



# Beans and Peas

Strategic Agrichemical Review Process  
2011-2014

HAL Projects - MT10029 & VG12081

AgAware Consulting Pty Ltd  
Checkbox 3D Pty Ltd

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**Horticulture Australia project no:**

MT10029 – Managing pesticide access in horticulture.  
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**Contact:**

Noelene Davis  
Checkbox 3D Pty Ltd  
PO Box 187 Beecroft NSW 2119  
Ph: 0424 625 267 Email: ndavis@checkbox3d.com.au

**Purpose of the report:**

This report was funded by Horticulture Australia and the Australian vegetable industry to investigate the pest problem, agrichemical usage and pest management alternatives for the beans and peas industry across Australia. The information in this report will assist the industry with its agrichemical selection and usage into the future.

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*Horticulture Australia*

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## **1. Media Summary**

A Strategic Agrichemical Review Process (SARP) through the process of a desktop audit and industry liaison assesses the importance of the diseases, insects and weeds (plant pests) that can affect a horticultural industry; evaluates the availability and effectiveness of fungicides, insecticides and herbicides (pesticides) to control the plant pests; determines any 'gaps' in the pest control strategy and identifies suitable new or alternatives pesticides to address the gaps.

Alternative pesticides should ideally be selected for benefits of:

- Integrated pest management (IPM) compatibility
- Improved scope for resistance management
- Sound biological profile
- Residue and trade acceptance domestically and for export.

SARP workshops for beans and peas were conducted in Queensland, New South Wales and Tasmania as part of combined vegetable meetings in 2008, 2010 and 2011. The results of the process provide the beans and peas industry with pesticide options for the future that the industry can pursue for registration with the manufacturer, or minor-use permits with the Australian Pesticides and Veterinary Medicines Association (APVMA).

### **DISEASE**

Diseases identified as high priorities:

| <b>Disease (common name)</b> | <b>Disease (scientific name)</b>   |
|------------------------------|--|
| Damping off                  | <i>Pythium</i> spp., <i>Phytophthora</i> spp., <i>Fusarium</i> spp., <i>Rhizoctonia</i> spp. |
| Sclerotinia mould            | <i>Sclerotinia sclerotiorum</i>  |

There are few control options for the major diseases of beans and peas. This is a problem as growers prefer to alternate the use of fungicides within a crop and through crop rotations.

Beans and peas are crops where growers turn to non-chemical solutions, partly due to lack of approved pesticides, but partly also by choice. Integrated crop and disease management strategies are considered best practice in many cases. Nevertheless there remain considerable gaps and growers would like the newer fungicide entrants to the market to be considered for beans and peas.

### **INSECTS**

Insects identified as high priorities:

| <b>Insect (common name)</b>                                  | <b>Insect (scientific name)</b>                                    |
|--|--|
| Helioverpa   | <i>Helicoverpa</i> spp.  |
| Bean podborer  | <i>Maruca vitrata</i>  |
| Thrips, including Bean Blossom Thrips, Western flower thrips | <i>Megalurothrips usitatis</i> , <i>Frankliniella occidentalis</i> |

There are a considerable number of insecticides registered for use in beans and peas. However it would be helpful if a registrations in specific pea and bean crops could be extended to beans and peas more broadly. It would also be helpful if registrations for *Helicoverpa* covered Lepidoptera more extensively.

Some soft chemistry is available but growers would welcome registration of others to use in alternation, particularly as the use of the older, broader spectrum chemistry is disruptive to beneficials that are important for control of *Helicoverpa* and as resistance is a risk.

IPM is practiced widely and includes strategies of pest monitoring, spray timing, protection of beneficials and control of weed hosts.

## **WEEDS**

Growers generally use a pre-plant weed control (general knockdown herbicides) to prepare the paddock. Growers then either alternate the herbicides used or use them in combination for effective weed control. All the herbicides registered are either pre-emergent herbicides or early post-emergent herbicides. Most weeds can be controlled with currently available herbicides.

