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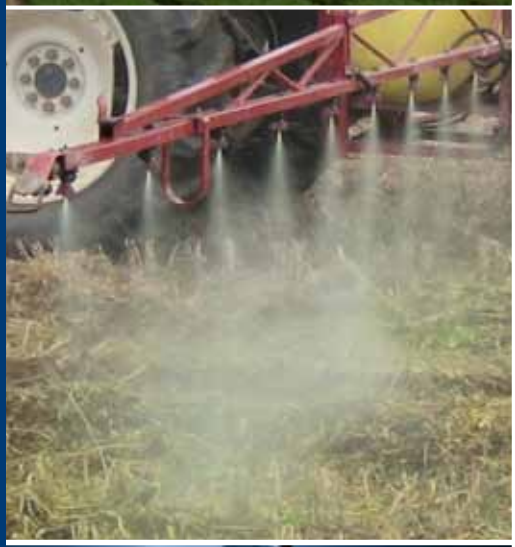
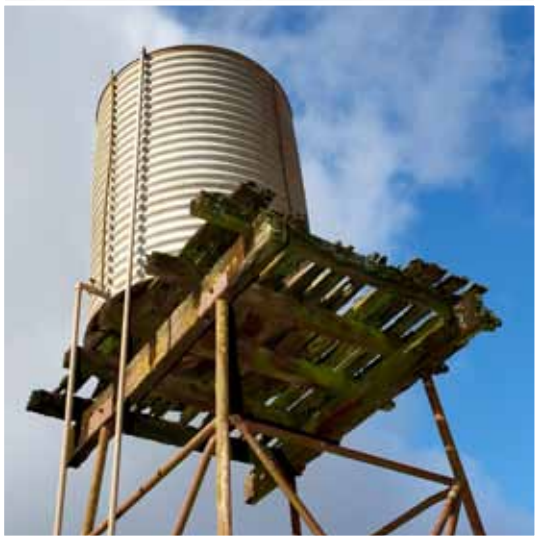
Development of effective pesticide strategies compatible with IPM management used on farm

Project no: VG07109

An expert "think-tank" has helped to fill the information gaps about the effects of fungicides on Integrated Pest Management (IPM) techniques.





Optimising water and nutrient use on vegetable farms

Project no: VG08020

Vegetable growers in WA's Swan Coastal Plain are learning how to tailor their irrigation and fertiliser schedules in order to enhance crop quality and reduce budget and environmental pressures.

Development of effective pesticide strategies compatible with IPM management used on farm

Introduction

Increasing numbers of Australian vegetable growers are expressing an interest in implementing IPM techniques, however there is limited knowledge about the impact of fungicides on overall crop management. A research group led by AgAware Consulting Pty Ltd has scoured the globe in a bid to unearth the most useful information available. The data collected has been collated in a series of Best Practice documents that detail the fungicides available for the control of selected diseases along with their environmental compatibility.

The Bugs Boom

The increasing popularity of natural predators such as mites, ladybirds, lacewings and spiders has been sparked by a range of factors including; resistance to existing pesticides and a lack of effective alternatives, the impact of pesticides on beneficial organisms, residues in produce and trade implications. These have all contributed to the trend towards IPM. While considerable research has focused on insect control and insecticide use in relation to IPM, more information is needed about the application of fungicides so that their impact on these beneficial organisms can be taken into account when planning on-farm IPM programs.

Sourcing Information

As part of this project, data was gathered from a range of Australian and international sources in order to construct a management system outlining the IPM compatibility of currently used fungicides as well as their pesticide residue and environmental profiles. Researchers utilised the knowledge of a wide group of industry personnel including private IPM consultants, state government pest management experts, chemical company experts and key growers who currently practice IPM farm management.

Information on registered and permitted fungicides, fungicide use patterns, efficacy, impact on beneficial organisms, the environment and ecology, was presented in five user-friendly Best Practice documents covering the diseases and crops identified as high priority for investigation and reporting:

- Downy Mildew (all crops)
- Fusarium, Pythium and Rhizoctonia (all crops)
- Powdery mildew (all crops)
- Sclerotinia (beans)
- Sclerotinia (lettuce)

Each document also contains information on current pesticide and non-chemical control methods and is accompanied by a Best Practice for Vegetables—Introductory Document which provides additional references and expands on Integrated Crop Management and the structure of each report.

