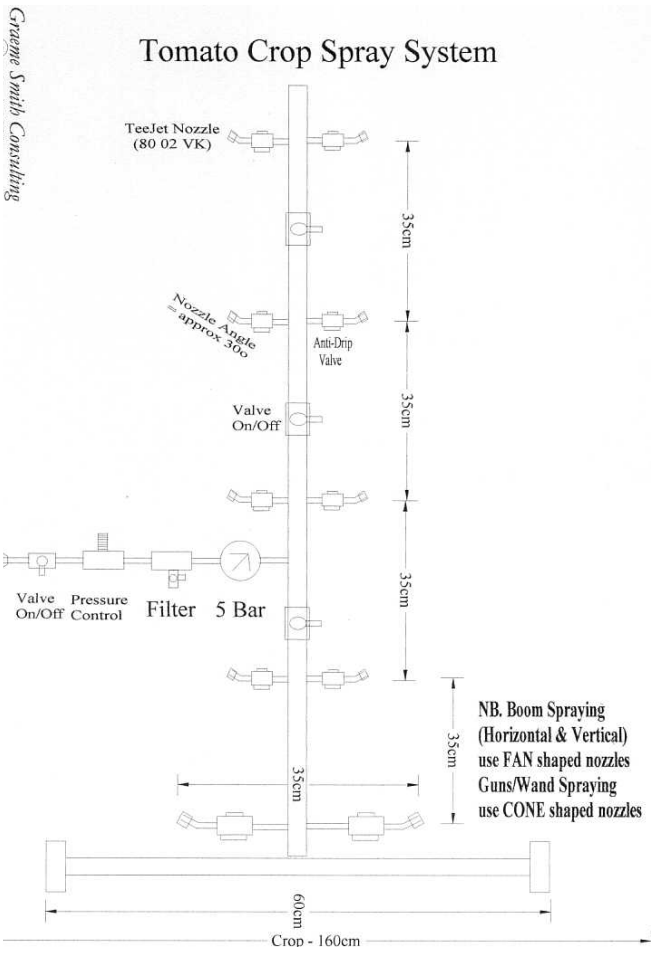
This centre in Ede (Holland) specialises in horticultural training (being close to Wageningen, the centre of horticultural research in the Netherlands).
PTC+ has purpose built greenhouses to demonstrate technology & put into action their slogan “Learn by Doing”.

They annually train 40,000 graduates (in 5 campuses) have 450 employees and annual turnover of US$28million

The group completed the ‘Advanced Horticultural Course on Greenhouse Management’ (computerised environmental control, substrates, water & fertiliser management, post harvest, crop protection)

As part of the course, the group developed and tested an effective crop spray trolley suitable for tall greenhouse crops (tomatoes, capsicums, cucumbers, egg plants, etc)

The resultant design is pictured below



Media-Based Nutrient Recirculation System.

Water is the life-blood of all horticulture and access to quality water should be the goal of all greenhouse managers, however the inherent low buffering of hydroponic systems demands a higher level of water management than soil based systems. Even media based systems allow root-zone conditions to change rapidly if not well managed. This aspect can be both our strength & weakness. 'Strength' in un-equalled control of plant performance if achieved, 'weakness' is lower yield & quality if not well managed.

Hydroponic systems can deliver substantial reductions in water usage compared to traditional farming activities (as much as 85%), and also increase yields per m2. The challenge for growers is to continue to reduce water consumption and to responsibly discharge wastewater to minimise environmental impacts.

Growers in the Netherlands are all obligated by legislation to recycle their drain water due to a high water table, as a large proportion of the country is flat and 4 – 6m below sea level. As a result they have been successfully recirculating their nutrient for some time after many years study on the recalculation of the nutrient load to maintain a healthy crop balance. They also capture high quality rainwater off the glasshouse roof into lined dams (called basins).

One of the prime reasons for our study tour was to study recirculation systems, the physical requirements (valves, tanks, pumps, piping, etc), and the technical methods of balancing the nutrient solution to a level suitable for the crop.

