RMCG

NOVEMBER 2022

Coir and its alternatives

Hort Innovation
Strategic levy investment

RASPBERRY AND BLACKBERRY FUND

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This project has been funded by Hort Innovation using the raspberry and blackberry research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

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Coir use - a risk for hydroponic producers?

Over the past 25 years, the use of coir as a hydroponic substrate has increased internationally. In Australia, coir has been used for vegetable and flower crops for some time.

Currently, most *Rubus* hydroponic producers are using coir as the preferred growing medium. It produces good results and it is considered the most environmentally sustainable option.

However, transportation is a large portion of the cost of substrates. Coir is largely sourced from India, Sri Lanka, Indonesia, the Philippines and other tropical coconut-growing regions.

Cost to get coir on-farm, delivery timeframes and reliability of supply have all experienced large changes in the last 3-4 years.

The *Rubus* industry's reliance on coir presents an increasing risk, particularly as it is competing with other industries for the substrate.

RMCG conducted a national and international scan to identify previous, current and emerging alternative growing media. Growers, substrate producers and industry representatives contributed industry insights.

The identified substrates were compared using a SWOT analysis (strengths, weaknesses, opportunities, threats).

Further analyses of coir and the preferred option included:

- comparative gross margin
- economic threshold analysis
- high level emission assessment.

What substrate characteristics are important?

What physical and chemical characteristics are important?

water holding capacity

air holding capacity

nutrient holding capacity

What logistical characteristics are important?

cost

weight of the medium

sustainability of supply - availability, consistency of supply, low carbon equivalent emissions

"sustainable recovery" of spent materials - recycling / reuse options

Other desirable physical characteristics

- compressible - saves space, decreases transport costs
- mix of particle sizes - coarse, medium and fine
- durable - low rate of decomposition (e.g. over 3-4 years of use)
- pH range - 5.5 - 6.5, or able to be buffered to within this range
- nutrients in solution are available to plants - substrate does not encourage nitrogen drawdown
- weed, pest and disease free - or ability to be sterilised

Other desirable logistical characteristics

- locally produced - preferably close to berry production regions
- good insulation properties - to protect plant and roots from temperature extremes
- low carbon emissions compared to coir

Which substrates?

Currently used

- coir (coconut fibre)
- rockwool
- perlite
- vermiculite
- pine-bark.

