Generation of Residue Data for Vegetable Minor-use Permit Applications - 2009 - Agronico

Dale Griffin
Crop Protection Research Pty Ltd

Project Number: VG09136

VG09136

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Purpose: To report on GLP studies conducted to generate residue data in various vegetable crops for several pesticide active-constituents; data which will be submitted to the APVMA for their consideration along with permit applications seeking the use of these pesticides in these crops.

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1. Media Summary

Growers of some horticultural crops are left exposed to greater production risk and can incur significant crop losses when pesticides are not registered for use on their crop(s). This potentially leaves pests, weeds and diseases inadequately controlled.

This situation occurs when a cost-benefit analysis indicates that the cost of generating data and preparing data packages for product registration is significantly higher than the additional sales that may be generated from a new registration.

To address this situation, the Australian Pesticides and Veterinary Medicines Authority (APVMA), who regulate pesticide-use in Australia, developed a permit system whereby, they permit the use of a pesticide on a crop after reviewing less data than would otherwise be reviewed when a manufacturer registers a pesticide.

Their review tends to focus primarily on residue data when considering an application for a minor-use permit. However, crop safety is also an important consideration for them. This is particularly so when reviewing permits seeking the use of selective herbicides.

Because the amount of supportive data required for permits is typically much lower than is required for a full registration, growers and industry groups can sometimes afford to generate enough data to satisfy the APVMA, without waiting for a manufacturer who may never generate it.

AusVeg, the Australian vegetable industry's representative group, through Horticulture Australia Ltd (HAL), commissioned Crop Protection Research Pty Ltd (CPR), to generate such data for a number of situations where the permit system was the only path available to growers of certain crops.

This report summarises the work undertaken by CPR to generate residue data and, for some pesticides, crop-safety data, which was subsequently submitted to the APVMA for their consideration with applications seeking minor-use permits.

Pesticide residue data and crop safety data were generated for the pesticides: abamectin, azoxystrobin, bifenazate, chlorthal-dimethyl, clethodim, fluazifop-p-butyl, iprodione, linuron, methomyl and pirimicarb.

The residue data generated for each of the pesticides was supportive in regard to a minor-use permit application. Thus, the applications were or are being prepared and have been submitted or are about to be submitted to the APVMA.

On the basis of data generated during this project, the APVMA has released permits allowing the use of: bifenazate on cucumber and capsicum for suppression of two spotted mite and another allowing the use of Chlorthal-dimethyl to control stinging nettle on lettuce.

Permits for the use of abamectin on lettuce and sugar snap and snow peas, and for the use of azoxystrobin on beans and lettuce are being considered by the APVMA and have not been released to date.

Permit renewals for the use of clethodim on peas; for the use of fluazifop-p-butyl on sweet potato, leeks and eggplants; for the use of iprodione on onions and eggplants; for the use of linuron on leeks and celeriac; for the use of methomyl on parsley, coriander and sweet potato, and; for the use of pirimicarb on eggplants have been sent to the Pesticide Minor-use Co-ordinator for consideration and approval before submission to the APVMA.

2. Technical Summary

Project VG09136 was separated into 10 sub-projects, each of which was a single pesticide residue study which was conducted in accordance with the OECD principles of Good Laboratory Practice (GLP).

Each of the 10 residue studies was designed to determine the residual level of a single, pesticide active constituent, which remained in horticultural produce following one or more applications of a commercially-formulated agrichemical product.

The active constituents studied, followed in parentheses by the crops treated with them, were: bifenazate (cucumber and capsicum), Chlorthal-dimethyl (lettuce), abamectin (lettuce and sugar snap and snow peas), azoxystrobin (beans and lettuce), clethodim (peas), fluazifop-p-butyl (sweet potato, leeks and eggplants), iprodione (onions and eggplants), linuron (leeks and celeriac), methomyl (parsley, coriander and sweet potato), and, pirimicarb (eggplants)

A range of crops were treated with the pesticide in each of the studies with each crop located at different study-sites in most circumstances. Where possible, the study-sites were positioned in commercially-grown crops, otherwise they were grown specifically for the study at facilities or properties where staff were on hand to grow them in accordance with local Good Agricultural Practice (GAP). An example of such a non-commercial farm facility is the Bundaberg Research Station, which is managed by the Queensland Department of Primary Industries.

Application of each pesticide was completed using a hand-held, gas-powered boom sprayer fitted with flat-fan nozzles, when herbicides were applied or, with hollow-cone nozzles when fungicides and insecticides were applied. The fungicides and insecticide were applied on multiple occasions whereas, the herbicides, which were typically pre-plant herbicides, were only applied once.

At certain times after the application of pesticides, samples from non-treated crop, as well as treated crop, were collected, packaged to prevent contamination, deep-frozen to minimise pesticides residue degradation. Furthermore, where chlorthal-dimethyl was under study, crops were inspected for signs and symptoms of phyto-toxicity caused by the product.

