FINAL REPORT
PROJECT NUMBER – VG09068

EUROPEAN GREENHOUSE STUDY TOUR - OCTOBER 2009

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VG09068 – *European Greenhouse Study Tour - October 2009*

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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

Funding Source: Horticulture Australia Limited

Date of Report: February 2010

Know-how for Horticulture™

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Contents

Tour Participants

Paul Butterworth – Costa Exchange – Guyra NSW
Marcus Brandsema – J&A Brandsema – Turners Beach TAS
Elly Brandsema – J&A Brandsema – Turners Beach TAS (not pictured)
Graeme Smith – AHGA – Woodend VIC
Andrew Potter – P'Petual Holdings – Virginia SA
Mark Lines – Holla-Fresh – Tantanoola SA
Saskia Blanch – Way to Grow – Narrabeen NSW
Rick Donnan – Growool Horticultural Systems – Kurmond NSW
Fergus Roberts – VF & EM Roberts – Bundaberg QLD
Bill Bright – Greenhouse Automation – Diamond Creek VIC
Lauren Aspland – Margaret River Hydroponics – WA (not pictured)
Kim Aspland – Margaret River Hydroponics – WA (not pictured)

Also Pictured:
Ben van Onna – Head trainer – PTC+
Herman Eijkelboom – Technical trainer – PTC+

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 Australian 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

Wednesday 7th October
Depart Australia (Melbourne 4pm, other capital cities as advised)

Thursday 8th October
Arrive Schiphol Airport (Amsterdam) 6.35am
Travel to Delft to offload our bags at the Coen Hotel and have early lunch in Delft Village
Travel to Honselersdijk to visit Metazet Demonstration Nursery (1.30 – 2.45pm)
Visit Sion Orchids in De Lier (Sion is a fully automated, double story growing facility with a 'walking plant system' under lights, 3.00 – 4.00pm)
Late afternoon – arrive Delft hotel approx 4.30pm

Friday 9th 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 Steenbergen to visit Rijk Zwaan Demonstration greenhouse (1.00pm – 2.30pm)
Travel to Kruibeke (Belgium) to visit hydroponic lettuce grower (3.30pm – 5.00)

Saturday 10th October
Travel to Merle (Belgium) to meet Christien Sauviller (09.00 – 11.00am)
Inspect Belgium National Research Centre for Strawberries (includes tomatoes under lights and capsicums)
Lunch in Hoogstraten (Belgium)
Travel to Meer to visit pepper grower – (2.15 – 3.15pm)
Travel to Achter de Vaart to visit strawberry grower – (3.45 – 4.45pm)

Sunday 11th October
Free morning in Delft
Travel to Hotel De Rehorst in Ede in afternoon.

Monday 12th October
1st training day at PTC+ in Ede (08.30 – 4.30pm)

Tuesday 13th October
2nd training day at PTC+ in Ede (08.30 – 4.30pm)
Travel to Crowne Plaza Hotel in Amsterdam in late afternoon

Wednesday 14th October
1st day at NTV (Hortifair) at The RAI in Amsterdam

Thursday 15th October
2nd day at NTV (Hortifair) at The RAI in Amsterdam

Friday 16th October
Visit Penning Freesias in Honselersdijk (Penning utilises a unique 'ground-loop' system to both heat and cool root-zones, 10.00 – 11.30am)

Visit Flamingo Van Der Meer in Monster that trades in refurbished second-hand technology for greenhouse projects. (this is essentially a large greenhouse 'supermarket') (11.45am – 1.00pm)
Visit KUBO greenhouse manufacturers (1.00pm – 2.30pm)
Visit 7ha Pepper grower (VitaPep) in Monster (2.45 – 4.00)

Saturday 17th October
Visit 'Priva HQ in De Lier to view presentation on climate management, have lunch then inspect latest fertigation technology (9.45 – 1.30pm)
Visit Delta project to view massive 'sea-gates' to prevent lowland flooding due to tidal surges

Sunday 18th October
Free morning in Amsterdam
Travel to Ede in afternoon.