## **2. The Australian bean and pea industry**

The Australian bean and pea industries are well established, resourceful horticultural industries, which are always looking for systems to improve production efficiencies. Consumption of beans and peas has remained relatively stable over the past few years. Beans were Australia's 10<sup>th</sup> largest vegetable crop in 2008/09, accounting for 2.4% of total vegetable production (Ausveg 2011).

Beans are grown across Australia with the main growing regions being:

- Qld - Burdekin, Bowen, Bundaberg, Stanthorpe, Lockyer Valley, Gympie
- Tas - north west
- NSW - mid north coast
- Vic - Gippsland, Murray Valley
- WA - Carnarvon, Perth metro
- SA - Adelaide plains

In 2010, Queensland accounted for 54% of bean production, Tas 25% and NSW 12%.

In 2008/09, the area planted to beans (butter, French and runner) was 4,507 ha by 317 growers, production was 12,259 tonnes with a gross value of \$70.7 mill. Production has fluctuated between butter, French and runner beans varieties. (Ausveg 2011).

Peas are grown across Australia with the main growing regions being:

- Tas - north west
- Vic - Gippsland, Murray Valley
- NSW - Griffith, Sydney basin
- Qld – Stanthorpe, Brisbane metro area
- WA - Perth metro
- SA - Adelaide plains

In 2010, Queensland accounted for 54% of bean production, Tas 25% and NSW 12%.

In 2010/ 11 a total area of 6 054 ha of French and Runner beans was planted yielding 37 818 tonnes of product, with a total value of \$129.6 Mill.

In 2010/11, the area planted to peas (fresh & processing) was 3,333 ha by 306 growers, production was 14,205 tonnes with a gross value of \$8.3 mill. (Ausveg 2011). Processing peas accounts for 3,006 ha and 13,392 tonnes of the total pea production.

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Due to Australia's varying weather conditions, various production locations and the introduction of different varieties of beans and peas, the Australian industry is now able to supply the domestic markets with fresh beans and peas throughout the year.

## **3. Introduction**

### **3.1 Introduction**

Growers of some horticultural crops suffer from a lack of legal access to crop protection products (pesticides). The problem may be that whilst a relatively small crop area is valuable in an agricultural sense, it is not of sufficient size for agchem manufacturers to justify the expense of registering a product use on that crop. Alternately, the disease, pest, or weed problem may be regional or spasmodic, making agchem companies unwilling to bear the initial high cost of registering suitable pesticides. As an added complication some horticultural crops may be grown in protected cropping or hydroponic situations. These can have a significant impact on pesticide performance and residue outcomes, further increasing product development requirements and registration costs.

Growers may at times be in a situation where they face severe losses from diseases, pests and weeds if they do nothing to protect their crops, or face penalties if they use a product that is not registered or available via a permit. The beans and peas industry is very aware of the possible consequences of the use of unregistered or non-permitted pesticides. These can include: produce with unauthorised pesticide residues; rejection at both local and export market levels; placing Australian export trading arrangements in jeopardy, and; fines and penalties.

Environmental concerns, consumer demands, and public opinion are also significant influences in the marketplace related to pest management practices. Industry/IPM Practitioners must strive to implement best management practices and tools to incorporate a pest management regime where strategies work in harmony with each other to achieve the desired effects while posing the least risks.

Pesticides have always been an important tool in the production of beans and peas. They control the various diseases, insects and weeds that affect the crop and can cause severe economic loss in modern high intensity growing operations. Pesticides are utilized in seedling production, pre-plant, during plant establishment, through crop development and into crop maturity to maximise crop yield, quality and customer appeal.

From a pesticide access perspective, the APVMA classifies beans and peas as a major crop. The crop fits within the APVMA crop group 014 Legume vegetables (succulent seeds and immature pods).