Previously used

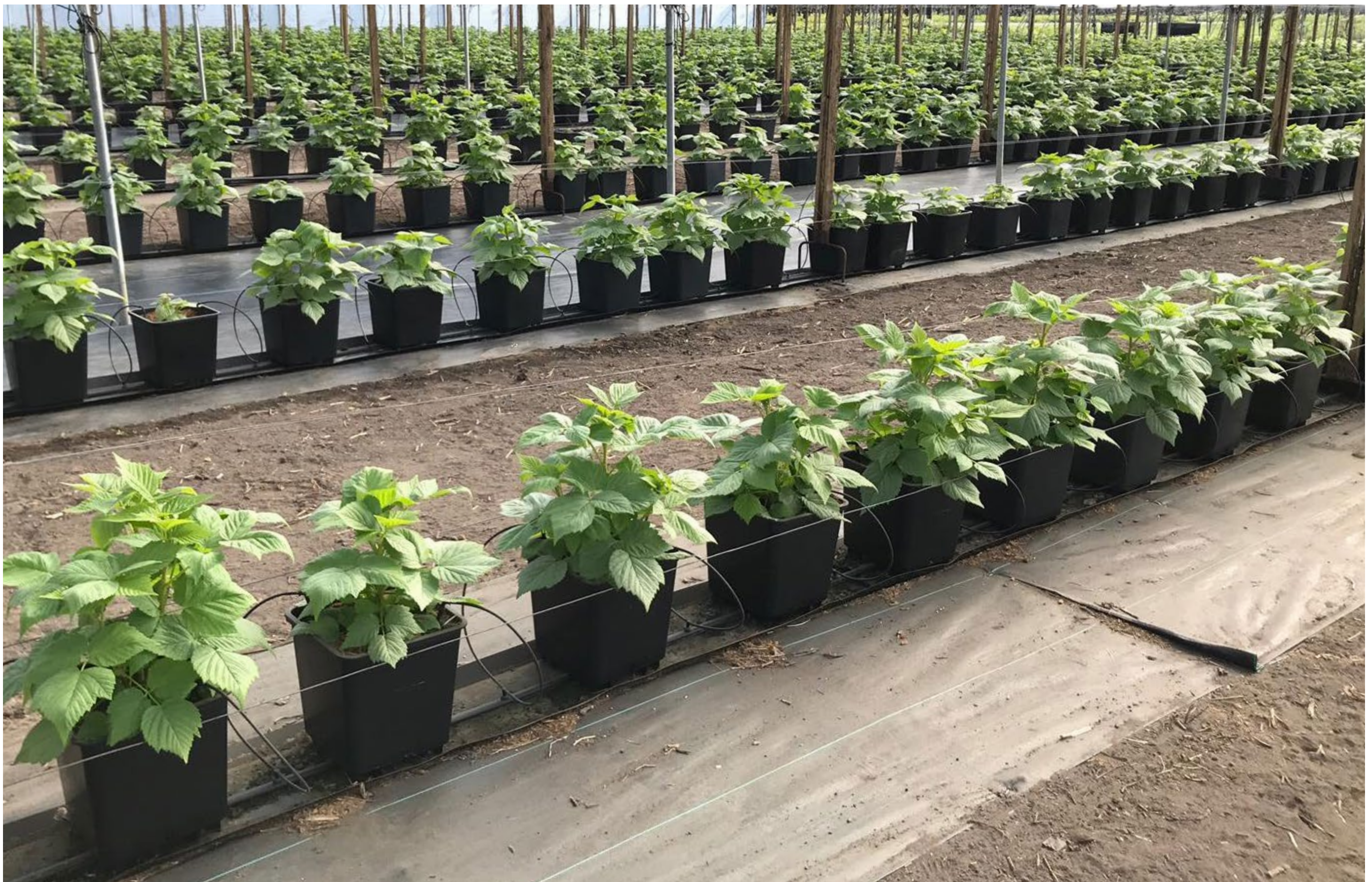
- peat (not considered here as it is a non-renewable resource)
- sawdust.

Emerging

- rice hulls
- wood fibre substrates.

One Dutch, one US and two German companies are producing wood fibre substrates.

Two Australian companies (one in Victoria, one in Queensland) are in proof of concept and early commercialisation phases with wood fibre substrates.



SWOT analysis - coir

STRENGTHS

- Excellent water-holding capacity
- Sufficient air-filled porosity
- Biodegradable (can be composted)
- Low bulk-density
- Can be used as stand-alone substrate or mixed with others
- Can be compressed up to 6x its normal state size – excellent for transportation
- Renewable material (produced from coconut husks)
- Various particle sizes produced from coir – both pith and chips.

OPPORTUNITIES

- Scope for increased re-use of spent coir substrate within production system – mixing with fresh substrate in *Rubus* crops. Spent strawberry coir substrate could be then used in *Rubus* crops (pending root separation, sterilisation).

WEAKNESSES

- Produced in Asia – must be shipped to Australia and transported from the port of entry to *Rubus* growers (anecdotal information suggests up to 50% of the cost to growers is in shipping in 2022)
- Shipping costs are currently expected by industry to continue to increase
- High cation exchange capacity - requires 'buffering' (with calcium nitrate) to displace large amounts of bound sodium ions to ensure it is a neutral substrate
- Variable quality
- Perceived high costs of handling/recycling spent coir
- Increasing competition for coir from other hydroponic industries.

THREATS

- May pose a biosecurity risk as coir is imported
- Increased competition from other hydroponic industries for coir
- Shipping/supply chain disruptions leave *Rubus* industry at severe risk
- Increasing timeframes of supply – in 2019 it took approximately 9-10 weeks from order to delivery on-farm, in 2022 this is now 6-7 months.