Monday 19th October
3rd training day at PTC+ in Ede

Tuesday 20th October
4th training day at PTC+ in Ede

Wednesday 21st October
5th training day at PTC+ in Ede
Travel to Amsterdam Crowne Plaza Hotel in late afternoon and hold farewell dinner that evening

Thursday 22nd October
Travel to Schiphol Airport (Amsterdam) following breakfast ready to travel home. (depart Noon)

Friday 23rd October
Arrive home (Melbourne 8.40pm, other capital cities as advised)

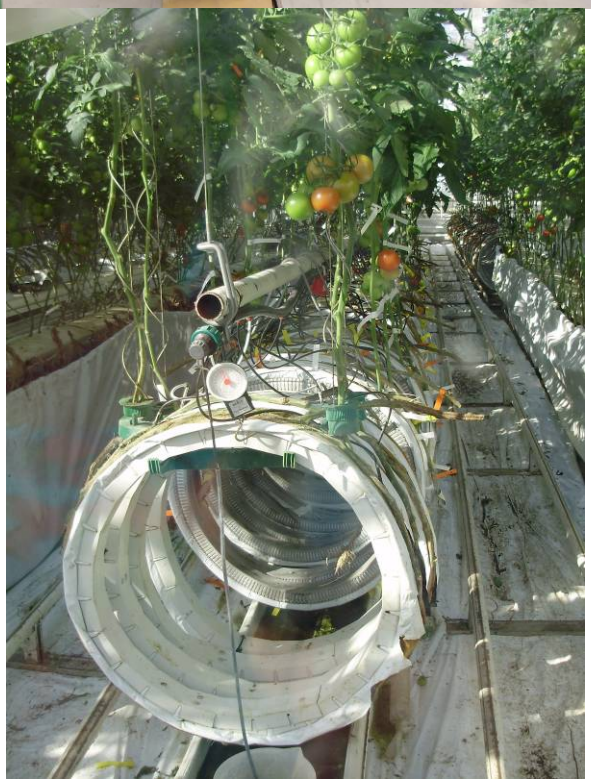
Metazet Demo Nursery –(Honselersdijk)
5,000m² (flowers, vegetables, pot-plants)
Various systems (harvesting, internal transport, cultivation, plant lighting, etc)
Wire mesh benches, chain path system, suspended chain rails, hanging plants, wire monorail systems, tube rail supports, harvesting carts,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

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 Research
This centre has growing compartments available for lease by various horticultural companies for testing new greenhouse production techniques & technologies.

One such compartment is trialling a system to remove the need for moving vine crops sideways as they layer. A circular wheel fitted with horticultural foam is used to encourage a plants 'adventitious' root system to develop then allow the early stem and root-ball be cut away and discarded.
This trial system will also assess whether renewed plant vigour is restored with a newly developed and shorter stem.



Another innovative research compartment has a pepper (capsicum) crop being intermittently shaken by a motor connected to a hanging gutter to determine any effects on production or quality compared to the control.

Another research project is re-trialling vine crops in a NFT growing system. This type of growing system was common in the Dutch industry many years ago but fell out of favour when it was considered to significantly increase the risk of spreading major diseases.

The length of each gutter was 12m with the solution fed at the rate of 3lt/min which was increased up to 6lt/min when solution temperature approached 28°C (n.b. typical flow rates used in Australia are ± 1-2lt/min)

Practical Training Centre + (Ede)

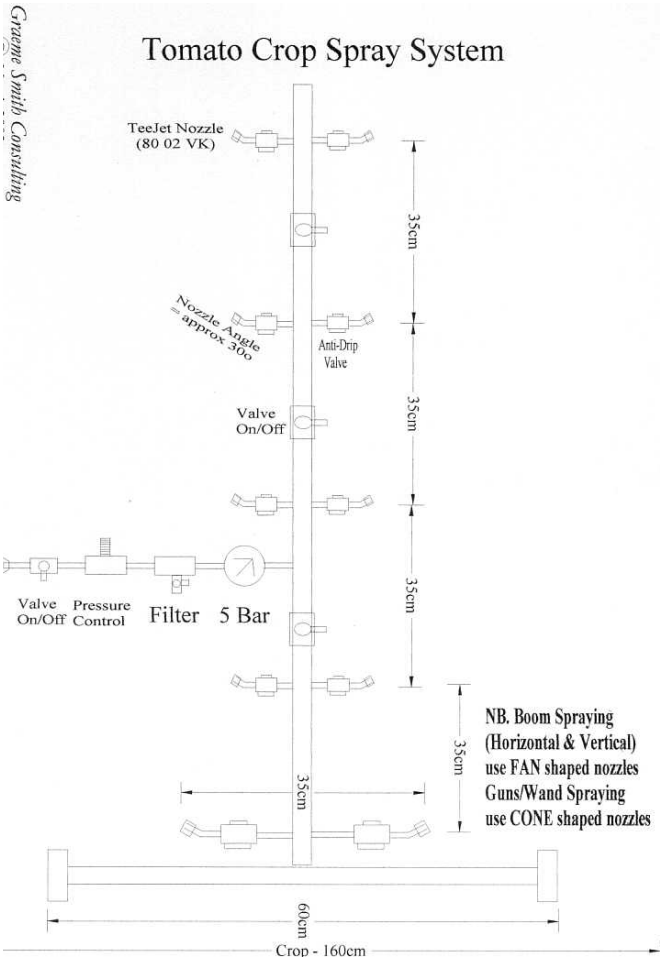
This centre in Ede (Holland) specialises in horticultural training (being close to Wageningen, the centre of horticultural research in the Netherlands).
PTC+ has purpose built greenhouses to demonstrate technology & put into action their slogan “Learn by Doing”.