The samples were then sent to a pesticide-residue laboratory for analysis where they were unpacked, defrosted to the point where they could be sub-sampled and homogenised before residue extraction procedures were conducted on the homogenate.

Depending upon the pesticide, the extract was analysed using validated methodology, based on liquid or gas-chromatography and mass-spectrophotometry, to detect and quantify the residue(s).

When pesticides that were detected at levels higher than the limit of quantitation (LOQ), the results were recorded, and reported as milligrams of pesticide per of kilogram produce (mg/kg) which is equivalent to parts per million (ppm).

Each residue study was reported separately before being submitted, along with the appropriate minor-use permit renewal forms, to Horticulture Australia Ltd's, Pesticide Minor-use Co-ordinator (PMUC) for consideration. Following this, all material was sent to the APVMA for regulatory consideration and approval.

An application seeking the use of abamectin on lettuce and sugar snap and snow peas, and, azoxystrobin on beans and lettuce supported by residue data generated during this study was received by the APVMA, but a permit has not yet been released.

On the basis of supporting data generated during this project, the APVMA has released minor-use permits allowing: (1) the use of bifenazate on cucumber and capsicum for

suppression of two spotted mite, and; (2) the use of chlorthal-dimethyl to control stinging nettle in field-grown lettuce.

Minor-use permit applications for the use of clethodim on peas; fluazifop-p-butyl on sweet potato, leeks and eggplants; iprodione on onions and eggplants; linuron on leeks and celeriac, methomyl on parsley, coriander and sweet potato, and; pirimicarb on eggplants have been finalised and forwarded to the Pesticide Minor-use Co-ordinator for consideration and approval before submission to the APVMA.

3. Introduction

In Australia, before an agrochemical product can be sold or used, the Australian Pesticides and Veterinary Medicines Authority (APVMA) must register it. This only occurs following a review of a comprehensive package of data that includes efficacy, crop safety and residue data. The manufacturer of the product must supply this information to the APVMA before this process can begin.

The cost of generating and collating such data packages is high, often costing many hundreds-of-thousands of dollars. These costs must be recouped by the manufacturer through sales of their product.

However, only small areas of many horticultural crops are grown and manufacturers consider it too difficult or impossible to recoup their registration costs. Thus, manufacturers will rarely spend resources on generating the data or preparing the associated applications.

As a result, horticulturalists are often placed in situations where they risk severe crop losses from insects, weeds and diseases because the agrochemical tools needed to protect their crops from these pests are not registered for their situation. On the other hand, they could spray their crops with pesticides that are not registered and risk buyers rejecting their produce and potentially-face severe penalties for pesticide miss-use.

The need to gain minor-use permits and new registrations has come about due to loss of some agrochemical products and/or registered uses because of chemical reviews and product rationalisation.

The APVMA's permit system adds some flexibility to the lengthy registration process and legalises the availability of products for minor-use purposes, not specified on the product label. However, off-label permits issued by the APVMA still must be applied for along with information and data that verifies that the permitted use will be effective and will not have any harmful effects on humans, the crops or the environment.

In early 2000, the vegetable industry undertook a national approach to permits by working with industry generated 'wishlists' for new pesticide uses, but this led to congestion in Australian Pesticide & Veterinary Management Authority (APVMA) system and dissatisfaction amongst growers and grower groups. This was in part due to widespread duplication of the requests made for permits in the absence of a truly co-ordinated system and concern over the priority assessment for each pesticide. This approach was also unable to give relevant priority to new pesticide technologies and available Integrated Pest Management (IPM) friendly pesticides that were outside the industry's experience.

A new approach to address the current and future pesticide requirements for horticultural crops has been developed using the Strategic Agrichemical Review Process (SARP). This approach had the benefit of IPM compatibility, where possible, improved scope for resistance management, sound biological profile and residue and trade acceptance domestically and for export.

This review process provides the vegetable industry with sound pesticide options for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with APVMA for clearly identified crop protection needs, many of which will also assist the expansion of effective IPM strategies. All of the studies reported in this project have been identified through that SARP.

4. Materials and methods

Project VG09136 was managed as 10 separate residue studies (Table 1), one for each of the active constituents included in the project.

In accordance with the OECD Principles of Good Laboratory Practice (GLP), each residue study was uniquely identified; they included several different crops and were conducted across multiple study-sites.

Before each residue study began, an audited study plan was prepared. These documents were much like a scientific protocol and contained all details necessary to complete the field-phase activities of the study as well as the laboratory (analytical-phase) activities. The auditing was completed by an independent, third party quality assurance expert.

