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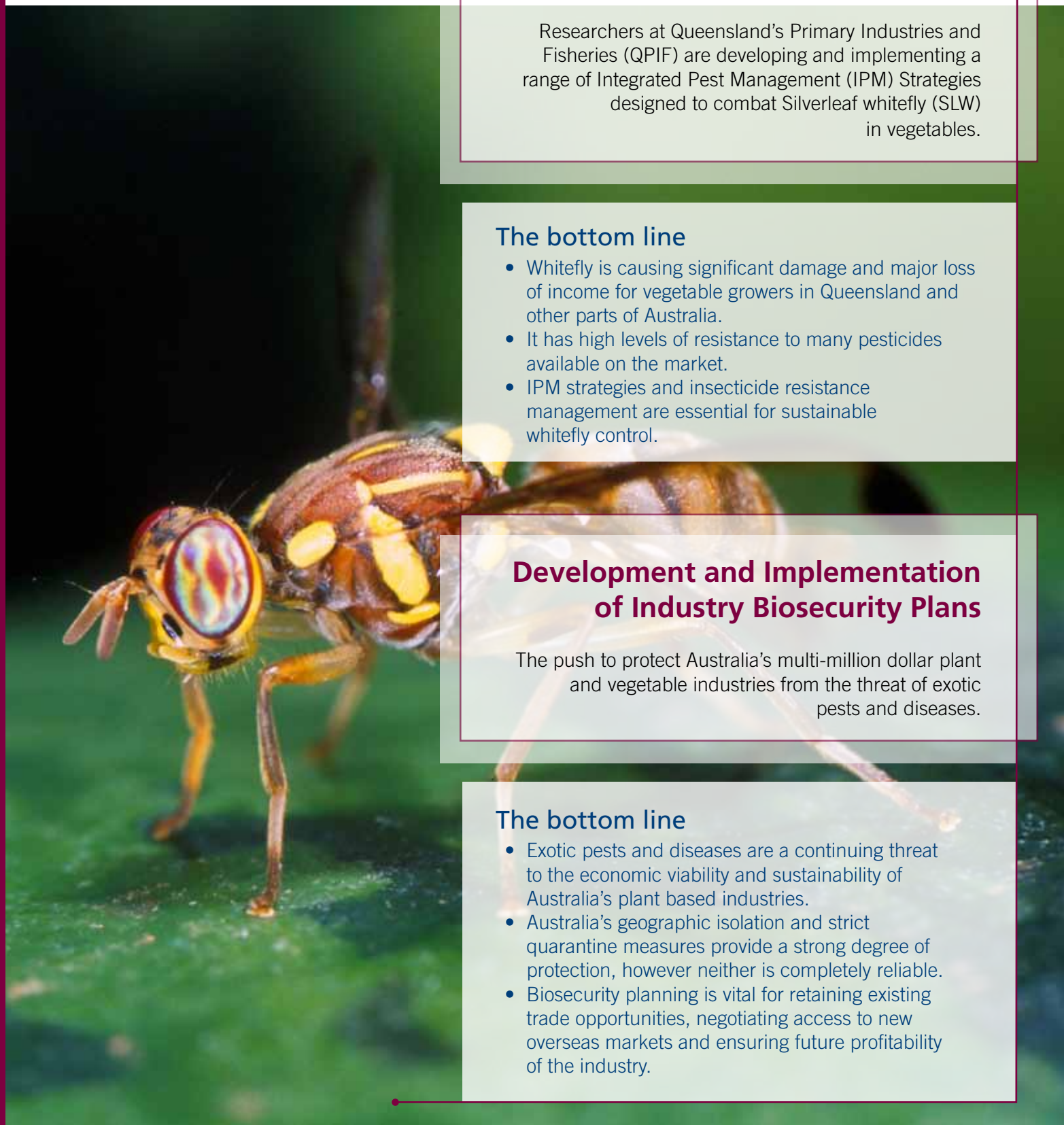
IPM Strategies for Silverleaf whitefly in Vegetables

Researchers at Queensland's Primary Industries and Fisheries (QPIF) are developing and implementing a range of Integrated Pest Management (IPM) Strategies designed to combat Silverleaf whitefly (SLW) in vegetables.

The bottom line

- Whitefly is causing significant damage and major loss of income for vegetable growers in Queensland and other parts of Australia.
- It has high levels of resistance to many pesticides available on the market.
- IPM strategies and insecticide resistance management are essential for sustainable whitefly control.



Development and Implementation of Industry Biosecurity Plans

The push to protect Australia's multi-million dollar plant and vegetable industries from the threat of exotic pests and diseases.