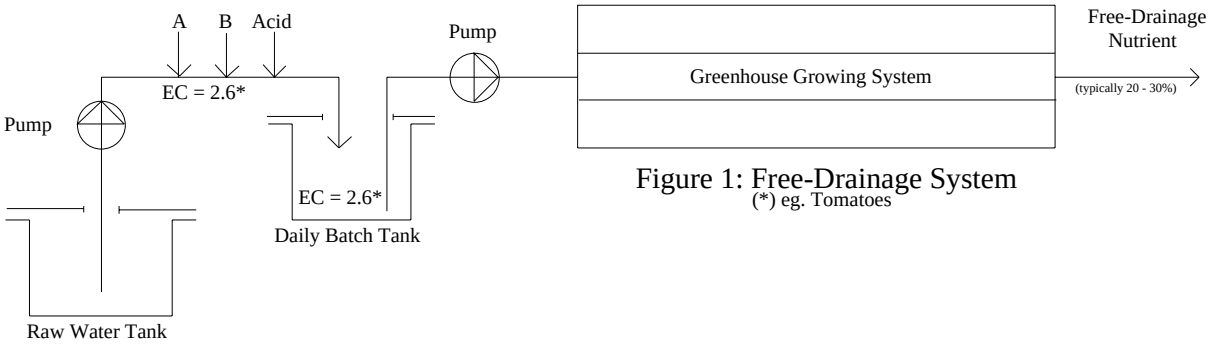


Figure 1: Free-Drainage System
(*) eg. Tomatoes

Figure 1: shows a typical media based 'Free-Drainage' system used in Australia today. This simple schematic shows a pump drawing raw water from a supply tank to fill a batching tank. On the way a fertiliser injection system adds the nutrient to an EC & pH set-point. The greenhouse irrigation controller calls for a feed and a second pump draws from the batch tank to feed the crop. Any waste water (typically 20 - 30%) is then collected and disposed of or used on a secondary crop (eg. pasture improvement). Some systems utilise a direct injection system to the crop and do not have a batch tank, however the principle and outcomes are the same.

Growers strive to maintain around 20 – 30% free drainage to balance out root-zone conditions in the media and environmental impacts, however this relatively low figure makes our media management that much tighter, hence a higher degree of control is necessary.

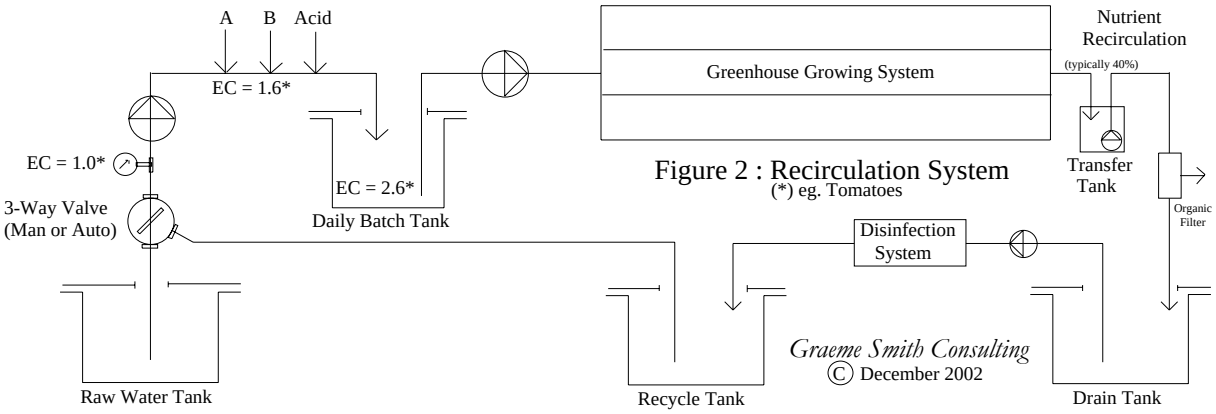


Figure 2 : Recirculation System
(*) eg. Tomatoes

Figure 2: shows the Dutch recirculation system, which is collected in a small transfer tank, pumped via a filter (to capture organic wastes), to a drain tank.

This nutrient is then pumped to a second 'recycle' tank via a disinfection system. This recycled, disinfected water is then introduced into the raw water pump via a proportional 3-way valve that is adjusted to supply an output EC target (eg. 1.0). This 3-way valve can be manually or automatically adjusted to maintain the required set-point to the pump.
This tomato example then shows that our fertiliser injection system only needs to supply an EC of 1.6 to deliver our required 2.6 to the batch tank. (1.0 recycle water + 1.6 injected = 2.6EC).
We have now seen the basic mechanics of a recirculation system.

Growers in this system typically aim for a 40% drain solution as it delivers them a more stable media condition and they are not losing any precious resources (water or nutrient) to the environment. This 40% drain matches the recycle EC (2.6 / 1.0); therefore our zero waste system is in balance!