Because the pesticide active-constituent in each study was unique to each study, as was the spectrum of crops, the methods used, particularly the laboratory methods, varied in some aspects between studies. A complete description of the methods used for each study was provided in the final report of each study, the reference for which is provided in Section 9 of this report. Brief details are provided in sections 4.1 to 4.10 below.

4.1. Abamectin (lettuce and sugar snap and snow peas)

A single residue study was conducted across three sites located in Victoria and northwest Tasmania.

At the Victorian site, leafy lettuce and snowpeas were grown in a protected, hydroponic production system (polyhouse) which is primarily a commercial-production teaching facility.

The Tasmanian site was an outdoor commercial hydroponic production facility.

At each site, two applications of Vertimec® miticide/insecticide (abamectin 18 g/L) at a rate of 450 mL/ha were applied at approximately 30 and 3 days before harvest (DBH) on leafy lettuces, and at 30 and 1 days before harvest on snow peas. Regardless of test-system, treatments were applied using a gas-powered, hand-held boom sprayer, typical of commercial application equipment.

Specimens of leafy lettuce were sampled for residue analysis at 0, 1, 3, 5 and 7 days after the final application of treatments (DAFA). For snow peas, specimens were sampled at 0, 1, 2 and 3 DAFA. Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of abamectin were determined using liquid-chromatography, mass-spectrophotometry methods.

Table 1. Project VG09136 was managed by separating it into 10 sub-projects (GLP Studies). In accordance with the OECD Principles of Good Laboratory Practice, each of these was identified uniquely. The sub-projects included a single active constituent, usually included several crops and were conducted across multiple study sites.

Residue study ID (HAL reference)	Active constituent	Crops	Number of study sites	Locations by State	Reference
09-HAL-020(a)GLP (AVG449 & AVG643)	**Abamectin**	Lettuce (leafy – greenhouse & hydroponic) and Snow peas or sugar snap peas (greenhouse)	3	VIC (x2) and TAS (x1)	Griffin and Lean, 2011a
09-HAL-020(b)GLP (HAL1204)	**Azoxystrobin**	Beans and lettuce (leafy – field and hydroponic)	8	VIC (x3), NSW (x2), TAS (x2) and North QLD (x1)	Griffin and Lean, 2011b
09-HAL-020(c)GLP (HAL1263 & HAL1815 & HAL1816)	**Bifenazate**	Cucumber (field and hydroponic), zucchini (field), capsicum (field and hydroponic) and eggplant (field and hydroponic)	11	VIC (x4), TAS (x2), SA (x1), NT (x1), North QLD (x1), NSW (x1) and South QLD (x1)	Griffin and Lean, 2011c
09-HAL-020(d)GLP (AVG712)	**Chlorthal-dimethyl**	Lettuce (leafy and head – field)	5	VIC (x2), NSW (x1), SA (x1) and WA (x1)	Griffin and Lean, 2011d
09-HAL-020(e)GLP (AVG1012)	**Clethodim**	Peas (green and processing – field)	2	TAS (x1) and NSW (x1)	Griffin and Lean, 2012e
09-HAL-020(f)GLP (AVG688 & AVG53 & AVG1073)	**Fluazifop-p-butyl**	Eggplant (hydroponic), leeks (field) and sweet potato (field)	5	South QLD (x3), VIC (x1) and North QLD (x1)	Griffin and Lean, 2012f
09-HAL-020(g)GLP (HAL1808 & HAL1491)	**Iprodione**	Onions (field) and eggplant (hydroponic)	4	TAS (x1), South QLD (x1), VIC (x1) and SA (x1)	Griffin and Lean, 2012g
09-HAL-020(h)GLP (AVG44 & HAL1546)	**Linuron**	Leek and celeriac (field)	4	VIC (x2), South QLD (x1) and SA (x1)	Griffin and Lean, 2012h
09-HAL-020(i)GLP (AVG798 & HAL1781)	**Methomyl**	Parsley, coriander and sweet potato (field)	4	Vic (x2) and South Qld (x2)	Griffin and Lean, 2012i
09-HAL-020(j)GLP (HAL1475)	**pirimicarb**	Eggplant (field and hydroponic)	2	Vic (x1) and North Qld (x1)	Griffin and Lean, 2012j

4.2. Azoxystrobin (beans and lettuce)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken across eight sites located at Victoria, New South Wales, northern Queensland and northwest Tasmania.

At the Victorian site, leafy lettuce was grown in a protected (polyhouse), hydroponic production system and green beans and leafy lettuce in a field grown production system which is primarily a commercial-production teaching facility. The Tasmanian leafy lettuce site was a commercial, hydroponic production facility that was not covered by a glass or polyhouse environment and green beans, a field grown production system. The New South Wales green beans and leafy lettuce and northern Queensland bean sites were both commercial field grown production systems.

