

## The Challenge of Building a New Glasshouse and Embracing New Technology®

**Nick Cracknell**

Cracknell Tomatoes, 307 Lyell Highway Granton, Tasmania 7030 Australia

Email: nj.cracknell@bigpond.com

**My paper describes a project we undertook just over 1 year ago which has changed our whole view of growing tomatoes.**

### **BACKGROUND**

In 1980 we bought a glasshouse tomato business at Granton, a suburb 20 min. north west of Hobart. There was just under an acre of glasshouses.

We had the typical glasshouse found in Australia at that time; only about 2 m high at the walls and possibly 3½ m at the ridge (Fig. 1). We were growing tomatoes in soil and steam sterilised annually to destroy soil and root diseases.

Growers in Tasmania were only producing one crop a year in the 1980s and picking normally commenced early November and went through to the end of February. Financial necessity made us experiment at growing two crops a year and this is what we did for 28 years until January 2008. We would plant out in July and picked from November to the end of January with the second crop planted 1st week February and picked from April to June.

Originally all watering was done by hand. Dragging a 1-in. hose around the glasshouses, and would take about 8 h to get through our four blocks, either twice or three times a week. Very time-consuming and hard work. We very quickly installed a dripper system and fertigation was upgraded to an inline injector system. Later still we progressed to solenoids and a reasonably automatic system. It got us by.

Our poor old glasshouses were continually being repaired and patched up after each storm — which each year seems to be becoming more severe. We had often looked at the latest glasshouse structures that were beginning to appear but the financial commitment was something we shied away from. We would make do with what we had until retirement.

All this changed when our eldest son, Matthew, returned from working overseas. He was keen to join us in the business and it became obvious that to continue long term we had to modernise.

### **DECISIONS**

After many lengthy discussions we decided if we were going to rebuild we had to include all the latest and most up-to-date technology to make the business viable. We hired Graeme Smith Consulting Services and Graeme's assistance, guidance, and expertise have been invaluable.

When it came to selecting which technology was the most important we were only guessing but after much discussion with our consultant, we ended up with three lists:

- 1) Must Haves
  - a) Definitely a glass house — not plastic — which was an easy decision for us as we had always grown in glass
  - b) A good heating system
  - c) Climate control
  - d) Fertigation — plus good irrigation system
  - e) A good growing medium
  - f) Fans for air circulation
  - g) Water content meters
  - h) A good electrical system to support all the motors and pumps — and a back-up generator capable at least of maintaining fertigation, irrigation, and computer system in case of power failure
  - i) Scissor Lift trolleys from which to work
- 2) Should Haves
  - a) Thermal — solar screens
  - b) Hanging gutters
  - c) Fogging system
- 3) Could Haves
  - a) CO<sub>2</sub> enrichment
  - b) Closed water system, and some method of sterilization to allow water and fertiliser reuse

Although the costs of some of these items were frightening we decided to have everything except CO<sub>2</sub> enrichment and the closed water system as we felt we could possibly include these after 12 months.

## **BUILDING**

To save costs we project managed the whole construction.

The demolition began on 5 Feb. 2008. We put our faith with Faber Glasshouses to build a 4032 m<sup>2</sup> glasshouse, 72 m long, 56 m wide, by 5 m at the walls, and with two other companies, PowerPlants and Greenworks, to assist and provide all the technology and fit out (Figs. 1 and 2).

Faber built the glasshouse in about 6 weeks, and we were amazed how quickly it all came together. The fitting out of thermal screens, foggers, hanging gutters, heating, fans, plus crop support wires, and electrical wiring took another 7 weeks.

## **THE HEATING SYSTEM**

We had heard some horror stories about heating costs and with so many types of heating systems, we knew this decision would be absolutely vital for the long-term success of our business. After looking at various boilers we finally chose a bio-mass boiler manufactured in New Zealand by Morrow Engineering. It can be fueled by most types of wood waste. As we had access to sawdust and wood shavings we decided to use this for our fuel.

The boiler can produce upwards of 1.5 mw and is quite capable of heating up to 1 hectare if we expand in the future. The sawdust is tipped straight from the truck into a 20 ft shipping container and hydraulic rams create a moving floor. An auger feeds the sawdust on demand into the furnace and the heat created is then blown into the boiler where water is heated to the required temperature and pumped around the glasshouse.



**Figure 1.** The conventional old wooden glasshouses before removal.



**Figure 2.** The new glasshouse under construction.



**Figure 3.** Internal equipment being installed.

A series of pipes travel the perimeter of the house and are then fed up and down each of the 36 rows. The pipe-rail system comprises of around 7 km of pipe work and the radiant heat gives us temperatures of up to 24 °C at night if required. We have achieved this on nights of -2 °C.