The Environmental Impact Quotient (EIQ) system

The US-developed EIQ system has been endorsed as a support tool for growers. Its ranking system not only explores the consequences of pesticide use in relation to formulation, application rate and the number of applications, but can be used as a guide for ranking the effects on:

- Farm workers—applicators and pickers
- Consumers
- Environmental—leaching, runoff, soil residue
- Ecology—insects, birds, fish & bees
- Beneficial Organisms

The EIQ system can be viewed at:
www.nysipm.cornell.edu/publications/EIQ/

Recommendations

Effective disease control requires all management options; site selection, crop varieties, crop timing, crop rotation, biological options and monitoring. Fungicides should only be considered to control, prevent, decrease or delay disease infection once all of these options have been investigated. Correct application is essential, and users are advised to always read the label and check state government agencies websites, retailers and consultants for pest management strategies.

No fungicides of a biological nature are currently registered in Australia for disease control in vegetables. The only exception is a permit (PER9978) for potassium bicarbonate (Ecocarb®) for powdery mildew control in greenhouse vegetable crops.

Conclusion

The need for fungicide IPM information is critical to the disease management of all vegetable crops, and helps in the decision making process of growers, advisors, retailers, government agencies and researchers. The success of this project has been

based on its ability to communicate with industry by identifying the major disease / crop combinations, sourcing product lists and use patterns, providing scientific and regional information and developing Best Practice documents. The information from these documents is now being incorporated into additional levy-funded research.

References

The final report of project VG07109, which includes the Best Practice documents, is available at www.ausveg.com.au

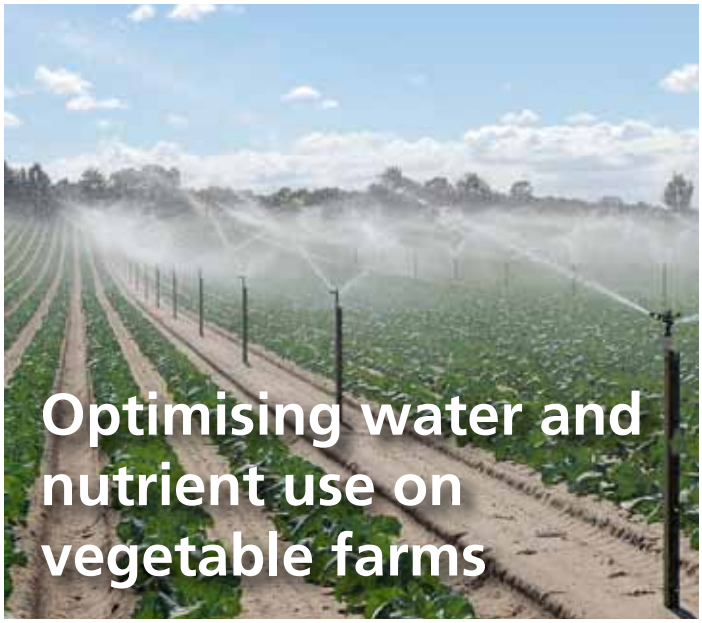
Information and labels on registered fungicides can be obtained from the APVMA Pubcris website at:
http://services.apvma.gov.au/PubcrisWebClient/welcome.do

Information and copies of permitted fungicides can be obtained from the APVMA Permit website at:
www.apvma.gov.au/permits/permits.shtml

University California Online – Statewide IPM Program:
www.ipm.ucdavis.edu

The Bottom Line: Project no: VG07109

- The use of IPM techniques in the Australian vegetable industry is growing.
- While IPM principles are well known for insect control and insecticide use, less is known about disease control and fungicide use.
- Information has now been collated in a series of user-friendly documents designed to educate growers about the costs and benefits of certain fungicides.



Introduction

The unconfined aquifers beneath the sandy soils of the Swan Coastal Plain (SCP) are the lifeblood of WA's vegetable industry. Detailed monitoring of crops by the Department of Agriculture and Food is helping to protect this resource by encouraging growers to implement tailored irrigation and fertiliser programs that promote efficient water use with minimal environmental impact.

Area Snapshot

The SCP extends 100 kilometres north and south of Perth. Its coarse sandy soils with low levels of clay and organic matter produce the majority of WA's vegetables, and their year-round production is highly dependent on frequent irrigation and large amounts of fertiliser.

Table 1: Estimated Quantity of Vegetables produced on the Swan Coastal Plain (tonnes) 2007

Beans	1,593
Broccoli	3,345
Carrots—winter	26,849
Carrots—summer	29,833
Celery	9,402
Lettuce	11,235
Sweetcorn	152

Source: Australian Bureau of Statistics

Any surplus applications can be readily leached into the same underlying aquifer which supplies around half of Perth's integrated water supply scheme, raising strong concerns over the industry's long-term environmental sustainability.