The bottom line

- Exotic pests and diseases are a continuing threat to the economic viability and sustainability of Australia's plant based industries.
- Australia's geographic isolation and strict quarantine measures provide a strong degree of protection, however neither is completely reliable.
- Biosecurity planning is vital for retaining existing trade opportunities, negotiating access to new overseas markets and ensuring future profitability of the industry.

IPM Strategies for Silverleaf whitefly in Vegetables

About the pest

Silverleaf whitefly (Bemisia tabaci B Biotype) is a major global pest first recorded in Australia in 1994. Since then, it has become a widespread problem in northern Australia after demonstrating an outstanding capacity for rapidly developing resistance to insecticides.

It causes severe damage to vegetable crops by:

- Directly feeding on plants, which removes nutrients and can cause stunting, poor growth, lower sugar levels in melons, reduced yields and plant death.
- Causing the growth of sooty mould that contaminates the product, reducing photosynthesis and therefore marketable yield.
- Injecting a toxin into plants while feeding causing physiological damage such as silvering on leaves and discolouration of fruits.
- Transmitting Gemini viruses such as tomato yellow leaf curl.

Fighting Back

Dr Siva Subramaniam has spent the past decade working with the Queensland vegetable industry to combat SLW. His latest project, which began in October 2005, is targeting the development and promotion of IPM management strategies for SLW in brassicas, green beans, eggplant, sweet potatoes, pumpkins and zucchinis. Dr Subramaniam said this is one of the most serious pests Queensland has encountered, and as a conservative estimate, they are spending $3-5 million each year on chemicals in a bid to try and control it. The project focuses on four areas of research and development in the Bowen-Burdekin, Bundaberg and Lockyer Valley regions:

1. IPM strategies based on crop monitoring, spray thresholds and the use of softer insecticides.
2. Integrating natural enemies including the exotic parasitoid (Eretmocerus hayati) to reduce SLW populations within the IPM system.
3. Developing and promoting Insecticide Resistance Management Strategies (IRMS).
4. Developing strategies to reduce mass migration between crops.

New whitefly - Q biotype

A new whitefly, known as Bemisia tabaci Q biotype, has been found in vegetable crops in the Bowen & Burdekin regions of north Queensland. Q biotype looks the same as SLW (B biotype) and can only be distinguished using biochemical or molecular techniques. The presence of high densities of whitefly eggs and nymphs not readily controlled by insecticides is one indication Q biotype is present.

Management recommendation

Overseas studies indicate Q biotype has the capacity to develop resistance to many insecticides including insect growth regulators (IGR) such as Admiral and neonicotinoids such as Confidor. High levels of resistance to Admiral have been detected in crops in north Queensland and some field control problems have also been observed.

Avoidance measures:

- Don't repeat spray with the same whitefly insecticide treatment if it is obviously not working.
- Conduct weekly checks and apply treatments only when whitefly numbers reach spray threshold levels.
- Rotate insecticide groups and avoid overuse of any single group of insecticides.
- Thorough coverage of the under-surface of leaves, where SLW lives, is essential.
- Be aware insecticides used to control other pests may also disrupt natural enemies and flare whitefly numbers.

Biological Control (Natural Enemies)

Several parasitic wasps, including Eretmocerus mundus, E. hayati, and Encarsia species attack SLW in vegetable crops. Predators like brown smudge bugs, big-eyed bugs, lacewing larvae and ladybirds also provide some level of biological control. More than one million wasps were released on several farms in Bowen, Gumlu, Burdekin and Rockhampton during the 2006 and 2009 seasons. Post-release evaluation showed the parasitic wasp was established in all released locations where parasitism levels ranged between 30 to 85 per cent. The high level of parasitism was often recorded in minimally sprayed crops. The IPM program focused on integrating the parasitoids with existing insecticide control strategies and best farm management practices. Data shows that integrating parasitoid releases with narrow-spectrum insecticides as part of the IPM program has maintained the whitefly population at its lowest levels, where the parasitoids have contributed between 50 and 70 per cent

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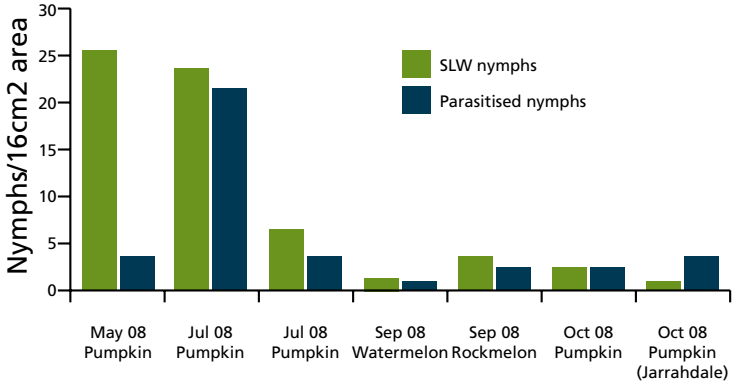
Figure 1. Comparison of silverleaf whitefly and Q biotype