Grower's outcomes are 40% saving in fertiliser, 40% water saving, and are environmentally sound and responsible!

Nutrient analysis of the recycle tank is initially required every 2 weeks to convert the nutrient load to a standard reference, which in turn is used to modify the injection recipe. This recipe modification takes account of the individual nutrient ions already present and adjusts these ions if necessary to maintain a reasonable balance at all times.
We can also allow for different recipes at different crop stages (eg. cucumbers - filling bags, starter mix, heavy fruit load stage), to meet changing crop demands for maximum yield & quality.
Analysis frequency can be dropped to approx 3 - 4 weeks once the system is stable.

The Australian Hydroponic & Greenhouse Association is keen to encourage all greenhouse growers to adopt the above 'closed' system principles as a basic tenet of a code of conduct (yet to be developed). This code is intended (in part) to further minimise any impacts on the natural environment.

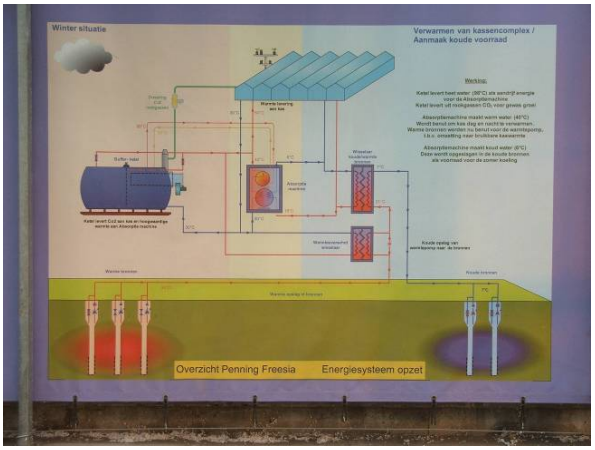
The knowledge gained has been part of the industry presentations (see technology transfer on page 23) to encourage grower adoption nationwide.

Penning Freesias (Honselersdijk)

3.7ha (growing, breeding, research, cooling)
Developed 30 new varieties over 30 years
Currently aim for 2-3 new varieties annually
Leading supplier of corms & cormlets (local & export)
New 1.2ha for propagation, commercial testing & showing new varieties

polystyrene beads introduced into the growing media to provide insulation to both cool and warm in summer/winter

innovative 'ground loop' system to both heat & cool crops using 2 adjoining bores via a heat exchanger (for winter & summer temperature control in the plants root-zone)



Hortifair

Also included was 2 days at Hortifair (NTV) at the RAI. This Expo is the worlds largest in the protected cropping industry and showcases the latest (existing, new & emerging) technologies.

The area is so large that 1 day is required to have an overview of what is available, and the second day is to target the products of most interest.

The 1005 booths showcases many items to the 50,000 visitors, that are not yet in common use in Australian greenhouse systems. We can expect adoption in the near future as they have assisted Dutch growers earn a strong reputation for being the most productive and efficient.

Some full sized units on show included CHP systems (combined heat & power) that allow growers to produce greenhouse heat and CO_2 and sell any surplus energy to the power companies.

Hortifair is well known for showcasing innovative technologies for greenhouse growers, and this year there was a strong emphasis on alternative lighting, including LED lighting to drive crops by selective use of the light spectrum with lower power and heat output.

Also introduced were special crop clips and supports developed to last as normal over 12 months in a greenhouse, however were fully biodegradable over 12 weeks when composted

Berg Produkt (well known to Australian greenhouse growers for their crop management trolleys) released a new 'UV Robot' unit that submitted crops to intense UV light that killed powdery mildew and botrytis spores on the plants.

This robot also automatically de-leafed cucumber crops 3 days after being subjected to intense UV light.

The unit automatically moves around the greenhouse overnight to complete its tasks to keep out of the way of workers in the day.

Also on display was a demonstration of greenhouse whitewashes and their affect on light transmission and temperature within the greenhouse.

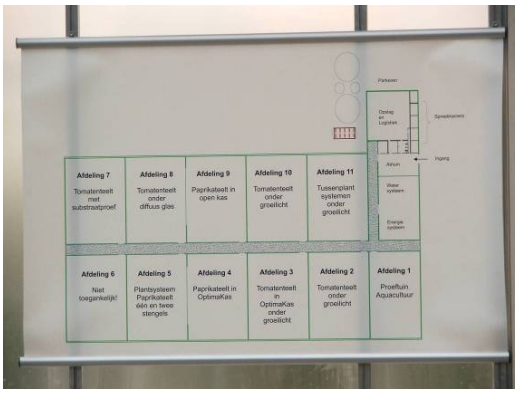
Greenhouse Improvement Centre (Bleiswijk)

This R&D centre is co-funded by government and commercial partnerships to assess new greenhouse innovations and technology.