At each site, three spray applications of Amistar® AZ 250 SC fungicide (azoxystrobin 250 g/L) at a rate of 600 mL/ha were applied at approximately 15, 8 and 1 days before harvest on green beans and at 28, 21 and 14 days before harvest on leafy lettuce. Regardless of test-system, treatments were applied using a gas-powered, hand-held boom sprayer.

Specimens of leafy lettuce at two of the sites were sampled for residue analysis at 0, 7 and 14 days after the last application of treatments (DALA) and the two remaining sites were sampled at 14 DALA. For green beans, specimens were sampled at 0, 1 and 5 DAFA at two sites and at 1 DALA at the remaining two sites.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis where residue of azoxystrobin was determined using gas-chromatography, mass-spectrophotometry methodology.

4.3. Bifenazate (capsicum, cucumber, zucchini and eggplant)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken across eleven sites located at south east Victoria, Northern Territory, South Australia, Queensland and northwest Tasmania.

At the Victorian site, capsicum, cucumber and eggplant were grown in a protected (polyhouse), hydroponic production system and Zucchini a field grown production system which is primarily a commercial-production teaching facility. The Tasmanian sites for capsicum and cucumber, the South East Queensland and South Australian eggplant sites, Northern Territory cucumber site and Northern Queensland capsicum site were grown in a protected (polyhouse) hydroponic production systems representative of commercial practice.

The New South Wales site, zucchini was a field grown production system.

At each site, one spray application of Acramite® Miticide (bifenazate 480 g/L) at a rate of 65 mL/ha was applied at approximately 7 days before harvest on all crops. Regardless of test-system, treatments were applied using a gas-powered, hand-held boom sprayer and sampled at 0, 1, 3 and 7 days after the last application (DALA).

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis using liquid-chromatography, mass-spectrophotometry methods.

4.4. Chlorthal-Dimethyl (Lettuce)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of chlorthal-dimethyl in leafy and head-lettuces following a single planting-application of the registered herbicide product, Dacthal® 900WG (chlorthal-dimethyl 900 g/kg) at a rate of 6.25 kg/ha or 12.5 kg/ha.

The study was undertaken at five sites across 5 different regions including, south-east Victoria, western Victoria, central New South Wales, south-eastern South Australia and the south-west coast of Western Australia. .

The treatment was applied at transplanting using a gas powered, hand held boom sprayer.

Samples of lettuce were collected for residue analysis at 28 and 42 days after application (DALA) and at typical commercial harvest.

At the time of sampling, observations on any phyto-toxic effects that may have appeared following application of chlorthal-dimethyl were made by comparing the health of the non-treated crop with that of the treated crop.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis where residues of azoxystrobin were determined using gas-chromatography, mass-spectrophotometry methods.

4.5. Clethodim (Peas)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of clethodim in green and processing peas following a single application of the registered herbicide product, Innova clethodim 240 herbicide (clethodim 240 g/L) at a rate of 500 g/ha.

The study was undertaken at two sites across two different regions including, north eastern Tasmania and eastern New South Wales.

The treatment was applied at 26 days before typical commercial harvest (DBTCH) using a gas powered, hand held boom sprayer.

Samples of peas (whole commodity and forage) were collected for residue analysis at typical commercial harvest.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of clethodim were determined in specimens of forage and whole commodity (excluding roots) using gas-chromatography, mass-spectrophotometry methods.

4.6. Fluazifop-p-butyl (sweet potato, leeks and eggplant)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of Fluazifop-p-Butyl in eggplant, leek and sweet potato following various applications of the registered herbicide product, Fusilade Forte® (Fluazifop-p-Butyl 212 g/L) at a rate of 3300 mL/ha or 160 mL/10L.

The study was undertaken at five sites across 3 different regions including, south-east Victoria, northern Queensland and South-east Queensland.

The treatment was applied at 35 days before typical commercial harvest (DBTCH) on leeks, 28 DBTCH on eggplants and 70 DBTCH on sweet potatoes using a gas powered, hand held boom sprayer.

Samples of eggplant, leeks and sweet potatoes were collected for residue analysis at typical commercial harvest.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of Fluazifop-p-Butyl were determined in whole-fruit using gas-chromatography, mass-spectrophotometry methodology.

4.7. Iprodione (onion and eggplant)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of iprodione in onions and eggplants following multiple applications of the registered herbicide product, Rovral® Aquaflo (iprodione 500 g/L) at a rate of 2 L/ha on onions and 100mL/100L on eggplants.

The study was undertaken at four sites across 4 different regions including, south-east Victoria, south-eastern South Australia, north-eastern Tasmania and south-east Queensland.

Four treatments were applied at the early stages of bulbing on onions, and, at 21, 14 and 7 Days before harvest (DBH) on eggplants using a gas powered, hand held boom sprayer.

Samples were collected for residue analysis at typical commercial harvest for onions and approximately 0, 3, 7 and 10 days after last application (DALA) for eggplants.