Substrate comparison

	Coir	Wood fibre
Physical properties		
Water holding capacity	excellent (~40%)	good (20-25%)
Air-filled porosity	good (13-28%)	high (30-35%)
Mix of particle sizes	yes	coarse
Weight	light	
Compressibility	6x	1.4x (low)
Insulation properties	good	good
Chemical properties		
Nutrient holding capacity	good - high CEC - requires "buffering"	good (lower CEC than coir)
pH range	6.0 - 6.8	5.0 - 7.5
Degradation rate	low	not yet known
Other properties		
Useable lifespan for *Rubus* production	3-4 years	no data yet
Consistent quality	variable depending on source	consistent within each type of wood and manufacturing process
Weed, pest, disease free	yes, need import phytosanitary certificate	sterile, as heated during manufacturing
Able to be sterilised	yes	yes, via composting
Sustainability of supply – availability, consistent	variable, increasing competition & shipping times	dependent on timber supply
Transport and costs		
Cost (relative to coir)	increasing due to other hydroponics industries use	approx. $130/m3, ex works
Locally/ Australian made	no	yes
Transport costs	high	lower than imported products
Recycling		
Recycling options	yes, biodegradable, compostable	yes, biodegradable, compostable
Reuse options	yes	yes
Recycling/reuse costs	high (if in plastic) moderate if no plastic	high (if in plastic) moderate if no plastic
Renewable resource	yes	yes
Other	can be dusty, can heat up during transport in compressed form	

Rockwool	Perlite	Vermiculite	Pine bark	Sawdust
Physical properties				
good	low	too high	variable depending on grade	variable depending on grade
good	high	low		
uniform	uniform	uniform		
light		light		
no	no	no	negligible	negligible
good	no data	no data	good	good
Chemical properties				
moderate	none	good	moderate	moderate
high – requires adjustment	neutral	alkaline	acidic – requires pH adjustment	variable depending in timber source
n/a	n/a	n/a	higher than coir	higher than coir
Other properties				
very long lasting	very long lasting	very long lasting	acceptable, depending on grade	acceptable, depending on grade
yes	yes	yes	variable depending on source	variable depending on source
yes	no data	yes	may contain weed seeds, depending on production process	yes
yes	yes	cannot be sterilised	yes, via composting	yes, via composting
easily available	increasing competition	good	easy to source in all Australian production regions, but may change	easy to source in all Australian production regions, but may change
Transport and costs				
relatively high	relatively inexpensive	relatively inexpensive	currently relatively cheap	currently relatively cheap
no	no	no	yes	yes
high	high	high	lower than imported product	lower than imported product
Recycling				
no – to landfill	no – to landfill, (all substrates containing perlite)	no data	yes, biodegradable, compostable	yes, biodegradable, compostable
yes	no	limited	yes	yes
n/a	n/a	n/a	high (if in plastic) moderate if no plastic	high (if in plastic) moderate if no plastic
no (made from mineral/rock)	no (made from volcanic glass)	no, requires mining	yes	yes
	dust – human health issue; prone to algal growth	needs to be mixed with other substrates		

Economics - assumptions

These assumptions were made after consultation with growers, including those trialling wood fibre substrate(s):

- yield of 1.5 kg/plant, 2 tips/pot - no yield difference between coir and wood fibre substrates
- 7 L pot size
- $0.50 to plant and place substrate
- 4 yrs effective plant life / growing cycle*
- 125 hrs labour/ha for substrate removal and cleaning every 4 yrs
- $1.50 / 7 L pot of coir, delivered on farm
- $130 / m^3 of new substrate, plus $50 / m^3 for transport every 4 yrs^
- $2,500 / ML fertigation costs for both substrates
- $300 / ML irrigation pumping costs+
- $5 / m^3 for organics processor collection cost (will vary with distance)#

Not examined:

- long cane production

Footnotes

* it is noted, but not modelled, that plant life is usually 2 yrs in northern production areas

^ transport cost of fresh substrate - wood fibre production assumed within 100 km of farm

\+ wood fibre substrate may require increased frequency of irrigation but in shorter bursts, overall variable costs are assumed to be comparable

\# cost is only to take substrate away, not pasteurise and return to farm

Economics - gross margin

Coir gross margin

64.4%

Data and assumptions

New substrate gross margin

64.5%

negligible change in gross margin (64.4% vs 64.5%)