	Silverleaf whitefly (B biotype)	Q biotype whitefly
IGR resistance	Low to moderate	High to Very high
Neonicotinoid resistance	Low to moderate	Moderate
Whitefly population levels	Low to moderate numbers in well managed crops	Increase to larger numbers even after insecticide application
Physiological reactions in plants e.g. silver leafing, irregular ripening, fruit discolorations	Induces physiological reactions in sensitive crops	Not known to cause silvering or pod discoloration
Honeydew secretion	Moderate	High
Efficacy of introduced parasitoid	High	Not known but probably effective

of the whitefly control (Figure 2). In order to preserve and promote the activity of parasites and predators, avoid the use of broad spectrum insecticides such as organophosphates (e.g. methamidophos), carbamates (e.g. methomyl) and pyrethroids (e.g. bifenthrin) early in the crop's growth. Pyriproxyfen (Admiral ®), pymetrozine (Chess®), spirotetramat (Movento®) and imidacloprid soil injection are less toxic to adult wasps.

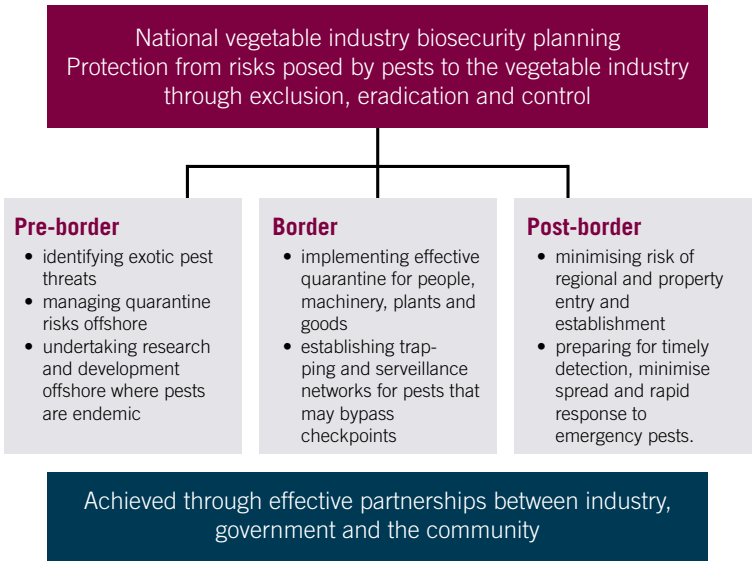
Figure 2. Intergration of parasitoid releases with insecticides in melons and pumpkin crops, Burdekin



Further Reading

The Queensland Primary Industries website:
<http://www2.dpi.qld.gov.au/horticultureresearch/18362.html>
Q biotype fact sheet:
<http://www.dpi.qld.gov.au/26_13554.htm>
Subramaniam et al (2008). Parasitic wasps for Silverleaf whitefly control in vegetable crops. Queensland Primary Industries and Fisheries.
Subramaniam et al (2007). Silverleaf whitefly management in vegetable crops. Queensland Primary Industries and Fisheries.
This project is being conducted by Queensland's Department of Primary Industries and Fisheries in collaboration with the New South Wales Department of Primary Industries and funded by Horticulture Australia (HAL) and AUSVEG.

Figure 3. Industry Biosecurity – A shared Responsibility



Development and Implementation of Industry Biosecurity Plans

Introduction

There are numerous pests and diseases affecting vegetable crops around the world currently not present in Australia. The country's geographic isolation and national quarantine laws have provided a strong degree of protection, however unwanted pests and diseases can penetrate even the toughest systems. The development of biosecurity plans has helped identify those posing the lbiggest threat to our nation. They also outline ways to reduce the chances of them crossing our borders and the steps needed to efficiently manage any outbreaks. This pre-emptive planning process provides a strong mechanism for maintaining domestic and international trade, and negotiating access to new overseas markets. It is also considered vital for the future sustainability and viability of plant and vegetable industries.

What is industry biosecurity planning?