All samples were maintained in frozen storage before they were transported to the analytical laboratory where residues of iprodione were determined using gas-chromatography, mass-spectrophotometry methods.

4.8. Linuron (Leek and celeriac)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine residues remaining in leeks following three applications at 550 g/ha and in celeriac following one application at 2200 g/ha of the formulated product DuPont™ Linuron DF® herbicide.

The study was undertaken at four sites across 3 different regions including, south-east Victoria, south-eastern South Australia and south-east Queensland.

Treatments were applied at 4-8 true leaf on celeriac and approximately 98, 85 and 70 days before typical commercial harvest (DBTCH) on eggplants using a gas powered, hand held boom sprayer.

Samples of celeriac and eggplants were collected for residue analysis at typical commercial harvest.

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of linuron were determined in whole-samples (excluding roots) using liquid-chromatography, mass-spectrophotometry methodology.

4.9. Methomyl (Parsley, sweet potato and coriander)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of methomyl in parsley, coriander and sweet potato following four applications of the registered product, DuPont™ Marlin® insecticide (methomyl 220 g/L) at a rate of 2 L/ha.

The study was undertaken at four sites across 2 different growing regions including, south-east Victoria and south-east Queensland. .

Treatments were applied at approximately 24, 17, 10 and 3 days before harvest (DBH) using a gas powered, hand held boom sprayer.

Samples of parsley, coriander and sweet potato were collected for residue analysis at approximately 0, 1, 3, 5 and 7 days after last application (DALA).

Immediately after sampling, specimens were packaged and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of methomyl were determined in whole-samples (excluding roots) using liquid-chromatography, mass-spectrophotometry methods.

4.10. Pirimicarb (Eggplant)

A residue study conducted in accordance with the principles of Good Laboratory Practice (GLP) was undertaken to determine the residues of pirimicarb in protected and field grown eggplants following three applications of the registered product, Pirimor® WG aphicide (pirimicarb 500 g/kg) at a rate of 200 g/100L.

The study was undertaken at two sites across two different growing regions including, south-east Victoria and northern Queensland.

The treatment was applied at approximately 22, 12 and 2 days before harvest (DBH) using a gas powered, hand held boom sprayer.

Samples of eggplants were collected for residue analysis at approximately 0, 1, 3, 5 and 7 days after last application (DALA). Immediately after sampling, specimens were packaged

and then stored in freezers before being shipped to the analytical-laboratory for residue analysis.

At the laboratory, residues of pirimicarb were determined in whole-samples (excluding roots) using gas-chromatography, mass-spectrophotometry methods..

5. Results

5.1. Abamectin (lettuce and sugar snap and snow peas)

Residual levels of abamectin were below the limit of quantitation (LOQ) of 0.01 mg/kg, in specimens collected from the non-treated control areas of the study site.

In all samples collected from the treated areas, levels of abamectin were below the LOQ in snow peas and above the LOQ in lettuce. However, all results reported were below the tMRL of 0.2 mg/kg accepted for leafy lettuce and the tMRL of 0.5 mg/kg accepted peas

5.2. Azoxystrobin (beans and lettuce)

The limit of quantitation (LOQ) was reported to be 0.05 mg/kg in green beans and 0.2 in leafy lettuce.

In samples of lettuce collected, regardless of study-site, samples at 0 DALA had an average that exceeds the current tMRL of 3 mg/kg and samples taken at 7 and 14 DALA had an average below the tMRL.

However, in green beans, the residual level of azoxystrobin was at or below the tMRL of 3 mg/kg regardless of the time after the final application that specimens of fruit were collected, and, above the tMRL in two of the sites where foliage was collected at 1 DALA and below the tMRL at all other sampling events

5.3. Bifenazate (capsicum, cucumber, zucchini and eggplant)

Residual levels of bifenazate were below the limit of quantitation (LOQ) of 0.01 mg/kg, in all specimens collected from the non-treated control areas of the study sites.

In samples of cucumber collected at site 1, capsicum at site 8, zucchinis at site 9 and 10 and eggplants at site 5 and 11, regardless of the time of collection after last application, the residues of bifenazate that were detected were below the LOQ.

However, samples of cucumber in sites 2 and 7, capsicums at site 3 and 4 and eggplants at site 6, regardless of the time of collection after last application, the residues of bifenazate in most cases, detection exceeded the LOQ.

Currently there is a tMRL of 0.5 mg/kg accepted for bifenazate in cucumbers.

5.4. Chlorthal-Dimethyl (Lettuce)

Residual levels of Chlorthal-dimethyl were below the limit of quantitation (LOQ) of 0.1 mg/kg in samples collected from the non-treated control areas of crop at all study sites.

The residual level of the chlorthal-dimethyl was below the LOQ in all samples collected from treated plots at typical commercial harvest. However, some samples collect at 28 and 42 DALA throughout the five sites showed residues higher than the LOQ.