Gross margin % =

$$\frac{\text{net berry sales (\$) - direct, variable costs (\$)}}{\text{net berry sales (\$)}}$$

VARIABLE COSTS

- substrate
- plants
- nutrients
- pest and disease control
- beneficials (soil amendments)
- irrigation running costs
- water cost
- packing and transport
- fuel and repairs (tractor/ plant)
- casual labour
- levies

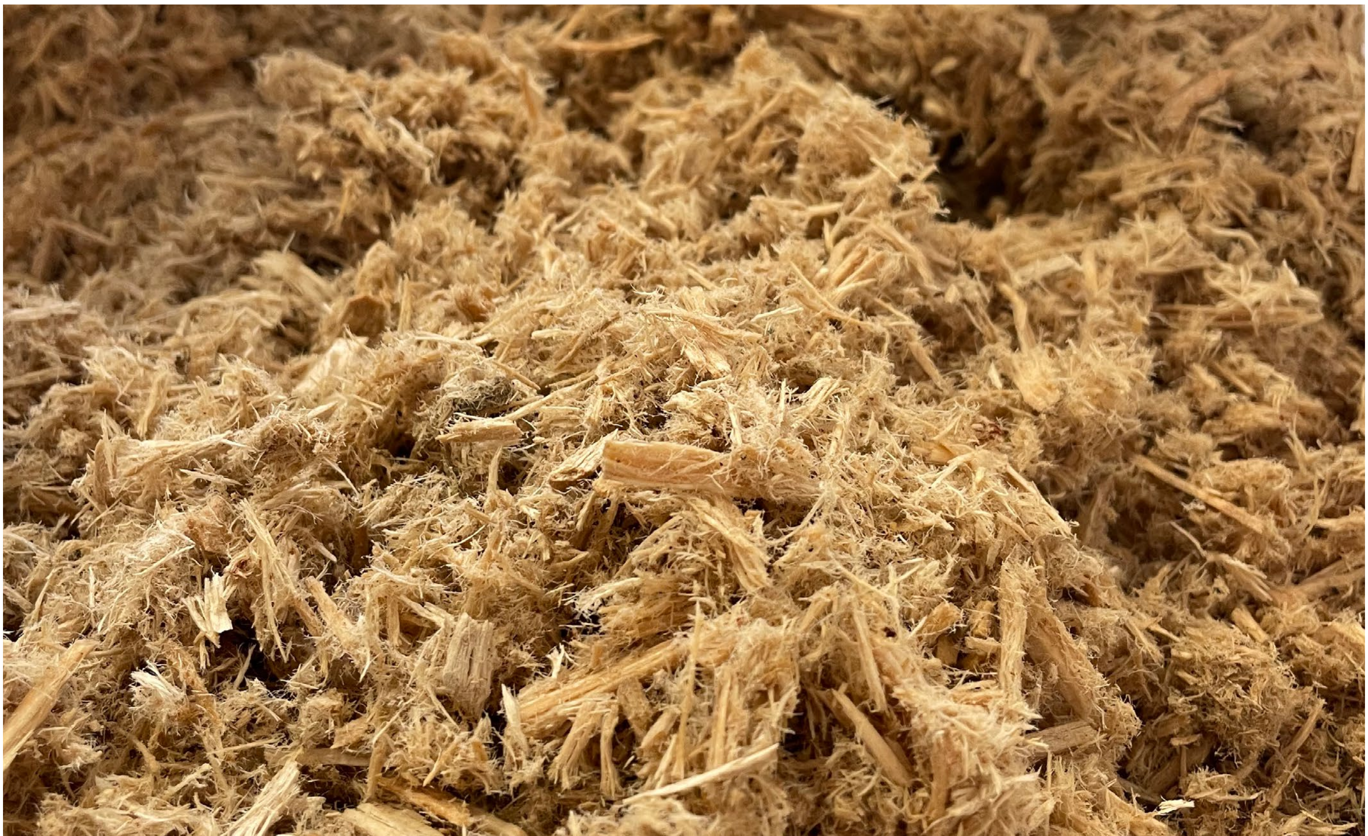
Economics - threshold analysis

A threshold analysis was conducted to investigate the effects of variations in substrate costs, berry yield and on the gross margin %.