It is divided into 11 equal glasshouse compartments that are dedicated to different projects that include:

1. comparing production with normal glass (direct light) with diffuse glass (diffuse light). (n.b. direct glass was 4kg/m2 in front of diffuse at this point)

2. closed greenhouse system with supplementary lighting (n.b. at 98kg/m2 to this point compared with standard around ± 70kg/m2)



3. aquaponics system by integrating tilapia fish and greenhouse tomatoes in a fully closed system

Hortiplan Moving Gulley System (Barendrecht)

This automated growing system maximises available production space by removing all human access aisles.
Young seedlings are grown in NFT channels (gullies) and placed on one end of the growing line and slowly transported down the line (approx 120m).

As the plants mature, the gullies are automatically spaced apart to allow for plant growth and are fully matured by the time they reach the far end of the line (± 3 – 5 weeks depending on season and variety)

Suitable plant types for this system include lettuce, herbs, Asian vegetables, etc

Compare Growing Systems (Annual Production Potential on 2Ha Footprints)

- Traditional Field: ± 500,000 units
- Standard Fixed-Channel Hydroponic: ± 3,000,000 units
- Moving Gulley System (Hortiplan) ± 8,000,000 units

Flamingo van Der Meer (Monster)

This 'supermarket' for second-hand greenhouse technology is a must for growers who are looking to make substantial savings on a wide range of equipment.

Sales include: boilers, spray units, HAF fans, graders, reverse osmosis, fertigators, heat sterilisers, etc

All equipment is serviced, performance checked and is warranted, with freight to Australian arranged if required.

'Themato' (Westlands)

This semi-closed greenhouse system produces 1.4Ha Strawberries ('Elsanto')

- Plant density – 8m2
- Media – coco-peat
- Target temps – 15ºC min, Vent 24ºC max
- 50,000 native bees, 10 boxes bumblebees
- Lighting – 16hours (min) (photoperiodism)
- Globes 150W incandescent
- 1 hour extra in am, 2.5 hours extra in pm
- Plant 1st Aug, Pick Oct – Dec 1st
- Harvest – 6kg/m2

'Themato' plans a future strawberry crop ('Arva') that will grow for a full 12 months

- Plant – Dec to Dec
- Target – 20kg/m2

'Themato' also has 4Ha tomatoes in a 'semi-closed' system

Tour Outcomes

The tour group was fortunate to experience a wide variety of experiences in a relatively short time frame, with none more so than the time spent at PTC+.

The trips main focus was a 5-day intensive training course at PTC+ (Practical Training Centre – Ede – Holland), on computerised environmental control, substrates, water & fertiliser management, post harvest, crop protection.

On the completion of the course, each participant was presented with a completion certificate entitled "Advanced Horticultural Course on Greenhouse Management"

PTC+ has well developed training facilities that include classrooms connected to a glasshouse (divided into 8 different compartments for 8 different crops), that allows us to immediately put into practice the theory learnt.
The course entry level is aimed at greenhouse managers & consultants, however ample time was allocated to ensure all participants' needs were met.
The course modules covered are subject to feedback from participants and can be tailored to best meet any group's needs.
Our main instructor was Ben van Onna who comes with great credentials and was well received during his all-states visits & workshops for the 2003 & 2007 AHGA national conferences.

PTC+ is not just a training institute but also offers a number of other roles that have been identified by the Australian protected cropping industry as constraints to industry development. These roles include:

- Centralised Training Facilities
  a location that delivers industry specific training in both theory and practical
- Demonstration Facilities
  to showcase both existing, new and emerging technology and how to integrate into growers systems
- Dedicated R&D Facilities
  to ensure our technology driven industry adapts to Australian conditions and crops
- Field Grower Incentives
  demonstrate alternative production techniques to traditional Australian farmers
- Model Business Plans
  developed using centre's growing technology for each crop
- Minor-Use Program
  a location to assist with efficacy trials on new greenhouse products
- Bio-control Facilities
  potential area to develop or trial new greenhouse bio-controls
- Energy & Water Efficiencies
  centre for industry research into resource utilisation and efficiencies