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

The group completed the ‘Technical Management Course in Greenhouse Horticulture (computerised environmental control, plant physiology, substrates, water & fertiliser management, pest management, 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.

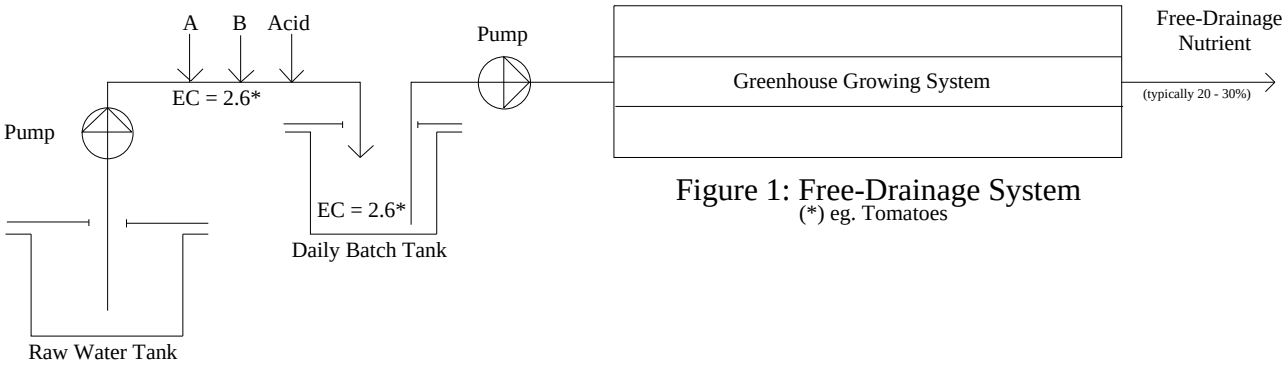


Figure 1: Free-Drainage System
(*) eg. Tomatoes

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.

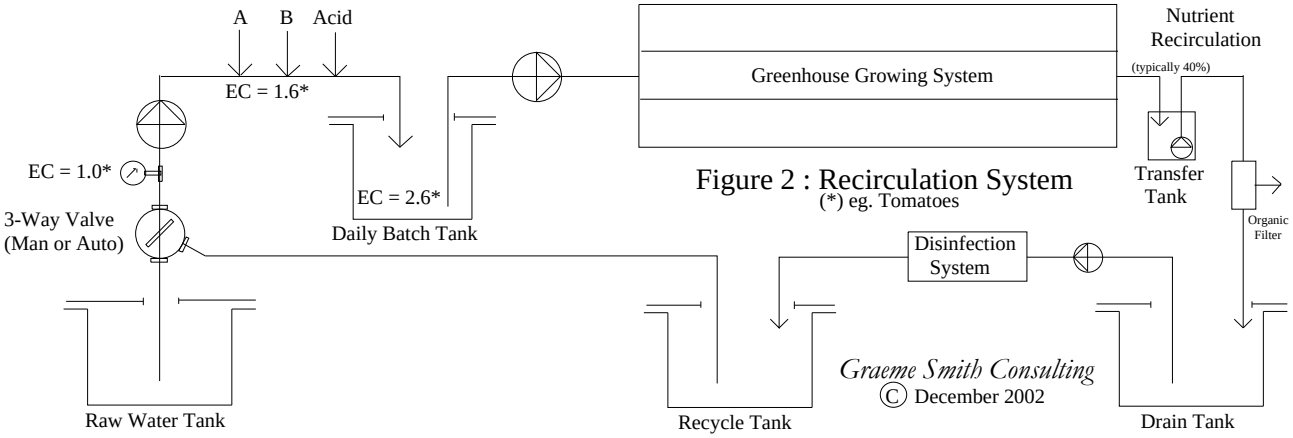


Figure 2 : Recirculation System
(*) eg. Tomatoes

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 60% 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. This code is intended (in part) to further minimise any impacts on the natural environment.

