

Transitioning to protected cropping

What are the costs and benefits?



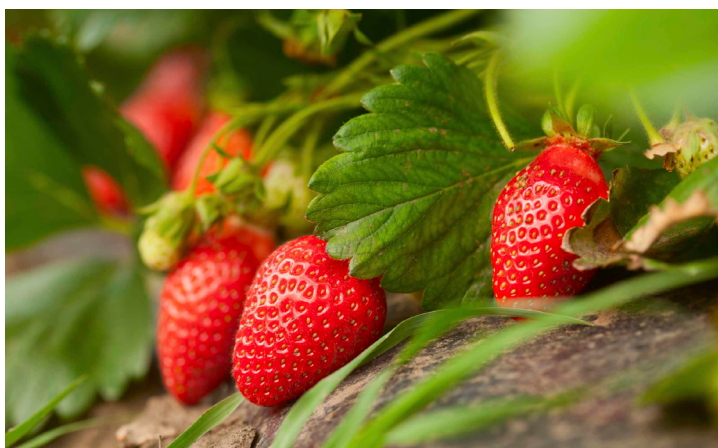
STRAWBERRY
INNOVATION

Why transition to protected cropping?

Our close proximity to Asian markets, a favourable seasonal supply window and a growing consumer preference for clean, safe food have assisted Australian strawberry growers and exporters to establish a foothold in Asian markets in recent years. But as we consider our current export strategies in the face of growing competition from Korea, Spain, Egypt and the US, it is arguably a good time to consider not just marketing strategies but also improvements in production that will enhance our presence in these export markets.

Whilst market access to China continues to be an important step to boosting our export potential (especially from WA and QLD), there is a risk that any early gains may prove difficult to maintain without consistent supply from the south-eastern states. Predictions of greater fluctuations in weather conditions and more extreme weather events also contribute to the challenges of in-field production; particularly with a sensitive crop like strawberries.

Transitioning to protected cropping may be worthwhile for interested growers to consider, particularly if looking at longer-term supply to export markets. Greater control over fruit quality, increases in yields and a wider choice of varieties offered through protected cropping are advantages that could enhance our competitiveness in these markets. Asian buyers are renowned for demanding consistent quality and supply, and are very specific about appearance and taste.



Protected cropping is a means of delivering this. It could also assist the south-eastern states to extend their season beyond mid- autumn and reduce the impact of domestic market fluctuations on building longer-term export supply.

In short, the major benefits of protected cropping and growing in substrate for strawberries, include:

- Increased yield (through increased plant density and effective use of IPM)
- Increased quality (through better nutrient control and protection from pests and inclement weather)
- Increased productivity (through faster growing times and lower labour costs)
- Extending the supply window over more favourable market conditions.

What do I need to think about?

Given that cost is a major consideration, it is important to consider the potential benefits that could be generated by a transition to protected cropping for production of strawberries, particularly in the south eastern states.

We compared field production with two popular protected cropping options (retractable greenhouses and tunnels) by constructing a simple case study over a one-hectare production area.

Although high-tech glasshouses are another potential protected cropping option for strawberry growers, we did not fully investigate this option for a number of reasons. These include:

- Significantly higher establishment costs (approximately \$250-\$350/m²)
- Variability of construction options (including heights, heating systems, and site preparation)
- Less severe climatic conditions in Australia compared to the production challenges that northern hemisphere producers face. Hence, the benefits of domestic supply in the winter months do not outweigh the significant capital establishment costs required for glasshouse production in comparison to field production.

Production data

Our analysis highlights the important factors for growers to consider when deciding whether to invest in tunnels or retractable greenhouses, over one hectare. That said, it is impossible to cover every variable, as each individual grower will have unique drivers of productivity, primarily to do with their location. Therefore, we need to make some assumptions and hold some variables constant to make the evaluation worthwhile. Whilst assumptions relating to key production drivers include, plant density, yield, waste and overpack; it does not account for other production variables such as variety or production expertise. Variety is obviously a key driver of productivity, but also highly variable and difficult to standardise in terms of performance in this study. Based on industry standards, Table 1 outlines the yield expected from the three production scenarios per square meter (m²) based on one hectare (10,000m²) of production. With assistance from industry sources, assumptions have been made regarding the planting density, yield and waste of each production method, per hectare (ha).

Table 1: Yield of strawberry fruit across three production scenarios

PRODUCTION TYPE	OPEN FIELD	RETRACTABLE GREENHOUSE / SUBSTRATE	TUNNELS / SUBSTRATE
Plant Density (no. of plants /ha)	65,000	82,000	76,000
Gross yield of large marketable fruit (kg/plant)	0.750g	1.10kg	0.950g
Gross yield of large marketable fruit (kg/plant (ha))	48,750	90,200	72,700
Downgraded/waste/shrink- age/loss %	30%	10%	10%
Net yield of large marketable fruit (kg/plant (ha))	34,125	81,180	64,980
Net yield of large marketable fruit (kg/m ²)	3.41	8.12	6.50
Net yield of large marketable fruit (punnet/m ²) + 10% overpack (25g)	12.41	29.52	23.63
Net yield large marketable fruit (punnet/ha)	124,091	295,200	236,291
Net yield of large marketable fruit (15 punnet trays/ha)	8,273	19,680	15,753

Fixed and variable costs

With the help of some ‘ball-park’ figures provided by suppliers, we have been able to estimate some of the key fixed costs of the protected cropping options considered. Variable costs are difficult to measure because of the customised nature of each individual farm, so assumptions have been included for both protected cropping examples and for field production.