Industry biosecurity is the minimisation of exotic threats through actions such as exclusion, eradication, and control. Its success depends on all stakeholders, including government agencies, industry, and the public.
With the assistance of AUSVEG, HAL and relevant representatives from the Australian and state/territory governments, an Industry Biosecurity Group (IBG) coordinated by Plant Health Australia (PHA) was formed to work on the development of a national biosecurity plan for the vegetable industry.
Vegetables included in the National Vegetable IBG include:

- Solanaceous – potato, tomato, capsicum, chilli and pepper
- Brassicas and leafy Vegetables – cabbage, brussel sprouts, broccoli, lettuce, cauliflower and celery
- Root crops – beetroot, carrot, parsnip, white and brown onions and asparagus
- Cucurbits – cucumber, marrow, squash, zucchini and pumpkin
- Grains and leguminous plants – French and runner beans, green peas, sweet corn.

Risk analysis

Once the risks have been identified, the potential of entry, establishment and spread is examined. Risk analysis also involves consideration of the consequences – such as economic, environmental and social impacts – and the likelihood that these may occur. There are a number of risk mitigation measures industries can implement to help protect its growers, production and market access. These can include:

- Surveillance, awareness and training activities including simulation exercises.
- Exclusion activities (e.g. restricting movement of planting material and machinery, and barrier quarantine).
- Including farm biosecurity in Industry Best Management Practice (IBMP) and Quality Assurance (QA) schemes.

- Development of contingency plans or business continuity plans.

The risk analysis highlighted in an Industry Biosecurity Plan identifies what pests are, or should be, targeted by risk mitigation activities. This also provides an industry with a framework to meet its obligations under the Emergency Plant Pest Response Deed (EPPRD). The EPPRD has been negotiated between PHA's government and industry members to provide a formal mechanism to manage and fund responses to emergency plant pest incidents, including the potential for owner reimbursement costs for growers. The EPPRD also formalises the role of plant industries' participation in decision making, as well as their contribution towards costs related to responses. The vegetable industry has been a signatory to the EPPRD since 24 November 2008.

Practical Steps for Better Biosecurity

Australia's national biosecurity system is at its most effective when protection is in place at all levels (national, state/territory, regional and individual farms or properties). PHA's General Manager - Programs, Rodney Turner, says it is important for individual vegetable producers to implement biosecurity measures, as this will help minimise problems and result in higher grower income.

Practical steps

- Regularly inspecting crops and reporting suspicious insects, diseases and weeds to the nearest agriculture department as soon as detected.
- Learning about local pests, diseases and weeds so that any new pests can be identified, and report anything unusual to the exotic plant pest hotline on 1800 084 881.
- Cleaning dirt and plant material from any footwear, equipment or vehicles entering your property (this includes your own footwear, vehicles or machinery if they have been taken off farm).
- Putting systems in place to deal with contractors and visitors to ensure pests and diseases are not introduced onto your property. eg signage and a visitor register.
- Minimising unnecessary movements of people or machinery around your property.
- Buying accredited seed or planting stock if possible.
- Controlling weed spread.
- Identifying any areas on the property infested with weeds, insects or diseases so that they can be avoided or precautions taken to prevent further spread.

In Summary

A consistent and co-ordinated approach to threat identification and risk assessment will provide a strong base for future risk management activities, priorities and response plans. It will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs. Other benefits include:

- Reduced costs, with early detection and management of biosecurity risks.
- Greater transparency and inclusiveness in decision-making and ongoing management processes.
- Optimisation of resources.
- Reduced loss/incident damage.
- Government and industry ownership of decisions, and a commitment to delivering real outcomes.

Risks will alter over time based on changing technology, practices, legislation and policy. With this in mind, a review of the Vegetable Industry Biosecurity Plan will begin in early 2010. Through the review, the industry will be able to determine strategies to maximise the adoption of recommended practices, agree where further improvements can be made, revise/update information about key pest threats, and enable decisions about the future allocation of resources in order to improve biosecurity of the industry. The new version should be released in May 2010.

Further Reading

Formore information, or to download a copy of the current Vegetable Industry Biosecurity Plan, visit www.planthealthaustralia.com.au, email admin@phau.com.au or phone (02) 6260 4322. Additionally, Plant Health Australia funds an initiative with Animal Health Australia delivering on-farm biosecurity information and a range of tools to producers. For more information, visit www.farmbiosecurity.com.au. The Exotic Plant Pest Hotline: 1800 084 881.

Cover, Melon fly which feeds on more than 125 species of plants and vegetables (Scott Bauer, USDA Agricultural Research Service, Bugwood.org); p.2 Scott Bauer, USDA Agricultural Research Service; p.3 Industry Biosecurity Plan cover; p.4 Carrots affected by Carrot Cyst (Christopher Hogger, Swiss Federal Research Station for Agroecology and Agriculture).

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