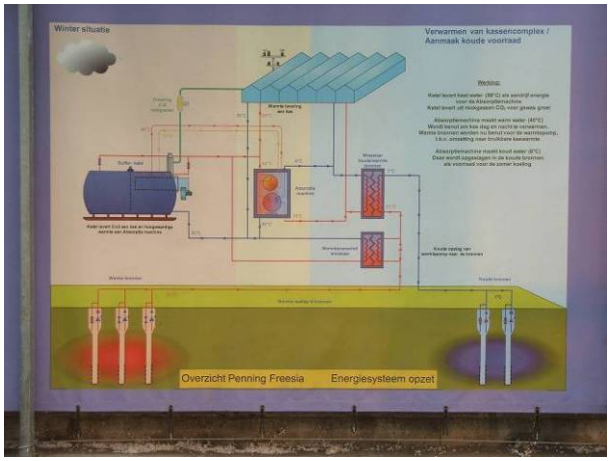
The knowledge gained has been part of the industry presentations (see technology transfer on page 21) to encourage grower adoption nationwide.

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 are 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

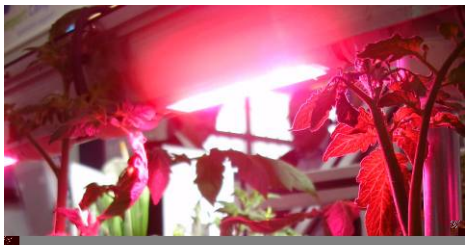
Also included was 2 days at Hortifair (NTV) at the RAI. This Expo is the worlds largest in the protected cropping industry and showcases the latest (existing, new & emerging) technologies.

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.

Hortifair is well known for showcasing innovative technologies for greenhouse growers, and this year there was a strong emphasis on energy conservation with PV Solar Cells integrated into glass panes

In addition, an increasing number of companies are releasing growing systems driven by LED lighting



Automation in the form of robots were regularly showcased to respond to the issues of system efficiency and labour cost

Glasshouse companies are offering various grades of glass to suit crop preferences for light transmission characteristics (e.g. direct vs. diffused light)

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).

2. closed greenhouse system with supplementary lighting

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

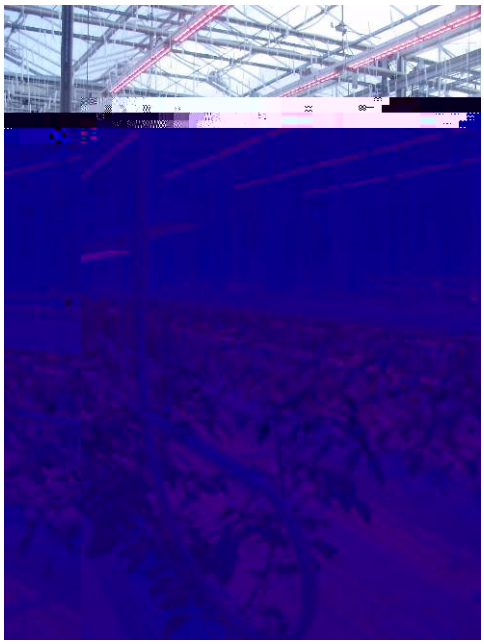
Wageningen UR (Bleiswijk)

This is another research centre funded by private enterprise to develop and assess new technologies and growing techniques. Ellly Nederhof (a NZ consultant) was on an 18 month contract to WUR to carry out a number of research projects.

One project was to assess efficacy and efficiency of LED lighting systems compared to standard HP Sodium horticultural lights.

They are trialling a range of LED types with various ratios of blue and red LED's, and various positions of the lighting systems in relation to the crop.

A surprising research outcome is that LED's are not very different in efficiency from standard horticultural lighting systems (approx 30% light & 70% heat).
The main difference is that LED's heat emanates from the rear (HP Sodium front), and they need to employ both fins and water-based cooling systems



It was also revealed that a minimum ratio of around 12% blue and 88% red LED's was required to meet normal plant lighting needs.