A National Greenhouse Training Institute

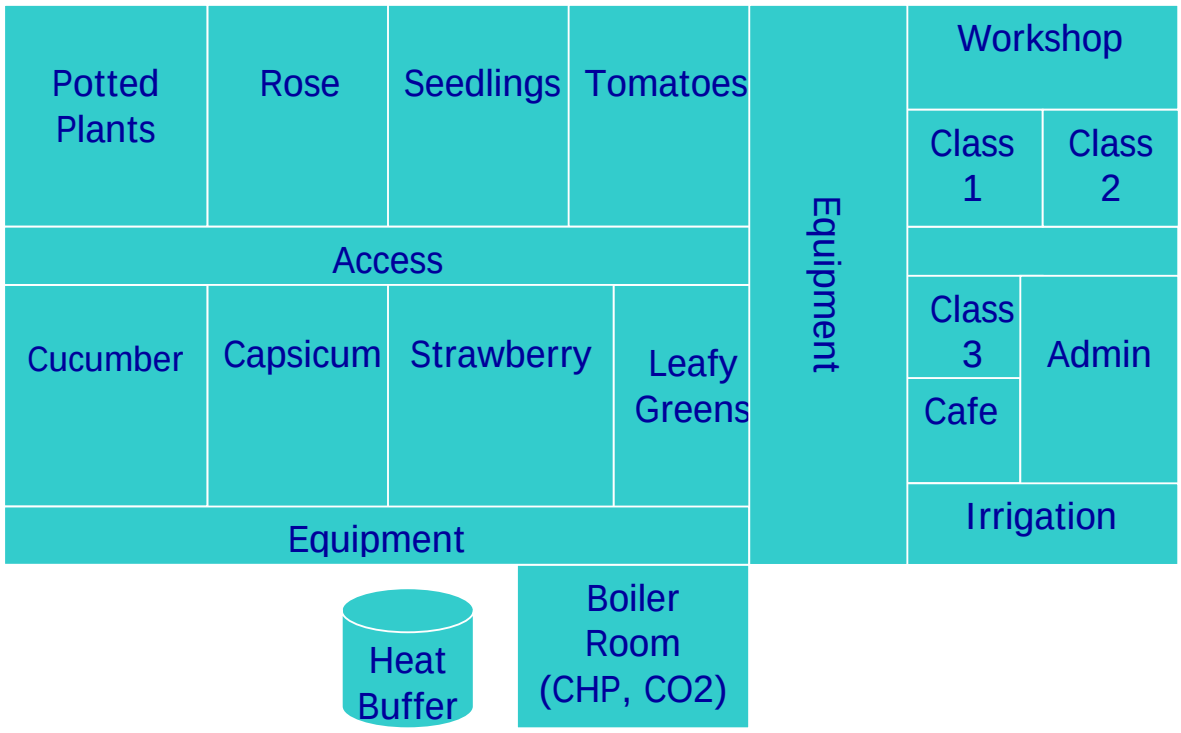
- Has capacity to lift entire industry through targeted education and research
- Assist in overcoming grower reluctance to invest in unfamiliar (yet proven) technology
- Sets industry standards and targets (both quality & production)

- Demonstrates best-practice growing techniques for Australian greenhouse crops
- Centre for Asia/Pacific education and training in greenhouse crops and technologies (targeting Malaysian, Indonesian, Chinese, New Zealand and other regional growers.)
- Partnership with PTC+ to develop & deliver specialist industry training.
- Based on PTC+ model (theory & practical)
- Include classrooms, growing systems, structures, common technology, café, catering, admin, student accommodation?, etc
- Crops targeted – tomatoes, capsicum, strawberry, cucumber, lettuce & herbs, rose, gerbera ++
- Located for best industry return (TBA?)
- Funding sources: industry and commercial partnerships, government, course fees from participants, produce sales, breeders trials, etc
- Capital infrastructure costs (yet to be determined?)

A National Greenhouse Training Institute can meet a significant number of identified industry failures and industry is urged to investigate this proposal.

We emulate Dutch growers in terms of technology and varieties, however if we aim to match their quality, efficiency & productivity, then industry up-skilling is mandatory. An institute can offer this and more.

Practical Training Centre + (PTC+), Ede, Holland (potential model for National Greenhouse Training Institute)



Suggestions for leaders of future study tours

Every three days or so, the participants shared with the group their experiences and what 'take-home' message they had discovered and would implement in their own greenhouses. This group discussion was included to enhance their learning experience and improve the quality of their tour experience.