Study site	Crop	Soil-type	Phyto-toxic effects observed	Comments
1	Leafy lettuce	Grey sand (Vic – South east)	No treatment specific damage caused; however, there was significant damage caused by disease. Although considered unlikely on the basis of observations at other sites, the disease symptoms may have masked symptoms of phyto-toxicity caused by chlorthal-dimethyl	Severe stunting
2	Head lettuce	Brown clay (VIC – Werribee)	None	No damage observed
3	Head lettuce	Clay loam (NSW)	None	No damage observed
4	Head lettuce	Clay loam (SA)	Not recorded	Not recorded
5	Leafy lettuce	Sand (WA)	None	No damage observed

5.5. Clethodim (Peas)

Residual levels of clethodim were below the limit of quantitation (LOQ) of 0.1 mg/kg in samples collected from the non-treated control areas of crop at each study site.

However, residues of clethodim were above the limit of quantitation (LOQ) in all samples regardless of crop, site and sampling-time after application.

5.6. Fluazifop-p-butyl (Sweet potato, leeks and eggplant)

Residual levels of fluazifop-p-butyl were below the limit of quantitation (LOQ) of 0.1 mg/kg in samples collected from the non-treated control areas of crop at each study site.

Residues of fluazifop-p-butyl were below the LOQ in all specimens, regardless of crop, site and sample-time after application.

5.7. Iprodione (Onion and eggplant)

Residual levels of iprodione were below the limit of quantitation (LOQ) of 0.1 mg/kg in eggplants and 0.2 in onion samples collected from the non-treated control areas of crop at each study site.

Residues of iprodione were below the respective LOQ in all specimens, regardless of crop, site and sample-time after application.

5.8. Linuron (Leek and celeriac)

Residual levels of linuron were below the limit of quantitation (LOQ) of 0.01 mg/kg in eggplants and celeriac samples collected from the non-treated control areas of crop at each study site.

Residues of linuron were below 0.2 mg/kg in eggplants and above 0.1 mg/kg in celeriac in all specimens, regardless of crop, site and sample-time after application.

However, the residual level of linuron was below the current tMRL in all specimens.

5.9. Methomyl (Parsley, sweet potato and coriander)

Residual levels of methomyl were below the limit of quantitation (LOQ) of 0.01 mg/kg in sweet potato, parsley and coriander samples collected from the non-treated control areas of crop at each study site.

The residual level of the methomyl was below the LOQ in all samples collected from treated plots for sweet potatoes.

Samples of parsley and coriander showed residues higher than the LOQ regardless of the sample timing. Coriander showed residues of 7.8, 3.2, 2.6, 0.32 and 0.22 mg/kg of methomyl in samples taken at 0, 1, 3, 5 and 7 DALA respectively.

Parsley showed residues of 7.1, 2.3, 0.99, 0.45 and 0.09 mg/kg of methomyl in samples taken at 0, 1, 3, 5 and 7 DALA respectively.

Whilst higher than the LOQ, residues in the herb crops were below the tMRL of 10 mg/kg.

5.10. Pirimicarb (Eggplant)

Residual levels of pirimicarb were below the limit of quantitation (LOQ) of 0.05 mg/kg in eggplant samples collected from the non-treated control areas of crop at each study site.

The residual level of the pirimicarb was below the LOQ in all samples collected from treated plots at the field grown site regardless of the sampling timings.

Samples collect at the protected site showed residue results of pirimicarb, However, residue are below the current tMRL of 1 mg/kg.

6. Discussion

6.1. Abamectin (lettuce and sugar snap and snow peas)

The data generated during this study supported an application for a minor-use permit that allows the use of abamectin in lettuce, sugar snap peas and snow peas.

Currently, there is a temporary MRL of 0.2 mg/kg accepted for leafy lettuce and a tMRL of 0.5 mg/kg accepted peas.

Thus, a permit renewal, seeking to allow the use of Vertimec® miticide spray was prepared. This permit application and the supporting GLP residue report were submitted, via email, to the Pesticide Minor-use Co-ordinator (PMUC) on October 20, 2011. Following consideration of the documents, it was submitted to the APVMA.

However, a permit allowing the use of this pesticide on lettuce, and, sugar snap and snow peas has not yet been released.

6.2. Azoxystrobin (beans and lettuce)

The data generated during this study supported an application for a minor-use permit that allows the use of azoxystrobin in beans and lettuce.

Currently, there is a temporary MRL of 3 mg/kg accepted by the APVMA for azoxystrobin in lettuces and beans.

Thus, a permit renewal, seeking to allow the use of Amistar® AZ 250 SC fungicide Spray was prepared by CPR.

This permit application and the supporting GLP residue report were submitted, to the PMUC on June 06, 2011. Following consideration of the documents, it was submitted to the APVMA.