Other trials assessed crop benefits or antagonisms of moving greenhouse air from top to bottom vs. bottom to top

Hortiplan Moving Gulley System (MEER)

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

This system allows for innovative growing and marketing by producing up to 3 varieties in one growing hole (known as 'Triples')

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.

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, pest management and crop protection.

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

PTC+ has well developed training facilities that include classrooms connected to a glasshouse (divided into 10 different compartments for 10 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 and 2009 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 Training Centre for Controlled Environment Horticulture

- 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)

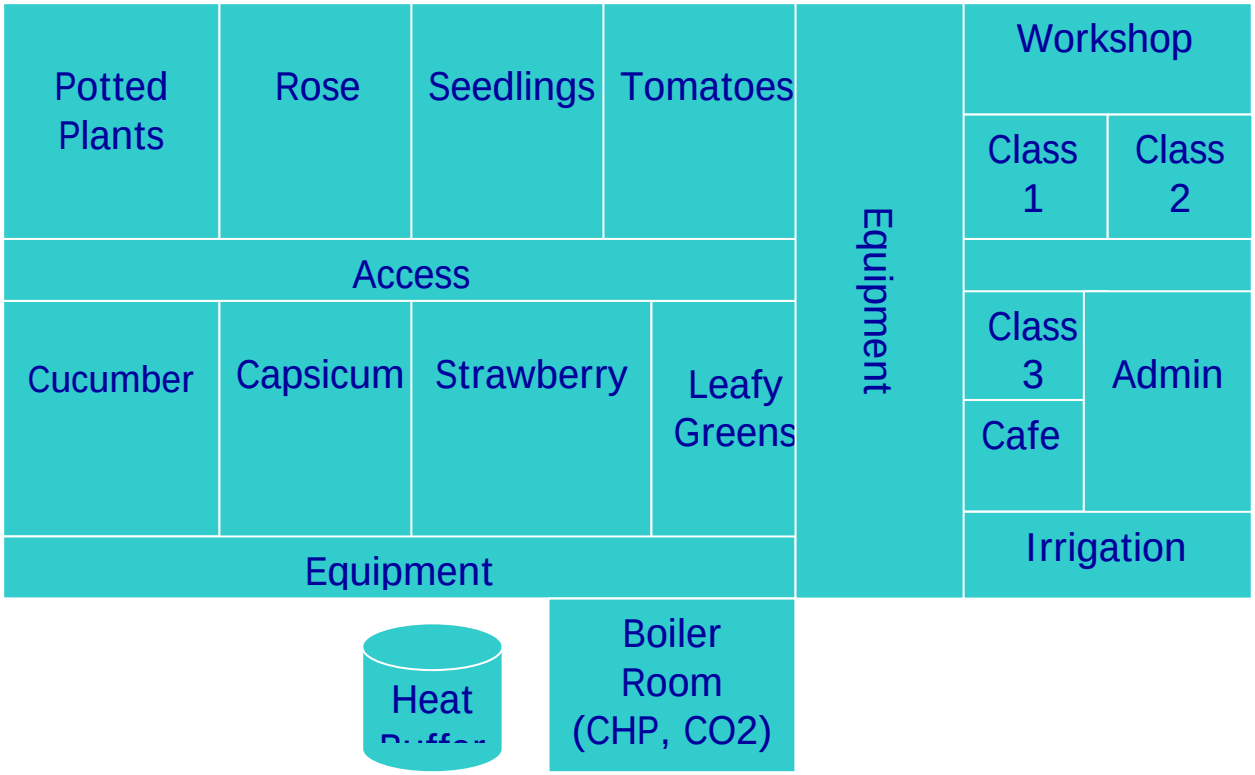
- Demonstrates best-practice growing techniques for Australian greenhouse crops

- 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, Asian greens, Aquaculture ++
- 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 Training Centre for Controlled Environment Horticulture 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 Training Centre for Controlled Environment Horticulture)



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.

A thank you gift was provided to all of the growers and company representatives of the enterprise that the group visited to show appreciation from the tour group, and also laid the groundwork for access on future tour visits.

