vegenotes

ISSUE 20
2010

Opportunities and challenges faced with emerging technologies in the Australian vegetable industry - Soilless Production Systems.

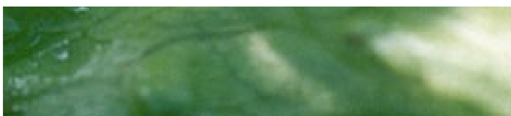
Project no: VG08087

The growth and competitiveness of the vegetable sector is dependent on the development and application of innovative solutions such as Soilless Production Systems.

Active surveillance of pests and diseases: A scoping study in vegetables.

Project no: VG09099

Options for establishing effective passive surveillance models to enhance early detection of pest incursions and improve market access for Australian produce.



Opportunities and challenges faced with emerging technologies in the Australian vegetable industry - Soilless Production Systems

Image 1

Intrduction

New technology is providing a range of breakthroughs in protected horticulture, yet Australia is severely lagging behind the Netherlands, US, UK and Canada when it comes to implementation. The international divide can be illustrated by comparing domestic vegetable production with figures from the UK; the UK grows four times more vegetables under protected cropping practices than Australia, while the latter is 1.3 times more productive in field vegetable cropping.

	UK	Australia
Total area used (outdoors and protected)	118,439	119,610
Protected area (ha)	680	673.6
Protected production ('000 tonnes)	247.4	60.1
Field production ('000 tonnes)	2,339.7	3,177.4
Protected production yield (t/ha)	363.8	89.16
Field production yield (t/ha)	19.87	26.12

Statistics of protected vegetable cropping in the UK and Australia 2007-08 (Department for Environment Food and Rural Affairs, 2009a, Department for Environment Food and Rural Affairs, 2009b, Australian Bureau of Statistics, 2008).

Soilless production systems

Soilless systems are a low-cost alternative for locations with poor soil and scarce water, and are popular in the greenhouse production of ornamentals and vegetables and outdoor container nursery production. The substitution of inert substrates minimises the risk of pests and disease at the start of the operation. It's also possible to reuse these substrates for future crops as the materials can be treated to kill any micro-organisms.

Soilless cultivation leads to greater control over the growing cycle and greatly improved plant performance; research has shown that greenhouse tomato producers can achieve yields of 50 tonnes of tomatoes per megalitre of water, compared to around eight tonnes for field producers.

Innovations in soilless production systems

Hydroponics

This attractive alternative for locations with water constraints is suitable for outdoor and greenhouse/glasshouse production. The total water and nutrient requirements are supplied by the system using common substrates such as peat, rockwool, sawdust, coir, compost, growstones (from recycled glass bottles), clay, gravel, vermiculite and perlite. A polyurethane foam with a high pore volume and a substrate made from primarily phenolic resin and air are among the new products also demonstrating strong results.

Greenhouses can produce up to 40 tonnes per megalitre of water compared to around nine tonnes per megalitre in the field. Hydroponic crops produced in closed systems can produce $100 of output from as little as 600 litres of water, compared to 37,900 litres per $100 of output for non-hydroponic crops.

Aquaponics

This production method reuses the nutrients released by fish to grow crops such as tomato, broccoli, carrots, lettuce, kale, aubergine and cucumber. It offers sustainable food production for small suburban systems through to large operations, but is yet to reach its full commercial potential. As the technology develops, it can become a more efficient and space saving method of growing fish, vegetables and herbs. By incorporating aquaponics, hydroponic growers can eliminate the cost and labour involved in mixing a fertiliser solution, and commercial aquaculturists may be able to drastically reduce the amount of filtration needed in recirculating fish culture.

Aeroponics

The need to maximise space in greenhouse horticulture has been a catalyst for the development of aeroponic growing systems which continually spray the suspended roots of plants with nutrient solutions. Crops such as vegetables, sprouts, berries, flowers and specialist pharmaceutical species can be arranged three-dimensionally. The capital costs of aeroponic systems are competitive with high-tech greenhouses, and potentially lower than the current average costs in Australia, which range from AUD$100/m2 to AUD$300/m2, depending on the equipment used.

Challenges and opportunities for R&D in soilless systems

Although one hectare of Australian glasshouse production can deliver four to 10 times more product than field cropping, it consumes about 900 times more energy due to the need for constant ventilation, temperature, humidity, irrigation and carbon dioxide. The challenge for industry is to develop cost-effective systems with less energy requirements.

Other limitations of soilless systems:

- The confined root zones require more frequent irrigation and more precise fertilisation than field cropping.
- Anaerobic processes and restricted root volume can significantly lower water and nutrient uptake and growth rates.
- The accumulation of root mat on the bottom of container-grown plants can lead to possible oxygen deficiency.
- Roots growing in containers are more exposed to extreme ambient temperatures than soil-grown roots.
- Higher evaporation of water from the root zone due to the typically high surface-to-depth ratio.
- High temperature may negatively affect the activity of nitrifying bacteria which could lead to toxic ammonium levels.
- Phytosanitary issues such as Pythium and Fusarium root rots, Anthracnose and Botrytis blights can still occur.