However, a permit allowing the use of this pesticide on lettuce, and, sugar snap and snow peas has not yet been released.

6.3. Bifenazate (capsicum, cucumber, zucchini and eggplant)

The data generated for this active constituent supported an application for a minor-use permit that allows the use of bifenazate in capsicum, cucumber, zucchini and eggplant.

Currently, there is a temporary MRL of 0.5 mg/kg accepted by the APVMA for bifenazate in cucumbers. However, there is no MRL released by the APVMA for bifenazate in capsicums, zucchinis and eggplants.

Thus, a permit renewal, seeking to allow the use of Acramite® Miticide Spray was prepared by CPR.

This permit application and the supporting GLP residue report were submitted, to the PMUC on April 01, 2011. Following consideration of the documents, it was submitted to the APVMA.

Subsequently, a minor-use permit (PER13047), which allows the use of bifenazate in capsicums and cucumbers for the control of two spotted mite, has been released by the APVMA (APVMA, 2011). However, a permit allowing the use of this pesticide on zucchini and eggplant has not yet been released.

6.4. Chlorthal-Dimethyl (Lettuce)

The residue data generated during this study supported the application for a minor-use permit that allows the use of Chlorthal-dimethyl on lettuce.

At four of the five sites where phyto-toxicity was observed each had distinctly different soil-types. One site showed stunting and yellowing throughout the crop and were considered to be caused by disease rather than treatment with chlorthal-dimethyl.

Thus, a permit application was prepared by the regulatory affairs expert, Mr Kevin Bodnaruk.

The permit application and the supporting GLP residue report were submitted to the PMUC on November 25, 2011. Following consideration of the documents, the permit application was submitted to the APVMA, who received it on 20th December, 2011.

However, a permit(s) allowing the use of Chlorthal-dimethyl on lettuce has not yet been released as it is being processed through screening at the APVMA.

6.5. Clethodim (Peas)

The data generated during this study supports an application for a minor-use permit that allows the use of clethodim on peas.

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 0.5 mg/kg for clethodim in peas.

The mean residual level of clethodim in peas reported here, at typical commercial harvest is below the tMRL accepted by the APVMA.

Thus, an application to renew permit (PER6611) has been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA for permit screening.

6.6. Fluazifop-p-butyl (Sweet potato, leeks and eggplant)

The data generated during this study supports the application for a minor-use permit that allows the use of fluazifop-p-butyl in sweet potato, leeks and eggplants.

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 0.1 mg/kg for fluazifop-p-butyl in sweet potatoes and eggplant and of 0.5 mg/kg in leeks.

The mean residual level of fluazifop-p-butyl in all crops reported here, at typical commercial harvest, was below the tMRL.

Thus, an application to renew permits PER7560 and PER10275 have been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA.

6.7. Iprodione (Onion and eggplant)

The data generated during this study supports the application for a minor-use permit that allows the use of iprodione on onions and eggplants.

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 7 mg/kg for iprodione in eggplant and of 0.2 mg/kg in onions.

The mean residual level of iprodione in all crops reported here, at typical commercial harvest, was below the tMRL.

Thus, an application to renew permits PER10885 and PER11082 have been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA.

6.8. Linuron (Leek and celeriac)

The data generated during this study supports the application for a minor-use permit that allows the use of Linuron on Leek and celeriac

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 0.05 mg/kg for linuron in celeriac and of 0.2 mg/kg in Leek.

The mean residual level of linuron in all crops reported here, at typical commercial harvest, was below the relevant tMRL.

Thus, an application to renew permits PER10468 and PER10111 have been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA.

6.9. Methomyl (Parsley, sweet potato and coriander)

The data generated during this study supports the application for a minor-use permit that allows the use of methomyl on parsley, sweet potato and coriander.

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 1 mg/kg for methomyl in sweet potato and of 10 mg/kg in parsley and coriander.

The mean residual level of methomyl in all crops reported here, at typical commercial harvest, was below the relevant tMRL.

Thus, an application to renew permits PER10147 and PER10334 have been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA.

6.10. Pirimicarb (Eggplant)

The data generated during this study supports the application for a minor-use permit that allows the use of pirimicarb on Eggplant.

Currently, there is a temporary MRL (tMRL), accepted by the APVMA, of 1 mg/kg for pirimicarb in eggplants.

The mean residual level of pirimicarb in all crops reported here, at typical commercial harvest, was below the relevant tMRL.

Thus, an application to renew permit PER9241 have been prepared and submitted, along with the supporting GLP residue report to the PMUC for consideration before being forwarded to the APVMA.

7. Technology transfer

Technology transfer activities were not included in the scope of this project. In regard to minor-use permits sought for the Australian Vegetable industry; such activities are co-ordinated and, or conducted by the Pesticides Minor-use Co-ordinator who is funded by Horticulture Australia Ltd, project number: MT10029 ‘Managing pesticide access in horticulture’.