Technology Transfer

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

Hydroponic Farmers Federation (HFF) Biennial Conference – Chisholm June 2010
Misc presentations to Victorian TAFE colleges – Shepparton & Burnley Jan – May 2010
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

AHGA European Greenhouse Study Tour 2009

'Soilless Australia' Vol 4/09 Published Dec 21st 2009

By Saskia Blanch

The October 2009 AHGA European Greenhouse Study Tour was like going to the Aladdin's Cave of Controlled Environment Horticulture (CEH). Particularly the enormous Hortifair expo in Amsterdam and the countless R&D 'Improvement' Centres, testing all the new products and ideas on display from the show. Intersperse this with dozens of hi-tech greenhouse visits and supplier demonstrations, Graeme Smith led us with ease from one jaw-dropping place to another.

The Netherlands has a very strong horticultural industry, supported by the government and tertiary education, supplying the rest of Europe, USA, Japan and beyond with fruit, vegetables and flowers.

To an Australian it was an incredible scale of operations, and the amount of willing and open communication exchange between growers, visitors, R&D centres, and the 5 star sales service from the allied trade. Our group of 12 elite Australian industry personnel asked lots of questions and discussed the Dutch replies. For two weeks we had the golden Graeme Smith tour, including five intense days of university-type training at the Practical Training Centre Plus (PTC+) at Ede, in climate control, crop protection, irrigation and fertigation calculation.

Among other things, we learnt for example about the importance of leaf temperature, over air temperature. Many growers will have fan and vent thermostats set on their greenhouse ambient temperature, highly dependent on the placement of probes and the questionable uniformity of the greenhouse atmosphere.

However, the sun hits a leaf first and then that heat energy goes into the atmosphere, through respiration and transpiration, for example. So reading the plant leaf temperature means you can anticipate plant responses sooner than the secondary ambient temperature.

Correcting the total environment according to leaf statistics, can prevent disasters. Cutting edge operations take measurements from many leaves within the canopy, as the placement and even angle of the infrared camera, will affect the reading. Leaf temperature is only one

of over 400 data inputs on a standard Priva Integra greenhouse climate computer controller, for example, that helps maximise net photosynthesis, and crop production.

Understanding how all these inputs interact, to steer a crop towards either generative or vegetative growth, was the objective of the PTC+ intensive technical management course in greenhouse horticulture, tailored to our AHGA group.

Energy Efficiency - Energy is an important production factor and large cost item in horticulture, especially in greenhouse horticulture, and even more so in the freezing cold Northern European winter. One of the most essential parts of the greenhouse is the heating unit. This unit ensures the correct growing temperature, so that the optimal crop production and quality can be achieved.

Warm Water Boilers - The most common system of heating glasshouses is the warm water boiler, fuelled by gas, light or heavy oil, and nowadays even green waste (biofuel). The heat is transported via a network of heating pipes or hoses to every corner of the glasshouse. The heat given off by the boiler is regulated by the climate computer, so that energy is only used if the crops demand it.

Co-generation, CHP & total energy systems Dutch glasshouses with a high electricity requirement often use a total energy installation. This installation, powered by gas, drives a generator which produces electricity. The cooling-water from the gas motor can be used to heat the glass house. Because the demand for electricity and heat is not always equal, a warm water storage tank is often used in Holland. The warm, cooling-water is stored in a well-insulated tank. When heat is later required, this water can then be used to raise that temperature.

Combined Heat and Power (CHP) systems, also known as cogeneration, generate electricity and thermal energy in a single, integrated system.

CHP is not a technology, but an approach to applying technologies. CHP is more energy efficient than separate generation of electricity and thermal energy. Heat that is normally wasted in conventional power generation is recovered as useful energy for satisfying an existing thermal demand, the heating and cooling of the building and water supply, thus avoiding the losses that would otherwise be incurred from separate generation of power. CHP systems provide three general categories of benefits—environmental, economic, and transmission and distribution.

In Dutch horticulture, co-generation refers to the system of selling the excess electricity generated back to the grid, and remarkably lately, this is where growers sometimes make more money than through the sale of their produce. The fluctuating world economic climate, can shift demand, and force us to diversify our income.

Sion Orchids Tour

Sion Orchids is a two storey, highly robotized, Phalaenopsis orchid glasshouse in the Westland's district, south of Amsterdam. Our group went to one of two locations at 30,000m2 & 50,000m2 each. The High Intensity Discharge (HID) lights glowed above the conveyer belts, as the automatic pot handling machines vision graded and colour sorted the divine potted plants that sell for up to AUD $300 each.