Ours is a strongly technology driven industry and when travelling overseas we will see lots of these new and emerging technologies, however it is important to realise that basic principles still apply. (in terms of plant physiology and environmental management).
Australian growers are yet to fully comprehend the growing basics and maybe should concentrate on these before necessarily investing in expensive equipment that possibly will not improve production or quality if not used well.
The Australian protected cropping industry suffers an acute shortage of opportunities for professional training and education in a range of technologies that are unique to the industry. Overseas study is mandatory if we are to match production standards with overseas competitors as well as up-skilling the industry resulting in enhanced productivity and farm viability.

It was very clear from the start of the tour that obtaining access to the best European growers was almost impossible unless you had an appointment that only major companies (like seed and equipment suppliers) could facilitate. Normal greenhouse access was restricted due to the threat of disease spread (ie Pepino Mosaic Virus) and prior arrangements were always necessary. Do your homework before you travel.

Whilst European distances are relatively short (compared to Australia), larger traffic volumes greatly affect road travel times and reasonable allowances should be made when planning routes. Growers are happy to welcome us into their greenhouses (provided prior arrangement made), but do not appreciate late arrivals as each & every day in the greenhouse is a busy one.

International phone charges (ie. roaming) can be substantial as charges are applied both to & from Australia and even received calls are charged at a premium rate. (inc data rates)

Vehicle parking & rates in Europe are substantial and can be as much as €35 per night per vehicle (even when parking at the hotel you are staying at). Also allow for parking a significant distance away from your hotel (ie larger centres like Amsterdam, etc). Best to ask about parking availability & costs when booking rooms.

Foreign Currency transaction fees add up to substantial figures when using credit cards, though these are considered desirable as they offer a full financial audit trail for tour costs.

Credit cards can be quickly exhausted by hoteliers or hire-car companies, as they typically hold against your card the full rate for accommodation and car hire, then charge the actual rate on top when paying the bill. The booking fees are not released for around 7 days and can be substantial if paying for 14 people or more!

Excess baggage was a common event charged by international airlines as tour participants often were overloaded due to an array of notes, books, brochures, gifts, etc that were gathered from expo's, training institutions, etc. Best to weigh suitcases at hotels and share around group if possible.

Technology Transfer

The learned outcomes of this tour have been presented at a number of industry association meetings and include the following:

Hydroponic Farmers Federation (HFF) Biennial Conference – Lilydale April 2008
Misc presentations to Victorian TAFE colleges – Shepparton & Burnley Jan – May 2008
Articles in the 'Soilless Australia', newsletter of the Australian Hydroponic & Greenhouse Association
Articles in the newsletter of the Hydroponic Farmers Federation in Victoria
Article in 'Practical Hydroponics & Greenhouse Magazine' – Casper Publications Australia

Published Article

Article for Soilless Australia
European Greenhouse Study Tour - 2007

On the morning of the 4th October 2007, 15 growers and 1 "ring in" (me) from Australia rendezvoused at Amsterdam's Schiphol Airport. Some had come direct from Australia, others like me had been lucky enough to spend some holiday time in Europe before being part of the 2007 European Greenhouse Study Tour.

This was the 3rd such study tour of Europe organised by Graeme Smith – known to us all as the principle of *Graeme Smith Consulting*; as long-serving President of the AHGA; and, for the sixteen participants (and others who have previously joined one of Graeme's tours) now famous as the perfect host and tour leader.

For two weeks the group experienced the latest in Dutch and Belgian research; viewed state of the art growing facilities; undertook 5 days of specialist greenhouse training at the *Practical Training Centre Plus* (PTC+) in Ede; as well as, two days at one of the largest horticultural trade shows in the world – Horti Fair.

For me, after working in horticulture for over 25 years, it was the experience of a lifetime, and being able to share it with an enthusiastic group of tomato, herb, lettuce and rose growers was a privilege.

Research

During our tour we visited the *Greenhouse Improvement Centre* an industry funded research facility of around 11,000m^2 under glass divided into 11 compartments where a variety of trials operated at any one time. Current trials included a tomato production trial to achieve 100kg/m^2 in 12 months. At the time of our visit they were on target to achieve this goal through supplementary lighting and a closed greenhouse system. The Centre also featured an aquaponics trial utilizing waste water from fish production as a nutrient source for tomato production.