Image 2

Conclusion

New technologies are providing a range of breakthroughs in protected horticulture. In view of environmental impacts, land use and population challenges, they present significant opportunities for vegetable production. They are crucial for the establishment of a secure supply chain of Australian-grown produce and to protect the industry against import competition. The challenge for the greenhouse industry is to develop cost-effective systems with less energy requirements than conventional methods.

The Bottom Line: Project no: VG08087

- Soilless systems are likely to play an increasing role in the world's food production in the wake of environmental and population challenges, and the need for increasing food security.
- Australia is lagging behind other developed countries when it comes to implementing new technology, which is reflected in lower production levels.
- The challenge for the greenhouse industry is to develop systems with less energy requirements.

Image 3

Active surveillance of pests and diseases: A scoping study in vegetables

Introduction

The future sustainability and viability of Australia's vegetable industry depends on the nation's capacity to minimise the risk of pests and diseases and respond effectively to any threats. While quarantine measures and on-farm hygiene practices can reduce the likelihood of an exotic pest incursion, some pests will inevitably manage to evade detection at the quarantine stage and will only be discovered upon establishment of a population. This project investigated the surveillance options available to ensure early detection.

The aim is to detect exotics early enough to ensure eradication, thereby reducing their impact. Growers need to be able to identify the exotic, but also to know that it must be reported to the appropriate authorities, as reporting triggers a targeted surveillance process to ensure the incursion is not more widespread.

Project format

The scoping study, representing the first stage of the research investigation, contained three sections:

1. Grower consultation document

This document investigated current pest surveillance practices and the potential for an Enhanced Passive Surveillance (EPS) program equippping growers with the skills and knowledge to not only increase the likelihood of detection but ensure that it is managed correctly. Information was obtained from interviews with growers, and their feedback suggested that an EPS approach must work with existing networks such as current crop monitoring and integrated pest management programs. It would also need to complement the services already provided by agronomists and consultants. Growers raised a number of other questions that will be useful when developing and initiating an EPS model for the vegetable industry, ie:

- How important is it to prove that Australian vegetable crops are free of exotic pests given the low level of export?
- What level of surveillance is sufficient to prove that Australia, a state or a particular region is free of exotics?

- What area of crop needs to be covered by an EPS program in order for it to be worthwhile?
- How much documentation will be required and who will complete it?

2. Literature Review
A worldwide review of literature examining the extension of passive surveillance for horticulture revealed limited information on the application of such models. Researchers did, however, discover that a basic form of surveillance based on existing informal communication networks could be conducted by adding a formal recording and reporting structure. The review also confirmed the strength and coverage of existing surveillance programs that are delivered through consultants in industries such as pome fruit (the Cropwatch program), grapes and citrus (private consultants), the Plantation Health Surveillance scheme for forestry, and the grain industry's CropSafe program.

3. Discussion Paper
A discussion paper presented different passive surveillance models that could be applied to enhance the vegetable industry's biosecurity activities. It reinforced the value of industry-driven programs (such as Cropwatch and CropSafe) and identified them as possible avenues for enhancing biosecurity, resulting in benefits to the vegetable industry's production outcomes in terms of reducing input costs and crop losses.

Future Recommendations

Governments can provide 'barrier quarantine', movement restrictions and training that will assist in reducing the risk of exotic incursions, however, they cannot provide thorough coverage of all crops to detect incursions that may still occur. Therefore industry must play a role in exotic pest surveillance.

There is a lack of information on the broad drivers and motivators for growers in the horticultural sector which would enable better targeting of best practice information to growers.

A specialist joint industry/government steering committee has examined the literature review, grower consultation document and discussion paper and is providing recommendations for a future pilot project that the industry can implement. The project will guide the development of practical models suitable for the diverse range of situations found in Australia's vegetable industries, and the report recommends running it in at least three separate situations, including one based on a geographic region and one on a commodity group.


Image 4

References

The grower consultation paper 'Enhanced passive surveillance and the vegetable industry,' and the discussion paper 'Surveillance of Pest and Disease: Scoping Study in Vegetables' features a bibliography and appendix containing tables of papers captured by the literature review.

The Bottom Line: Project no: VG09099

- The risk of plant pests entering Australia continues to rise.
- Early detection using an effective surveillance system is critical to minimise the potential spread of pests, protecting production levels and grower livelihoods.
- Enhanced passive surveillance is an under-explored aspect of biosecurity and warrants future research.

Acknowledgements

The research contained in these reports was funded by the Australian Vegetable Levy with matched funds from the Australian Government. VG08087 was conducted by Food Chain Intelligence. VG09099 was conducted by the Victorian Department of Primary Industries.
Images 3 provided by the Department of Primary Industries.

Please contact Erin Lyall at AUSVEG on 03 9822 0388 or email erin.lyall@ausveg.com.au to submit topics for potential inclusion in future editions of **vege**notes.

ISSN: 1449 - 1397

vegenotes is produced by AUSVEG Ltd
PO Box 2042, Camberwell West, Vic, 3124
T: 03 9822 0388 | F: 03 9822 0688
This project has been funded by HAL using the National Vegetable Levy and matched funds from the Australian Government.

Know-how for Horticulture™