Optimising water and nutrient use

This project works to achieve the fine balance needed to optimise yield while minimising the risks. A specialist development officer was appointed to tailor individual programs for 15 crops at nine different properties by:

(1) Demonstrating the value of daily evaporation-based irrigation scheduling and the use of soil moisture probes to fine-tune scheduling.
(2) Introducing the concept of '3Phase' fertiliser schedules that tailor applications to meet crop demand and increase efficiency.
(3) Promoting the use of soil analysis to validate crop nutrition.
(4) Developing the tools to monitor water and fertiliser use efficiency and demonstrate the importance of good irrigation and fertiliser practice in achieving good quality crops with minimum leaching of nutrients.

Monitoring Methods

Irrigation

The depth and timing of irrigation was measured using continuously recording tipping buckets on representative areas of the farms, with rain gauges confirming weekly irrigation totals. Volumetric soil moisture and drainage was continuously monitored at three depths using TDR soil moisture probes placed in the top 60cm of the soil profile. On most sites, soil tension at 15cm and 30cm depth was continuously monitored using a tensiometer fitted with a pressure transducer which helped to establish minimum water recharge levels.

Soil Nitrate

Nitrogen fertiliser practice was monitored weekly by estimating the quantity of plant available nitrogen (kg/ha) in the top 30cm of soil and the quantity collected in the lysimeters buried beneath the crop. This enabled growers to develop an understanding of how closely their crop's apparent nitrogen demand was being met, and helped to identify periods of surplus and deficit nitrogen supply.

Moisture Content and Leaching
Soil moisture over each 0-15cm profile was measured by inserting the probes at a 30-degree angle into the undisturbed soil under a plant. Drainage and nutrient leaching below the root zone was estimated weekly using three drainage lysimeters installed to collect water at a depth of one metre.

Data was downloaded daily from a logger via telephone modem. Irrigation timing, depth and soil moisture was then able to be summarised via a graphical interface and emailed as a PDF to participating growers. Results were discussed weekly with the individual grower, and seven-day summaries were also outlined in a comprehensive report prepared at the completion of each crop.

Key Results

The majority of growers involved embraced evaporation-based irrigation scheduling and successfully applied the recommendations to their cropping schedules. Some participants also chose to take advantage of the quantity of plant available water stored in the root zone after rain during the mid-growth stages. Better use of stored rainfall during the winter months and less frequent watering during summer resulted in water savings of 10-15 per cent.

Soil nitrate monitoring demonstrated the effectiveness of existing fertiliser methods. In general, crops with good irrigation control leached less nitrogen. Exceptions occurred when large amounts of fertiliser or manure (particularly raw poultry manure) were applied pre-plant and when mineralisation of existing soil reserves of organic nitrogen or crop residues took place before adequate plant maturity. As Table 2 demonstrates, the '3Phase' method is clearly the preferred approach to strategic rate applications of mineral fertiliser.

Table 2: Nitrogen leached from commercially grown and '3Phase' method (Medina Research Station) head lettuce crops from bed formation until harvest for crops monitored from 2006 – 2009.

Crop practice	Average nitrogen leached (kg N/ha)	% of applied nitrogen leached
No poultry manure	172	60
With poultry manure	642	96
3Phase method	126	45

Conclusions

Continuous crop and soil monitoring provides growers with a clear understanding of how irrigation, rainfall and fertiliser application interact within the soil, and enabling timely adjustments to be made throughout the life cycle of the crop. The impact of any changes can be demonstrated and quantified, providing growers with the confidence to implement change. The equipment, software and techniques developed have since been demonstrated in other Australian states with a view to more widespread adoption.

Further Reading

The final report of project VG08020 is available at: www.ausveg.com.au

A web-based Vegetable Irrigation Scheduling System (VISS) is available at: www.vegetableswa.com.au/demo_home.asp
Fertiliser programs for growing leafy crops in sand had been previously developed by Phillips et al 2007, and details of the programs for broccoli and lettuce are available as farmnotes on the following links:

www.agric.wa.gov.au/objtwr/imported_assets/content/hort/veg/cp/broccoli.pdf

www.agric.wa.gov.au/objtwr/imported_assets/content/hort/fertiliserstrategiesforlettuce.pdf

Prince, R (2009) Surviving a cut in your water allocation. WA Grower V. 42, no. 3. pp. 19

Prince, R. and Mc Kay, A. Text for Success. WA Grower V. 42 no. 4. pp. 26

Project Leader: Peter O'Malley
Contacts: Rohan Prince and Allan McKay,
Department of Agriculture and Food WA (08) 9368 3333.

The Bottom Line: Project no: VG08020

- The low water-holding capacity and poor nutrition of sandy soils makes it difficult to avoid leaching fertiliser into the underlying aquifers.
- Matching irrigation and fertiliser schedules to plant requirements is the key to achieving greater efficiency and better crops.
- By using water and fertiliser more efficiently, growers can lower inputs and minimise nitrogen loss.

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

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