At Steenbergen we visited the *Rijk Zwaan* demonstration greenhouse where some of the latest tomato varieties bred by *Rijk Zwaan* are assessed and trialed. It was interesting to be able to taste test many of the varieties and observe their various attributes. The *Research Station for Vegetable Production* (RSVP), formerly the *Belgium National Research Centre for Strawberries* also conducts variety trials in tomatoes, capsicum and strawberries. RSVP also research and trial in the areas of cultivation techniques, new growing systems, disease and pest management, as well as waste management.

Growing Systems

The future of greenhouse production is clearly linked to the implementation of appropriate and sustainable technology. In Barendrecht we viewed a "mobile gully system" for hydroponic lettuce developed by *Hortiplan*. The system enables the seedling crop - planted in gutters - to move in a loop via a chain drive system from one corner of the greenhouse to the other. Eventually the loop is completed within the greenhouse where the mature crop can be harvested and packed in the adjoining packing area. The quality and uniformity of the crop was impressive as we were able to track all stages of growth.

World famous *Penning Freesias* in Honselersdijk featured a unique 'ground-loop' system which stores excess heat or cooled water in subterranean wells to be used on demand. The stored energy can then be converted via a refrigeration/condenser unit to maintain optimum root zone temperatures for in ground freesia and amaryllis production.

Themato in the Westlands with their "never say never" approach, was a fascinating study of how a good grower's skills can be readily adapted to a totally new crop, based on sound principles.

The *Themato* greenhouse and hanging gutter system was originally designed and built by *Innogrow* in conjunction with *Priva* for Roma tomato production. The greenhouse is a 1.4 ha structure converted to a "closed" system, utilizing stored energy from subterranean wells, similar to *Penning Freesias*. Because the system is so efficient in relation to energy loss and heating, a further 4 ha "open" greenhouse was heated with the excess energy.

Market forces lead the family owned business away from tomatoes to strawberries. The greenhouse environment and growing system rewards the grower with significant reductions in energy costs through this unique heating and cooling system; condensing transpired air (to reuse in irrigation); and, concentrating CO_2 by only venting when absolutely necessary.

Horti Fair

Horti Fair runs over four days in the RAI Exhibition and Conference Centre, Amsterdam. It is one of the largest horticultural trade exhibitions in the world, with around 87,000m^2 of exhibition space. Over 980 exhibitors took part and attendance was close to 47,000 people.

As we made our way to the RAI, our instructions from Graeme were clear: "Use the first day to get around and try and see everything on display, then on the second day stop and talk to exhibitors". Sound advice! On day one I followed Graeme's advice. I was systematic, paced myself, didn't stop too much for idle chats and by around 4:30pm, a little weary, but satisfied I started to make the long walk to a familiar exit – only to stumble across a whole hall that I hadn't seen!

Day 2 was less hectic and a great opportunity to talk to industry people from around the world, visit some of the specialist lectures that were offered and generally look in awe at the length and breadth of our industry. There was everything on display from the latest releases in floriculture to biodegradable tomato clips to massive boilers and power generation units. My favourite piece of equipment was a robotic arm that was capable of taking 1,000 to 1,500 cuttings per hour, that were annoyingly uniform and then accurately placed into propagation containers (in this case 175mm squat pots) in a predetermined pattern.

PTC+

The Dutch horticulture industry is well established and has a long history; however after the devastation of World War II the parallel development of its education and training system has enabled it to become not only the leader in horticultural produce, but a leader in horticultural technology and innovation. PTC+ in Ede is one of 5 campuses of agricultural and horticultural training that has its foundations in the years of rebuilding directly after WWII.

As an educator involved in horticultural training, PTC+ was my main reason for joining the tour. After discussing the attributes and physical layout of PTC+ many times with Graeme, I thought I was well prepared for what I was about to experience.

The site at Ede has student accommodation, canteen and purpose-built greenhouses and classrooms to enable training and practical experience in all aspects of greenhouse management. The trainers have strong industry experience (some still working in the industry and teaching part time) and the well-equipped facilities enable immediate access to real practical learning. In the short time we were there, we experienced training that didn't just show us how a system or piece of equipment worked, but we were challenged to understand the principles behind the technology and look at the 'what if?' type scenarios. This is what good education is all about.

The other strength of PTC+ is their strong links with industry and up to date research. For the Australian greenhouse industry to develop and prosper it is important that the industry commit to and support education and training, as well as recognising the important role that research plays (especially in an Australian context) in improving what we do.