Cooling and heating

Phalaenopsis is a tropical plant that grows at a temperature of circa 28ºC. To stimulate the setting of more buds and to improve quality, another second growing area of 19ºC is needed. An incredible Dutch energy system enables Sion to both heat and cool, to maintain these two atmospheric temperatures requirements.

The innovative system used involves heat pumps and underground sources to store water, and to maintain its temperature, until needed. Heat pumps are an efficient means for low-level heating. The residual product, cold water, is stored in underground sources and can then be used in the summer to cool the greenhouses. This leads to the water warming up again. This water is pumped to other sources in the ground for use in the winter to heat the greenhouse.

Hi-tech lighting

The lighting installation at Sion Orchids is unique as the lamps can be dimmed. Controlled by indoor photometers, the shade cloth cover and the electronic lights always ensure that the same quantity of light falls on all the plants year-round. The greenhouse covering is made of Plexiglas and is as transparent as conventional glass, yet it allows much less warmth and cold to get through to the plants.

To optimise the Phalaenopsis climate, a system for dual ventilation through the glasshouse covering has also been installed. The ventilation system has been developed to allow the windows to be opened both from the ridge beam and from the girders halfway along the covering. To humidify the air, Sion uses Hygrofans to produce a more even cultivation climate.

Maximisation of space – 2 storey cultivation greenhouse

The Scion company has been adapted for multipurpose use of space on 70% of the surface area. For example, two cultivation layers have been set up over a single 6,500 m2. Also, the space under the roller containers (root zone) is used for the storage of 5 million litres of irrigation water.

Maximal benefit of automation

At Sion a mobile cultivation system with roller containers has been installed to almost entirely automate the cultivation process. Only four manual tasks are required throughout the entire growth and flowering cycle, which can all be done in the production hall, alongside the growing area(s).

Robots and cameras have taken over most of the work examining and sorting the flowers and plants, and distributing them accordingly. The ‘Plant Order System’ of conveyer belts and cameras, supplies plants in cultivation gutters and increases the employees’ efficiency and the utilisation level of the working space. Only their own cultivation expert has to go into the Sion greenhouse these days.

Space Age Protection Suits

Our group marvelled from the sidelines, in space age protector suits – protecting the plants, not us, from insects, virus, and bacteria unwittingly trespassing on our clothes and shoes.

So many destinations welcomed our group into large, highly serviced cafes & staff rooms, offering endless coffees and traditional Dutch treats like liquorice and pastries. Other's took us to lunch &/or opened their doors on their day off. The hospitality granted to us under Graeme Smith's introduction, was extremely gratifying.

Priva: Horticultural automation and building intelligence

We were swept off our feet at Priva head office in De Lier, one of the first CO2 neutral buildings in the Netherlands, constructed with many innovations in the field of sustainability, automation and efficiency. The green rooftop really impressed me.

Priva is a key player in the field of automated climate and process control, in both the Horticultural and Building Intelligence markets. Commercial, public and industrial building divisions, coupled with expertise in agribusiness (protected cropping), means there is a Priva computer installed somewhere in the world every 15 minutes. Indeed, the Prix Veuve Cliquot 2009 Award, better known as Businesswoman of the Year, was presented to Priva General Manager, Meiny Prins.

Priva Australian distributors, Powerplants and Hortworks directors, Carl van Loon and Marcus van Huyst joined our tour, including Hortifair and the Priva visit and delicious lunch(s). For more information visit www.priva.nl or www.powerplants.com.au

Networking

Barriers come down, friendships and connections are made, and the micro and macro elements of the Australian protected cropping industry came together in a dream.

Flamingo van der Meer was one of the most successful businesses we toured, who specialise in the reconditioning and supply of used horticultural materials and machinery. On display was more than 15,000m2 of equipment with worldwide guarantees, at less than half their original price.

Their website www.hortimat.com shows their professionalism and enormous range of greenhouse and growing equipment, from trolleys to seedling machines, to HID PL ballasts and Son T 600w lamps, by the pallet load.

LED Lighting trials by Dr. Elly Nederhoff

Long term AHGA member and conference guest speaker, Dr. Elly Nederhoff, kindly and enthusiastically showed us her LED Lighting trials vs. Son Agro 600w HPS at the leading research Institute in Wageningen UR in the Westland's.

Wageningen UR Greenhouse Horticulture develops and implements innovations for and in partnership with the horticultural industry. Up to a dozen clinical and scientific trials are always in operation, and growers, students, local associations, and manufacturers regularly visit to inspect the on-going results. If growers are dissatisfied with manufacturers' claims versus their results the Research Institute will run scientific experiments to clarify their questions.