8. Recommendations

8.1. Abamectin (lettuce and sugar snap and snow peas)

A permit application has been submitted to the Australian Pesticides and Veterinary Medicines Authority (APVMA); however, the outcome of this is yet to be determined.

Therefore, CPR recommends that the PMUC continues to regularly enquire to the APVMA regarding the status and outcome of this application

8.2. Azoxystrobin (beans and lettuce)

A permit application has been submitted to the Australian Pesticides and Veterinary Medicines Authority (APVMA); however, the outcome of this is yet to be determined.

Therefore, CPR recommends that the PMUC continues to regularly enquire to the APVMA regarding the status and outcome of this application

8.3. Bifenazate (capsicum, cucumber, zucchini and eggplant)

A permit application was received by the APVMA who subsequently released minor-use permit number: PER13047 (APVMA, 2011), which allows the use of bifenazate on capsicum and cucumber for two spotted mite control.

However, despite supportive data, a permit(s) allowing the use of bifenazate on eggplant and zucchini has not yet been released.

Thus, CPR recommends that the PMUC continues to regularly enquire to the APVMA regarding the status and outcome of this application, in relation to these 2 crops.

8.4. Chlorthal-Dimethyl (Lettuce)

A permit application has been submitted to the Australian Pesticides and Veterinary Medicines Authority (APVMA); however, the outcome of this is yet to be determined.

Therefore, CPR recommends that the PMUC continues to regularly enquire to the APVMA regarding the status and outcome of this application

8.5. Clethodim (Peas)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

8.6. Fluazifop-p-butyl (Sweet potato, leeks and eggplant)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

8.7. Iprodione (Onion and eggplant)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

8.8. Linuron (Leek and celeriac)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

8.9. Methomyl (Parsley, sweet potato and coriander)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

8.10. Pirimicarb (Eggplant)

A permit application has been submitted to the PMUC for consideration and approval before submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Because the data clearly supported renewal of the original permit CPR recommends that the PMUC approves the renewal application and submits it (via GrowCom) to the APVMA for their consideration.

9. References

APVMA (Australian Pesticides and Veterinary Medicines Authority) (2011) Permit to allow minor use of an agvet chemical product for control of two spotted mite on cucumber, capsicum and tomatoes. Permit number PER 13047. Department of Agriculture, fisheries and forestry, Australian Government.

Griffin, D. and Lean, R. (2011a). Determining the magnitude of abamectin residues in lettuce and peas grown in protected environments following two applications of Vertimec® miticide / insecticide at a rate of 450 mL/ha.

Griffin, D. and Lean, R. (2011b). The determination of azoxystrobin residues in field-grown beans and field-grown and protected lettuce following three applications of Amistar AZ 250 SC at a rate of 600mL/ha

Griffin, D. and Lean, R. (2011c). Determining the magnitude of bifenazate residues in fruits of cucumber, capsicum, zucchini and eggplant grown in field or protected environments following one application of Acramite® Miticide at a rate of 65mL/100L

Griffin, D. and Lean, R. (2011d). Determining the magnitude of chlorthal-dimethyl residues in field-grown lettuce following one application of Dacthal® 900WG pre-emergent herbicide at a rate of 6.25kg/ha and 12.5kg/ha.

Griffin, D. and Lean, R. (2012e). Determining the magnitude of clethodim residues in fresh market and processing peas following one application of Innova® Clethodim 240 Herbicide at a rate of 500 mL/ha

Griffin, D. and Lean, R. (2012f). Determining the magnitude of fluazifop-p-butyl residues in field-grown eggplant, leek and sweet potato following one application of Fusilade® post-emergence selective herbicide (212 g a.c./L) at a rate of 3300 mL/ha on leek and sweet potato and 160 mL/10L on eggplant.

Griffin, D. and Lean, R. (2012g). Determining the magnitude of iprodione residues in protected eggplant and field-grown onions following multiple applications of Rovril® Aquaflo fungicide at a rate of 100 mL/100L on eggplant and 2 L/ha on onions.

Griffin, D. and Lean, R. (2012h). Determining the magnitude of linuron residues remaining in leeks following three applications at 550 g/ha and in celeriac following one application at 2200 g/ha of the formulated product DuPont™ Linuron DF® herbicide

Griffin, D. and Lean, R. (2012i). The determination of azoxystrobin residues in field-grown beans and field-grown and protected lettuce following three applications of Amistar AZ 250 SC at a rate of 600mL/ha

Griffin, D. and Lean, R. (2012j). Determining the magnitude of pirimicarb residues remaining in the fruit of field-grown and protected eggplant, following three applications of Pirimor® WG aphicide at a rate of 200 g/100L