As a consequence of the issues facing the beans and peas industry regarding pesticide access, Horticulture Australia Ltd and the vegetable industry undertook a review of the pesticide requirements in beans and peas via a Strategic Agrichemical Review Process (SARP). See Appendix 1 – the Strategic Agrichemical Review Process. The aim was to determine solutions (primarily pesticide) to current and future pest threats.

This SARP process identified diseases, insect pests and weeds of major concern to the industry. Against these threats available registered or permitted pesticides, along with non-pesticide solutions, were evaluated for overall suitability in terms of IPM, resistance, residues, withholding period, efficacy, trade, human safety and environmental issues. Where tools were unavailable or unsuitable the process aimed to identify potential future solutions.

This report is not a comprehensive assessment of all pests and control methods impacting on beans and peas production in Australia but attempts to prioritise the major problems.

### **3.2 Minor-use permits and registration**

APVMA classify beans and peas and the crop group, legume vegetables as major crops. Therefore access to minor use permits can be difficult, and will only be granted for limited uses within the crop. Possible justification for future permit applications could be based on:

- New disease, insect or weed identified as a cropping issue
- No pesticide available
- Current pesticides no longer work – resistance
- Current pesticides limiting trade
- IPM, environmental or operator issues
- Loss of pesticides due to removal from market
- New, effective pesticide registered in another crop
- Alternate pesticide has overseas registration or minor use permit

With each of these options, sound, scientific argument is required to justify any new registrations or permit applications.

Another option for the lettuce industry is for manufacturers to register new pesticides uses in the crop.

### **3.3 Methods**

The SARP was conducted in Queensland, New South Wales and Tasmania as part of combined vegetable meetings in 2008, 2010 and 2011. The meeting included leading growers, consultants, government agencies, agchem companies and agricultural reseller staff.

- Participants were given a comprehensive list of most major pests of lettuces and asked to prioritise them into high, moderate and low categories.
- Participants were then asked to list the main pesticides and or other control agents used for each pest.
- Mostly pesticide trade names were used and the list provided was certainly not comprehensive but a starting point for further assessment.
- Pesticides that are under review by the Australian Pesticides and Veterinary Medicines Authority (AVPMA) were listed.
- Information was collated onto Excel spreadsheets for diseases, insects and weeds.
- The information was circulated to participants for any further comments to ensure the accuracy of the information.
- Each alternative pesticide was assessed for:
  - IPM compatibility
  - Improved scope for resistance management
  - Sound biological profile
  - Residue and trade acceptance domestically and for export

Final selections of proposed new pesticides for the lettuce industry to pursue were listed.

### **3.4 Results and Discussions**

Results and discussions are presented in the body of this document.

## **4. Pests and diseases of beans and peas**

### **4.1 Diseases of beans and peas**

| <b>Common name</b>               | <b>Scientific name</b>   |
|----------------------------------|--|
| <b>HIGH PRIORITY</b>             |  |
| Damping off (beans & peas)       | <i>Pythium</i> spp., <i>Phytophthora</i> spp.<br><i>Fusarium</i> spp., <i>Rhizoctonia</i> spp. |
| Sclerotinia mould (beans & peas) | <i>Sclerotinia sclerotiorum</i>  |
| <b>MODERATE PRIORITY</b>         |  |
| Ascochyta blight                 | <i>Ascochyta</i> spp.  |
| Anthracnose                      | <i>Colletotrichum lindemuthianum</i>   |
| Bacterial brown spot             | <i>Pseudomonas syringae</i> pv. <i>Syringae</i>  |
| Blight                           | <i>Mycosphaerella pinodes</i>  |
| Botrytis                         | <i>Botrytis</i> spp.   |
| Common bacterial blight          | <i>Xanthomonas campestris</i> pv. <i>Phaseoli</i>  |
| Downy mildew                     | <i>Peronospora viciae</i>  |
| Fusarium wilt                    | <i>Fusarium</i> spp.   |
| Halo blight                      | <i>Pseudomonas syringae</i> pv. <i>Phaseolicola</i>  |
| Leaf blight                      | <i>Ascochyta fabae</i>   |
| Leaf & pod spot                  | <i>Ascochyta pisi</i>  |
| Powdery mildew                   | <i>Erysiphe pisi</i>   |
| Rust                             | <i>Uromyces</i> spp.   |
| Stem blight                      | <i>Macrophomina</i> spp.   |
| <b>LOW PRIORITY</b>              |  |
| Angular leaf spot                | <i>Phaeoisariopsis griseola</i>  |
| Black spot                       | <i>Phoma medicaginis</i> var. <i>pinodella</i>   |
| Root rot                         | <i>Rhizoctonia solani</i>  |
| <b>Biosecurity risk</b>          |  |
| None listed                      |  |