Conclusions

The Horticulture Industry in the Netherlands provides us with many lessons for the future of our industry. Even for the Dutch, horticulture is a fiercely competitive industry – but the generosity and openness that we experienced in information sharing from growers, researchers and educators must be its greatest strength. The future of horticulture in Australia is developing, adopting, adapting and sharing information and technology to suit our unique circumstances.

The future is also equipping ourselves with knowledge. This can come from industry conferences, recognised training, short courses, industry focus groups or study tours.

It's important that we look at what's happening in other countries and learn. The European Greenhouse Study Tour provides us with that opportunity. Thanks to the foresight of people like Graeme Smith; the support of our industry association AHGA; and, funding from Horticulture Australia Ltd another 16 people had an enormous door opened to a room full of ideas, contacts and possibilities.

Leigh Taig is Manager of Horticulture at Goulburn Ovens TAFE in Victoria. In 2006 he was awarded an ISSI TAFE Fellowship to look at Management Level Training in the Netherlands.

Budget

Macedon Ranges Travel Service		
	Air Travel, Accommodation & Insurance	$66,593
Practical Training Centre +		
	Specialist Course Fees	$21,452
Hertz		
	3 x Ford Transit Vans	$5,560
Fuel Stations		
	Hire Car Fuel	$924
Australian Geographic		
	Thank you Gifts (European growers)	$450
Villa Brutus		
	Celebratory Dinner (end tour)	$1,003
Hortifair		
	Expo Entry Fees	$1066
Misc Fees		
	Train	$271
	Study Tour CD's	$140
	International Phone	$499
	Drivers (tour chauffeurs)	$1500
	Bank Processing & Foreign Exchange	$219
	Consultants Fee	$850
	GPS European Software	$245
	Tour Advertising (industry magazines)	$500
	Total Tour Costs	$101,272

PARTICIPANTS SURVEY

1	2	3	4	5
Strongly Disagree	**Mostly Disagree**	**Agree**	**Mostly Agree**	**Strongly Agree**

(please circle most appropriate answer!)

Study tour met my expectations				
1	2	3	4	5
I received suitable information prior to the study tour				
1	2	3	4	5
Training Centre (PTC+) met my expectations				
1	2	3	4	5
Grower visits met my expectations				
1	2	3	4	5
Transport arrangements met my expectations				
1	2	3	4	5
Accommodation arrangements met my expectations				
1	2	3	4	5
The Tour Leader met my expectations				
1	2	3	4	5
I would recommend future study tours to other growers				
1	2	3	4	5

Any general comments re this study tour

Name: (optional)

Please email or fax completed form ASAP to Graeme Smith (President AHGA)
Fax: (03) 5427 3843 or president@ahga.org.au

PARTICIPANTS SURVEY RESULTS

1	2	3	4	5
Strongly Disagree	**Mostly Disagree**	**Agree**	**Mostly Agree**	**Strongly Agree**

Study tour met my expectations
Mostly Agree x 6, Strongly Agree x 8

I received suitable information prior to the study tour
Agree x 5, Mostly Agree x 3, Strongly Agree x 5

Training Centre (PTC+) met my expectations
Mostly Agree x 4, Strongly Agree x 10

Grower visits met my expectations
Agree x 4, Mostly Agree x 4, Strongly Agree x 6

Transport arrangements met my expectations
Agree x 1, Mostly Agree x 3, Strongly Agree x 10

Accommodation arrangements met my expectations
Mostly Agree x 5, Strongly Agree x 9

Tour leader met my expectations
Mostly Agree x 5, Strongly Agree x 9

I would recommend future study tours to other growers
Strongly Agree x 14

Any general comments re this study tour
this was a well organised tour and the group was excellent
this tour is a must for growers
more time could be spent at PTC+
no crops same as mine however the rest was very good
thanks for tour it was fantastic
personally would have had less free time

ACKNOWLEDGEMENTS

In my role as Project Leader, I wish to thank the tour participants (refer page 4) for their co-operation and punctuality. Their interest in all things greenhouse and the general spirit of togetherness was most satisfying. I thank them for their friendship. I specially thank them for their contribution to the information included in this report.

Recognition and appreciation is also given to the following for their welcome contribution to ensuring a successful, informative and interesting tour:

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Marcus van Heyst & Carl van Loon	Powerplants Australia

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Ben van Onna	Senior Trainer PTC+
Peter van Oene	Coordinator PTC+
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Horticulture Australia Ltd

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AusVeg

AUSVEG Australian Vegetable & Potato Growers Federation

Graeme Smith
Project Leader