Based on the analysis, a *Rubus* production system could withstand a substrate price of up to $5 as long as there were no other changes in berry price and variable costs and/or no additional fixed costs were incurred when using a wood fibre based substrate.

Effect of an increase in substrate price on gross margin % (compared to coir)

	Substrate price ($/unit)							
	$1.50	$2.00	$2.50	$3.00	$3.50	$4.00	$4.50	$5.00
Change to gross margin % compared coir	0%	0%	-1%	-1%	-2%	-2%	-2%	-3%



Effect of changing berry and substrate price on gross margin %

Berry price ($ / punnet)	Substrate price ($/unit) $1.50	$2.00	$2.50	$3.00	$3.50	$4.00	$4.50	$5.00
$3.00	-36%							-39%
$3.50	-18%			Net loss (compared to coir)				-21%
$4.00	0.3%							-3%
$4.50	18%							15%
$5.00	37%			Net gain (compared to coir)				34%
$6.50	92%							88%

Effect of changing yield and substrate price on gross margin %

Yield (kg / ha)	Substrate price ($/unit) $1.50	$2.00	$2.50	$3.00	$3.50	$4.00	$4.50	$5.00
8,000	-4.5%							-1.5%
9,000	-3.7%			Net loss (compared to coir)				-0.6%
10,000	-2.8%							0.3%
11,000	-1.8%							1.3%
12,706	-0.3%							2.9%
13,000	0.01%			Net gain (compared to coir)				3.2%
14,000	0.9%							4.1%

Conclusions

The project findings demonstrate that wood fibre substrates most likely present a great opportunity for *Rubus* growers to diversify their substrate use. Further development and refinement of the substrates and their use as well as regional production options (circular economy) will be required, along with production, economic and emission assessment data collection and analysis.

RECOMMENDATIONS

- Conduct replicated trials (controlled, larger-scale, long-term) for identified alternative substrates, i.e. various wood fibre substrates, including:
    - different substrate mixes (e.g. 50:50, 75:25 ratios of coir or other organic substrate to wood fibre)
    - different geographic areas, differing methods of production (e.g. long-cane, different container sizes, etc.), different management practices.
- Conduct a feasibility assessment of setting up wood-fibre production facilities to supply substrate to *Rubus* producers in each production region; consider opportunities to supply other hydroponic crop producers and the nursery industry.
- Collect economic data as part of any trials.
- The costs of managing spent substrate (recovery, re-use, recycling) must be built into any future gross margin tools used to assess viable alternative substrates to coir. Emission impacts should also be considered.

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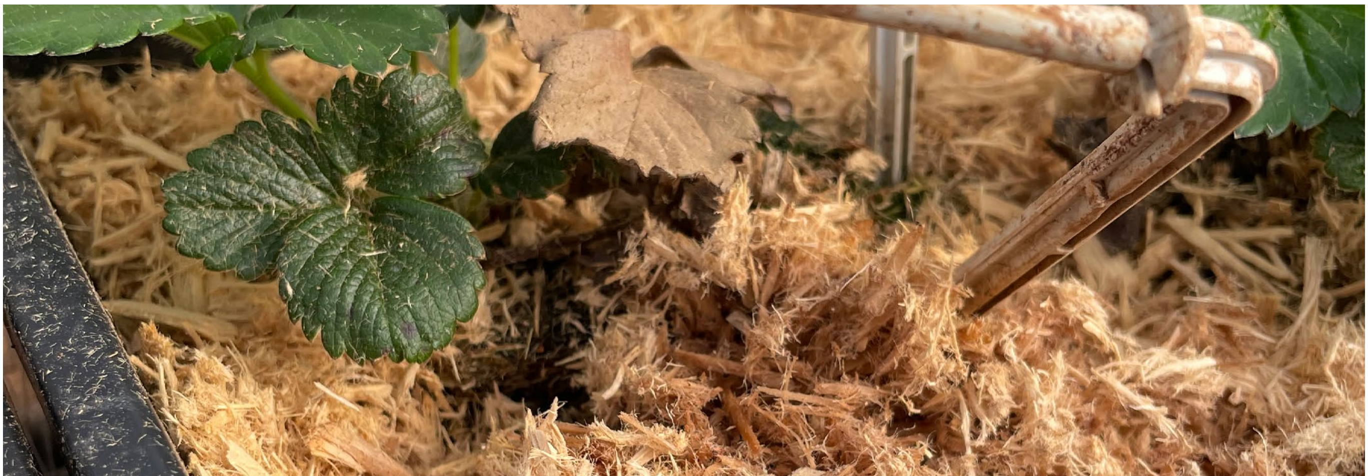