#### **4.1.1 High priority diseases**

##### **Damping off (*Pythium* spp., *Phytophthora* spp., *Fusarium* spp., *Rhizoctonia* spp.)**



*Pythium*, *Phytophthora* and *Fusarium* can cause pre-emergent rots and in some cases damping-off of young plants. Symptoms include water-soaked lesions with eventual collapse of the hypocotyl at or below ground. Plants become yellow and stunted if they survive. Occasionally, older plants are infected and develop water-soaked lesions that extend some distance up the stem, causing a linear band of dead cortical tissue. Common when temperatures vary dramatically with high soil moisture.

*Rhizoctonia* causes post-emergence damping-off of the seedling. Heavy infection will girdle the stem and the seedlings may die. Stems and roots can exhibit red lesions. Often the lesions heal over as the plant ages. *Rhizoctonia* root canker also occasionally occurs on the upper tap roots of older plants as discrete, reddish brown lesions and is common in lighter soils.

- Damping-off is considered a major-moderate problem in all states.
  - This is a plant establishment problem only.
  - Management strategies used by growers for this disease include crop rotation and alternation of chemicals from different fungicide groups.
- Fungicides registered for the control of Damping-off in beans and peas are:
  - 1,3-dichloropropene + chloropicrin (various products) fumigant
    - Restricted chemical
    - Broad vegetable claim for control of soil borne diseases as pre-plant treatment
    - Schedule 7 dangerous poison
  - Metalaxyl / Metalaxyl-M (various) - Group 4 – systemic seed treatment fungicide:
    - Registered in peas.
    - Occasionally used up by some growers.
    - Only used in known problem areas.
    - Does not provide control for long enough in adverse situations.
    - Works well when conditions are favourable.
    - Minimal impact on all beneficial insects.
  - Thiram (various) - Group M3 protectant fungicide
    - Registered in peas and beans as a seed treatment.
    - Registered as a drench for beans (Qld only)
    - There have been reports of lack of efficacy.
    - Minimal impact on all beneficial insects.
  - Thiram+Thiabendazole (various) - Group M3+1 protectant fungicide
    - Registered as a seed dressing in peas.
    - Registered to control seedling root rots (*Fusarium* spp, *Pythium* spp., *Macrophomina Phaseolina*).
- No fungicides are listed for the control of Damping-off in beans and peas via permits.
- Potential fungicide solutions
  - Cyazofamid (likely to be called RANMAN<sup>®</sup>, new ISK/FMC Fungicide) – first new product registration under assessment at the APVMA.
  - Fluopicolide, a new Bayer fungicide being assessed for first registration by the APVMA. Efficacy on *Pythium* spp.
- Non-chemical options
  - Crop rotation with gramineous or biofumigant crops
  - Disease-resistant varieties
  - Alternation of sowing dates to favour cooler, drier months
  - Avoidance of throwing soil up over the plants during inter-row cultivation
  - Consider disease species in the site when making planting decisions

### **Sclerotinia mould (*Sclerotinia sclerotiorum*)**



Sclerotinia produce prominent white, cottony mycelium covering affected plant parts. Initial lesions are small, circular, water-soaked and light green but rapidly increase in size. Affected tissues dry, turn brown, and may be covered with a white, cottony mycelium. Sclerotia form in infected tissue and entire branches or plants may be killed. Survival structures, known as sclerotia, which are about 1 mm in diameter and black in colour, develop on diseased tissue and within killed stems.