The estimated cost data (provided in Table 2 below) can then be compared to the production data to achieve a cost comparison per punnet level for each production method.

Table 2: Fixed and variable cost data

PRODUCTION TYPE	OPEN FIELD	RETRACTABLE GREENHOUSE / SUBSTRATE	TUNNELS / SUBSTRATE
Land cost (\$)	22,239	22,239	22,239
Structure cost (\$) (tunnel/retractable greenhouse)	-	550,000	110,000
Fit-out cost (\$) (gutters, substrate, irrigation)	120,000	315,000	290,000
Total capital cost (\$)	142,239	887,239	422,239
Miscellaneous variable costs	89,927	180,400	144,400
Labour costs (plant, pick, pack)	84,382	140,516	120,508
Total variable cost (\$)	174,309	320,916	264,908
Total variable cost (\$) per punnet (see Table 1))	1.40	1.09	1.12



Photo: Tunnels at Hillwood Berries

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For fixed costs:

- Land is estimated at \$22,239 per hectare (\$9,000 per acre).
- According to Director of Business Development for Cravo Equipment, Bede Miller, structural costs for retractable greenhouses can range from \$30/m² to \$70/m² depending on which retractable production system is appropriate for the crop and market requirements. We nominated \$55/m² or \$550,000/ha to cover framework and footings, covering, controller, associated electrical and all associated construction costs.
- Haygrove Australia stated structural costs for tunnels can range from \$7m² to \$12/m² depending on the wind ratings and other site dependent factors. As such, we have assumed \$11/m² or \$110,000/ha to cover the cost of framework and coverings, all labour and associated construction costs.
- Fit-out costs for field production are related to irrigation and land preparation costs only.
- Fit-out costs for both retractable greenhouses and tunnels can vary enormously according to the level of sophistication involved. For this study we have included gutters (slightly more for retractable where double gutters are often used), substrate, table tops and the fertigation and irrigation set-up.

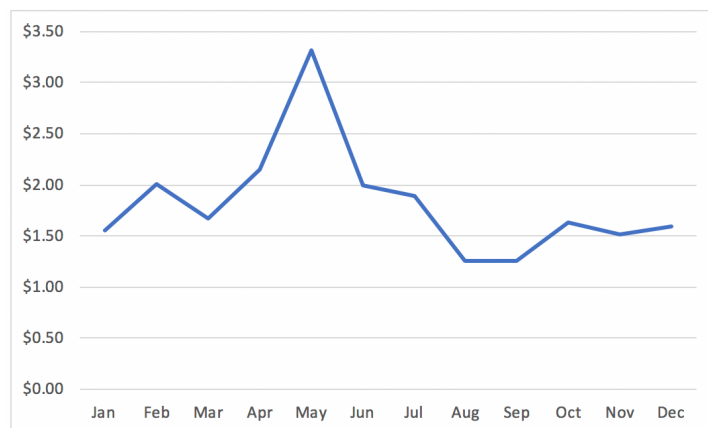
For variable costs:

- All variable costs for field production calculated per QDAF Agrilink article “Economics for Strawberry production” and adjusted for inflation and increased volume *i.e.* *this example estimated labour costs at \$36,800 for 1 ha, producing 90,000 x 250g punnets. Adjusted for inflation and increasing the volume to 124,091 x 250g punnets, this figure is now \$84,382 for 1ha of field production.*
- Miscellaneous variable costs for both tunnels and retractable production estimated at approximately \$2.00/kg of large marketable fruit, within specification. This is based on industry estimates ranging from \$1.80 to \$2.20 per kilo of marketable fruit.
- Labour cost for tunnel production is based on field costs, less an estimated 25% due to savings in harvesting at waist level, packing in field and less sorting and handling costs. Labour costs for retractable tunnels is estimated to achieve a 30% saving on field costs, due to the ability of labour to cover a larger area under a single roof structure.
- Freight or agents’ commissions are not included in variable costs.

Extending the supply window

Another important consideration is the ability of protected cropping to extend supply beyond the seasonal field production supply window, thereby supplying domestic markets when sales prices are traditionally higher.

Figure 1: Average price (\$) per punnet from Melbourne Market 2013 - 2018



*Sourced from Data Fresh, based on Melbourne Market estimated average wholesale sales prices only and does not include prices of fruit sold to larger chain-store retailers.

Figure 1 shows average weekly wholesale sales prices in the Melbourne Markets, less 12.5% commission, averaged per month from July 2013 to May 2018. Unsurprisingly, the months of April, May and June are the peak of the season whereas August and September consistently represent the lowest prices.

What are the benefits?