Temperatures in the glasshouse are pre-set and a mixing valve automatically increases or decreases the amount of hot water from the boiler as required. The boiler has been pulled down on three occasions during the year to clean the tubes. A multi-clone dust extraction system ensures that dust emissions from the stack are kept to an absolute minimum.

Heating costs for the year will be less than \$25,000, which makes it an extremely cost-effective unit, when compared to gas, coal, or electricity. It works out to around \$2.70 per hour.

### **THERMAL SCREENS**

Thermal screens are by far one of the most effective energy- and cost-saving technologies in the glasshouse. They open when light is limited and close when excessive. Most importantly they also reduce heat loss, dew drop, heating costs, and help maintain a more constant and comfortable greenhouse climate both for the tomatoes and staff.

We appear to be saving at least 8 to 10 °C in heat loss at night which represents a huge savings in heating costs. Our screens are made from a very light aluminum and polyester material and their operation is fully computerised.

### **ENVIRONMENTAL CONTROL SYSTEM**

We have learnt that our new glasshouse has a very complex and dynamic climate. It heats up and cools down quickly and changes in humidity can be quite rapid. Powerplants recommended their Maximizer System which controls ventilation, heating, cooling, irrigation, and fertigation. Balancing all these various components has been quite a challenge. Obviously if you alter one area it can have a substantial effect on another. We have made plenty of errors but by the same token I have always believed that the best way to learn is by the mistakes we make.

### **GROWING MEDIA AND IRRIGATION**

We chose to use coco-peat as our growing medium as we had heard that this is a little more forgiving and easier to control moisture content than rockwool. Apart from early problems with a very high EC level we have found the coco-peat supported our plants well over the 11 months. The fertigation system ensures that the correct recipe is fed to each plant and adjustments to the EC and pH levels are made at various stages though out the life of the crop.

### **HANGING GUTTERS**

After growing in soil for 28 years this was one thing that I definitely looked forward to. Our gutters are 50 cm above the floor and so easy to work with when plants are small. No more back breaking bending for hours on end. The gutters were formed on site where a machine rolled them into a continuous run of 70 m. The coco-peat slabs fit neatly inside and a gentle 1 in 300 slope allows run-off to travel to the lower end of the glasshouse.

## FOGGING SYSTEM

To maintain the relative humidity we installed a fogging system which operates when levels fall below a set point — usually 60%.

At 800 psi pressure at each nozzle the fog is extremely fine and doesn't leave plants damp. The foggers also help to maintain glasshouse temperature at a reasonable level. If too hot the solar screens will close to shade plants and you can see the effect almost immediately.

## END RESULT

All this equipment had to be installed and commissioned in 7 weeks.

In just over 3 months from when the bulldozer arrived, we had our first plants out in the new glasshouse (Fig. 4).



**Figure 4.** The first crop of tomatoes in production.

We had our hands full — 8,500 plants were growing rapidly, already in flower and therefore requiring to be pollinated with stem vibrators 3 times a week, winding and pruning trusses to 5 tomatoes per bunch plus coping with all the new technology. After growing tomatoes for 28 years we had to adjust to a completely different method of growing:

- Balancing growth between generative and vegetative
- EC and pH levels requiring constant monitoring and adjustment gave us plenty of headaches
- We had to embrace not only the technology but the science of growing tomatoes

I think the biggest change we noticed at this stage was how quickly the plants responded to change — 56 days from planting we picked our first ripe truss of tomatoes.

We had set ourselves realistic targets for a first crop and I am happy to say we finished slightly ahead of our estimates. Our yield per square metre was around 45 kgs, which we are confident that we can improve substantially over the next couple of years.

The new glasshouse with all the latest technology means we have so much more control over the growing environment. By the same token you need to be far more alert and responsive to any changes that occur. It has been a challenge to say the least.

### **TECHNOLOGY TO COME**

For our second crop we will introduce CO<sub>2</sub> enrichment and hope to maintain levels at above 400 ppm, we should increase fruit weight and generally improve our plants. We are also looking to install a closed water system to capture run off, and after sterilisation we should be able to save water and substantially reduce fertiliser costs.

We now employ 2 full time and 8 casual staff which will allow us more time to concentrate on the technical aspects this year.

The excitement of a new facility has now diminished but our enthusiasm has been rekindled as we learn and embrace all the latest technology, and strive to produce the best quality vine-ripened truss tomatoes possible.