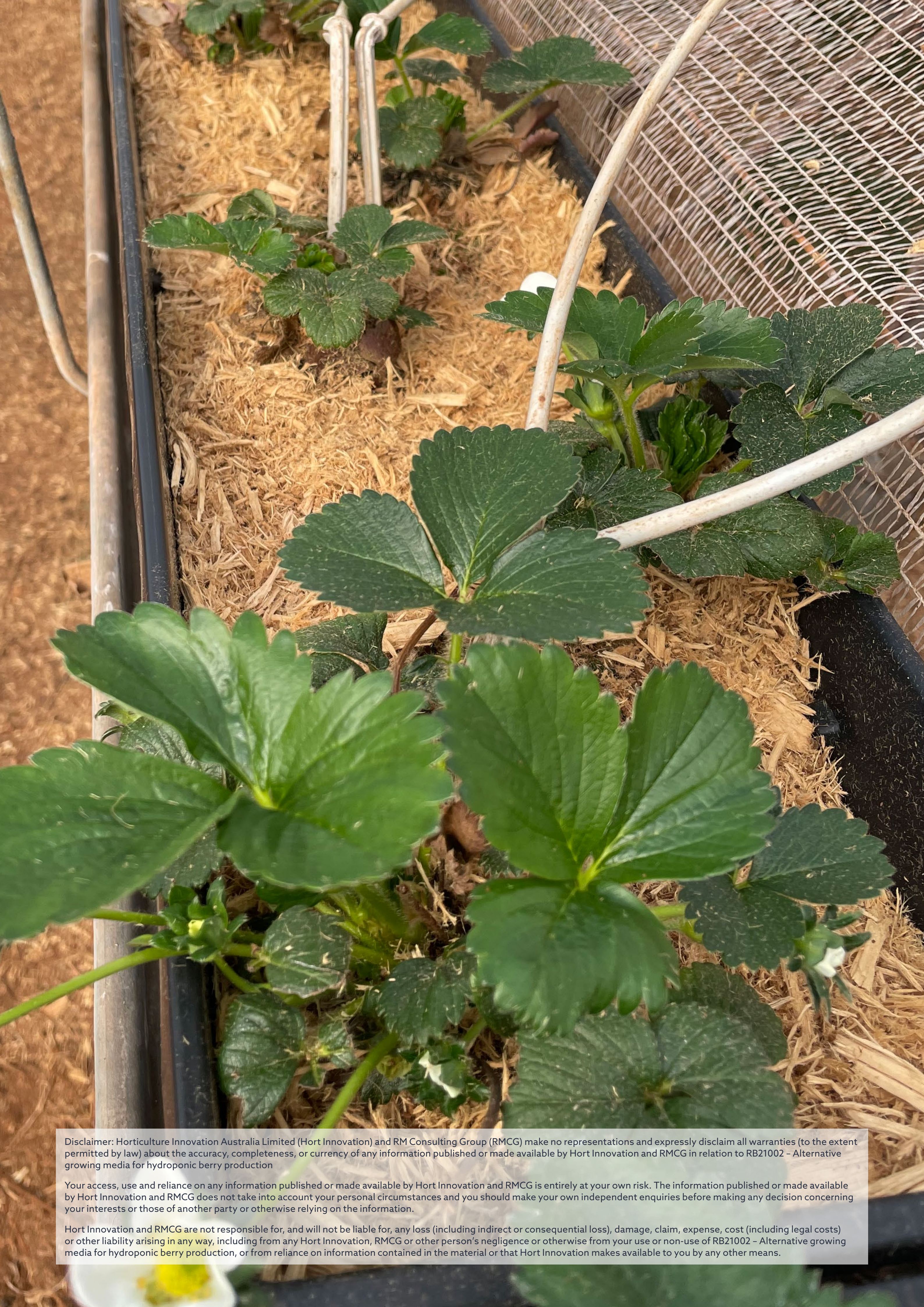

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