Based on the sales data, we looked at the effect protected cropping has on extending the seasonal supply window. The data in Table 3 show that by increasing more of the supply into April and May (*i.e.* 25% of the total crop compared to only 4% over that time period in the field), sales revenues could increase by over 35%, in addition to the gains in yield. In this exercise, Table 3 also shows that the gross margin percentage is highest in the tunnels, primarily due to the lower structural cost calculated for the benefit of the study *i.e.* compared with tunnels, an additional \$40K per annum is required under retractable greenhouses.

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It is important to note, this comparison is based on the assumptions identified above and requires interested growers to undertake their own due diligence thorough investigation of costs and key production drivers for their business, including supply-chain influences such a freight and marketing costs and unique growing conditions.

When evaluating the various production options available, it is worth considering the advantages of each option, according to your own individual location, expertise and return on investment required. As a guide a summary list of some of the advantages of each option is presented in Table 4.

Overall, this investigation demonstrates the benefits protected cropping could have on the bottom line, through the key drivers of increasing yield, reducing waste and extending the supply window.

Protected cropping offers an option towards a more efficient method of production that supports future growth. Whilst the above analysis is simple in its approach, it highlights some of the important components of production that need careful consideration prior to proceeding with any commitment to invest. It is recommended that individual growers seek professional advice in making decisions on changes to their production system, and tailor future investments to individual business goals.



Table 3: Change in seasonal supply

MELB MARKET PRICE AVERAGE			OPEN FIELD			RETRACTABLE GREENHOUSE / SUBSTRATE			TUNNELS / SUBSTRATE		
Average Return \$	Per 250g Punnet Large	Per 15 Punnet Tray	% of Crop	Volume (15p Trays)	Revenue (\$)	% of Crop	Volume (15p Trays)	Revenue (\$)	% of Crop	Volume (15p Trays)	Revenue (\$)
Jan	\$1.56	\$ 23.33	10%	827	19,300	10%	1,968	45,913	10%	1,575	36,752
Feb	\$2.01	\$ 30.18	10%	827	24,963	10%	1,968	59,386	10%	1,575	47,536
Mar	\$1.67	\$ 25.05	14%	1,158	29,007	15%	2,952	73,934	15%	2,363	59,181
Apr	\$2.15	\$ 32.19	4%	331	10,651	15%	2,952	95,019	15%	2,363	76,058
May	\$3.31	\$ 49.67	0%	-	-	10%	1,968	97,742	10%	1,575	78,239
Jun	\$2.00	\$ 29.97	0%	-	-	0%	-	-	0%	-	-
Jul	\$1.89	\$ 28.30	0%	-	-	0%	-	-	0%	-	-
Aug	\$1.25	\$ 18.82	0%	-	-	0%	-	-	0%	-	-
Sep	\$1.25	\$ 18.79	0%	-	-	0%	-	-	0%	-	-
Oct	\$1.64	\$ 24.57	12%	993	24,391	10%	1,968	48,353	10%	1,575	38,704
Nov	\$1.52	\$ 22.75	20%	1,655	37,634	15%	2,952	67,145	15%	2,363	53,747
Dev	\$1.60	\$ 23.97	30%	2,482	59,488	15%	2,952	70,758	15%	2,363	56,638
Total/Ave.	\$1.82	\$ 27.30	100%	8,273	205,434	100%	19,680	558,249	100%	15,753	446,855
Total Variable Costs (\$)			183,399			396,331			300,799		
Gross Margin (\$)			22,035			161,919			146,056		
GM %			11%			29%			33%		

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Table 4: Advantages of each type of production system

<p>OPEN FIELD</p>	<ul style="list-style-type: none"> • Lowest set up cost • Less sophisticated • High light exposure • High pollination rates • Firm fruit with high brix levels (when weather is ideal) • Perceived as more natural by consumers
<p>RETRACTABLE GREENHOUSE / SUBSTRATE</p>	<ul style="list-style-type: none"> • Ability to increase sunlight and prevent excessive transpiration • Can reduce the humidity through both horizontal and vertical ventilation • Easier to control chill-hours • Pollination less restricted • More control over plant vigour and ability to optimise balanced plant development • More efficient harvesting at waist level supporting OHS and reducing harvest costs • More consistent supply keeps pickers employed • Less sorting and double handling of fruit with lower wastage & supporting in-field pick and pack • Reduction in foliar and fungal diseases • Greater control of plant nutrients • More water and nutrient efficient directing usage to plant demand • Can construct in regions with lower land values • Automated retractable roof closure and opening
<p>TUNNELS / SUBSTRATE</p>	<ul style="list-style-type: none"> • Lower set up cost. Semi-permanent structures that can be easily removed and installed into other areas/regions as necessary • Relatively low tech and therefore easier to learn to operate. Climatic variables can be adjusted by venting • Usually no planning permit required to build • No three-phase power required to operate but options for roller venting & doors are available

Acknowledgement

This information was developed by Karl McIntosh for the Strawberry Innovation project (August 2018). Further resources on production of strawberries under tunnels and with substrates is available at www.strawberryinnovation.com.au