- Sclerotinia mould is considered a major-moderate problem in all states.

- Crop rotation critical to minimise disease. But as many alternate crops are also affected due to the wide host range, crop rotation alone is not in itself a solution.
- The industry desperately needs alternatives.
- No fungicides are registered for the control of Sclerotinia mould in beans and peas.
- Fungicides listed for Sclerotinia mould control in beans and peas via permits are:
  - Azoxystrobin (various) (PER13123, expires Mar 2014) – Group 11 protectant and curative fungicide
    - Protective and systemic fungicide.
    - Allowed in beans only.
    - Occasionally used in high pressure areas.
    - It is very effective but considered very expensive.
    - Minimal impact on all beneficial insects.
    - The expectation of the industry is that Syngenta will register the use.
  - Boscalid (various) (PER13897, expires Jun 2014) – Group 7 protectant and curative fungicide
    - Allowed in beans only.
    - Commonly used in high pressure areas.
    - It is very effective but considered very expensive.
    - Efficacy has been reported as better in some states than others. Poor in Qld. Reported as better than procymidone in Vic.
    - Minimal impact on all beneficial insects.
- Potential fungicides for the control of Sclerotinia in beans and peas:

Growers alternate between the different fungicides. Sclerotinia rot can be a significant problem in cool wet conditions which can lead to significant crop losses. Growers feel they need more systemic/curative options. The control of this disease needs a management strategy put in place to reduce the risk of resistance to the currently available products.

There is a new fungicide Penthiopyrad (FONTELLIS<sup>^</sup>, protective & systemic) with registration in brassica vegetables, brassica leafy vegetables and leafy vegetables for Sclerotinia mould control. It is not currently registered or on permit for use in beans and peas but is very effective in controlling the disease. Fontelis is a group 7 fungicide in the same group as Filan. The permit for Filan use on beans expires on 30-Jun-14 so if the permit is not renewed for Filan, Fontelis may be a possible alternative

#### **4.1.2 Disease control options**

| <b>Disease</b>  | <b>Active</b>  | <b>Crop</b>         | <b>WHP, days</b> | <b>Chemical group</b> |
|---|--|---------------------|------------------|-----------------------|
| Angular Leaf Spot   | Mancozeb   | Beans, peas         | 7(H),<br>14(G)   | M3                    |
| Anthracnose   | Mancozeb   | Beans, Peas         | 7(H),<br>14(G)   | M3                    |
|   | Metiram  | Beans               | 7                | M3                    |
|   | Zineb  | Beans               | 7                | Y                     |
| Ascochyta Blight / Late Blight  | Copper Oxide, Copper Sulphate                          | Peas                | 1                | M1                    |
|   | Mancozeb   | Beans, Peas         |                  | M3                    |
| Black Spot (Ascochyta Pisi, Mycosphaerella Pinodes, Phoma Medicaginis Var. Pinodella) | Chlorothalonil (PER11451, expires Jun 2018)            | Garden Peas         | 7(H),<br>*(G)    | M5                    |
| Black Spot (Leaf And Pod Spot And Collar Rot)   | Thiram+ Thiabendazole                                  | Peas, seed dressing | NR               | M3+1                  |
| Bacterial Brown Spot  | Copper Ammonium Complex, Copper Oxide, Copper Sulphate | Beans               | 1                | M1                    |
| Bacterial Spot / Bacterial  | Copper Oxychloride,                                    | Peas                | 1                | M1                    |