For more information visit www.glastuinbouw.wur.nl

Rijk Zwaan demonstration seed trials, were proudly revealed by grower manager Harry Augustijin, in Steenbergen. Relatively small 7,000m2 under glass has 11 different segments

of tomato trials covering fine beef tomato, clusters, cocktail, classic round, intermediate loose plum middle and fine, to name but a few. Their growing system is coconut fibre or Rockwool slabs with 2.5 plants/m2. All plants are grafted 1:1 in a V-system with a CO2 buffer of 140 m3 under a movable screen with ribbons 1:10.

Harry takes detailed weekly performance records on each variety in several categories such as fruit weight, Kg/m2, # of fruits/m2, plant length, head size, leaf length, flowering truss length as well as brix levels. The cumulative average of each category is also calculated and compared, throughout the 45 week growing season.

AHGA Euro Tour in Summary

Each participant spoke of their appreciation for the networking throughout the AHGA European greenhouse study tour. They also realised they already possessed certain equipment on the farm, but now know how to use it and interpret the data. Together we discussed the continued importance of trying to improve efficiency, in so many different sectors and how a 1% advantage can make such a huge difference down the track.

We also gained appreciation for our abundant Australian energy supply of sunshine. We have 50% more light compared to the Netherlands, and 1% of light equals a 1% increase in production. Therefore Australia should be doubling Dutch production rates, not chasing them.

The benefits for Soilless Australia of attending this tour will be felt for years to come. The niche industry contacts, the increased flow of information and comprehension of our issues will deliver knowledge and technology to members.

The ultimate compliment for the success of the AHGA Euro Tour is the repeat business. Every year there are a some well known customers, anxious for more.

Budget

Macedon Ranges Travel Service		
	Air Travel, Accommodation & Insurance	$52,827
Practical Training Centre +		
	Specialist Course Fees	$23,325
Hertz		
	2 x Ford Transit Vans	$1,820
Fuel Stations		
	Hire Car Fuel	$642
Australian Geographic		
	Thank you Gifts (European growers & companies)	$409
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)	$1000
	Bank Processing & Foreign Exchange	$219
	Consultants Fee	$850
	Tour Advertising (industry magazines)	$460
	Total Tour Costs	$84,531

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 5, Strongly Agree x 7

I received suitable information prior to the study tour
Mostly Agree x 3, Strongly Agree x 9

Hortifair met my expectations
Mostly Agree x 3, Strongly Agree x 9

Grower visits met my expectations
Agree x 1, Mostly Agree x 2, Strongly Agree x 9

Transport arrangements met my expectations
Strongly Agree x 12

Accommodation arrangements met my expectations
Agree x 1, Mostly Agree x 1, Strongly Agree x 10

Tour leader met my expectations
Mostly Agree x 2, Strongly Agree x 10

I would recommend future study tours to other growers
Mostly Agree x 1, Strongly Agree x 11

Any general comments re this study tour

i would have like to have visited more greenhouses but understand difficulties with disease issues.(for me growers discussions is vital in gaining information)
Possible consider touring earlier in the season to see younger crops
From my perspective very profitable
Program went very well and good backup plans when things went astray (e.g. sickness)
Tour was an excellent focusing point for the present direction of intensive horticulture
Many thanks to Graeme for opportunity to visit a wide range of farms and development centres

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:

For introductions to European growers & locations

Roelf Schroeder	Rijk Zwaan Australia & NZ
Aart Slobbe	Mgr, Deruiter Seeds Australia
Marcus van Heyst & Carl van Loon	PowerPlants Australia

For European courtesies & support

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Albert Haket	Ludvig Svennson
Mariska Schellevis	Rijk Zwaan Holland
Harry Augustijn	Rijk Zwaan Holland
Elly Nederhoff	Wageningen UR
Henk van Tuyl	KUBO Greenhouse Projects
Stephan Stolk	Flamingo van der Meer
Eric Moor	Sion Orchids
Marianne Sneekes	Penning Freesia
Harry Brugman	Hortimax Europe
Marnie Prins	Priva Hortimation Holland
Ben van Onna	Senior Trainer PTC+
Herman Eijkboom	Trainer PTC+
Pete van Adrichem	Metazet Demonstration Nursery
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AUSVEG

Graeme Smith
Project Leader