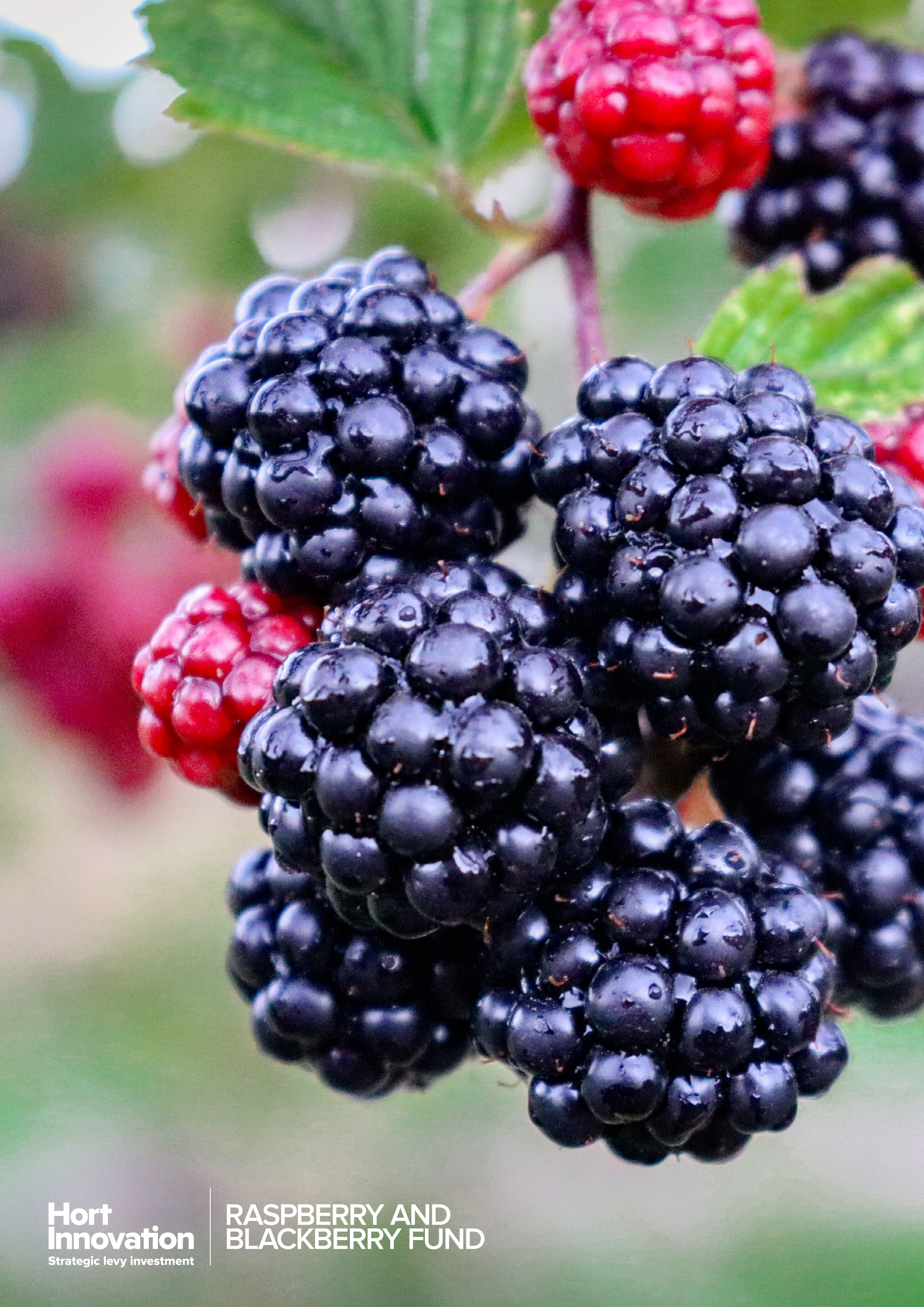
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