| Disease   | Active   | Crop   | WHP, days   | Chemical group |
|---|--|--|-------------|----------------|
| Blight  | Copper Ammonium Complex, Copper Oxide, Copper Sulphate   |  |             |                |
| Blight - Common   | Copper Oxychloride, Copper Ammonium Complex, Copper Oxide, Copper Sulphate                         | Beans  | 1           | M1             |
| Blight - Halo   | Copper Oxychloride, Copper Ammonium Complex Copper Ammonium Complex, Copper Oxide, Copper Sulphate | Beans  | 1           | M1             |
| Botrytis - Chocolate Spot   | Copper Oxychloride, Copper Ammonium Complex, Copper Oxide  | Beans  | 1           | M1             |
|   | Mancozeb   | Beans, Peas  |             | M3             |
| Botrytis - Grey Mould ( <i>Botrytis Cinerea</i> )   | Cyprodinil+fludioxonil (SWITCH^)   | Green peas   | 14          | 9+             |
| Downy Mildew  | Chlorothalonil   | Pea  |             | M1             |
|   | Metalaxyl / Metalaxyl-M  | Peas (NSW, Tas, SA, WA)  |             |                |
|   | Phosphorous Acid (PER11951, expires Mar 2015)  | Processing Peas  | NR          | –              |
|   | Zineb  | Peas   | 7           | Y              |
| Powdery Mildew  | Sulphur  | Vegetables   | NR          | M2             |
|   | Tebuconazole   | Peas   | 3(H, G)     | 3              |
|   | Triadimefon  | Peas   | 14          | C              |
| Rust  | Bitertanol (BAYCOR)  | Beans  | 3           | C              |
|   | Copper Oxide, Copper Sulphate  | Beans  | 1           | M1             |
|   | Mancozeb   | Beans, Peas  | 7(H), 14(G) | M3             |
|   | Metiram (POLYRAM)  | Beans  | 7           | M3             |
|   | Oxycarboxin (PLANTVAX^)  | Bean   | 7           | G              |
|   | Tebuconazole   | Bean   | 3(H, G)     | 3              |
|   | Zineb  | Beans  | 7           | Y              |
| Rust - Bean   | Sulphur  | Vegetables   | NR          | M2             |
| Sclerotinia   | Azoxystrobin (PER13123, expires Mar 2014)  | Beans  | 1           | 21             |
|   | Boscalid (PER13897, expires Jun 2014)  | Beans - Green Pods And Immature Seeds  | 7           | 7              |
| Seed Decay, Seedling Rot  | Thiram   | Peas, Beans, seed treatment (Qld, Vic, Tas, SA only)                           |             |                |
| Seedling Root Rots ( <i>Fusarium</i> spp, <i>Pythium</i> spp., <i>Macrophomina Phaseolina</i> ) | Thiram+ Thiabendazole  | Peas, seed dressing  | NR          | M3+1           |
| Soil Borne Disease - Damping Off  | Thiram   | Beans, drench (Qld only); Peas, Beans, seed treatment (Qld, Vic, Tas, SA only) | 7           |                |
| Soil Borne Disease - Damping-Off  | Metalaxyl / Metalaxyl-M  | Peas   |             |                |
| Soil Borne Diseases Incl Fusarium, Verticillium Wilts, Rhizoctonia, Pythium                     | 1,3-Dichloropropene + Chloropicrin   | Vegetables   | NR          | –              |

## 4.2 Insects of beans and peas

| Common name  | Scientific name  |
|--|--|
| <b>HIGH PRIORITY</b>   |  |
| Helioverpa   | <i>Helicoverpa</i> spp.  |
| Bean podborer  | <i>Maruca vitrata</i>  |
| Thrips, including Bean Blossom Thrips, Western flower thrips | <i>Megalurothrips usitatis</i> , <i>Frankliniella occidentalis</i> |
| <b>MODERATE PRIORITY</b>                                     |  |
| Bean fly   | <i>Ophiomyia phaseoli</i>  |
| Bean spider mite   | <i>Tetranychus ludeni</i>  |
| Green peach aphid  | <i>Myzus persicae</i>  |
| Green vegetable bug  | <i>Nezara viridula</i>   |
| Thrips   | <i>Thrips imaginis</i> , <i>T tabaci</i>                           |
| Rutherglen bug   | <i>Nysius vinitor</i>  |
| Silverleaf whitefly  | <i>Bemisia tabaci</i> Biotype B                                    |
| Two-spotted mite   | <i>Tetranychus urticae</i>   |
| <b>LOW PRIORITY</b>  |  |
| Looper caterpillars  | <i>Chrysodeixis</i> spp.   |
| <b>Biosecurity risk</b>                                      |  |
| None listed  |  |

### 4.2.1 High priority insects

#### Helicoverpa (*Helicoverpa armigera* and *Helicoverpa punctigera*)



This caterpillar varies greatly in appearance. They can reach lengths of 50 mm. It is generally initially pale green, sometimes with black dots, and a pattern of thin dark lines running along the body, the lines being darker around the second and third segments. Later the dark lines become less conspicuous, and the black spots develop red areas around them. There is a lot of variation in colour in this species. Some have white spots instead of black.

Helicoverpa species feed prolifically on leaves and are capable of causing large amounts of damage.

Newly hatched larvae are 1.5 mm long creamy in colour, hairy and have a dark brown head capsule. Older larvae vary greatly in colour and can be green, pink, buff, or brown. The larvae have distinct lateral (side) stripes and visible hairs. Helicoverpa species feed prolifically on leaves and pods and are capable of causing large amounts of damage.

- Helicoverpa are considered a:
  - Moderate-major problem in all areas.
  - Heliothis is of major concern as pods are developing.
  - *Helicoverpa armigera*, are known to develop insecticide resistance quickly. Effective rotation of soft option products and knowledge of IPM (Integrated Pest Management) practices will maximise control of this pest.

- Insecticides registered for *Helicoverpa* control in beans and peas are:
  - *Bacillus thuringiensis subsp. kurstaki* (various) - Group 11C contact insecticide
    - Registered in legume vegetables.
    - Btk is commonly used in bean and pea crops.
    - Very effective on small grubs, but needs regular application based on pest pressure.
    - Minimal impact on all beneficial insects.
  - Chlorantraniliprole (various, including CORAGEN<sup>^</sup>) - Group 28 contact and systemic insecticide
    - Commonly used in some regions up to twice per crop.
    - Controls all lepidoptera.
    - Very effective.
    - IPM compatible - low impact on beneficial insects and mites.
  - Efenvalerate (various) – Group 3A contact and ingestion insecticide
    - Registered in legume vegetables.
    - Occasionally used in some regions .
    - Considered effective.
    - Only used to get 'back in control' of grubs.
    - Moderately harmful to harmful to many beneficial insects.
  - *Helicoverpa* NPV (various) – biological insecticide
    - Registered in legume vegetables.
    - Commonly used.
    - Very effective .
    - Minimal impact on all beneficial insects.
  - Methomyl (various) - Group 1A contact and ingestion insecticide
    - Registered in beans only.
    - Occasionally used in some regions .
    - Very effective on a range of pests, including thrips.
    - Moderately disruptive to beneficial insects.
  - Permethrin (various) - Group 3A contact and ingestion insecticide
    - Registered in legume vegetables.
    - Occasionally used in some regions .
    - Considered effective.
    - Only used to get 'back in control' of grubs.
    - Moderately disruptive to beneficial insects.
  - Spinetoram (SUCCESS NEO<sup>^</sup>) - Group 5A contact and ingestion insecticide
    - Registered in legume vegetables.
    - Commonly used.
    - Very effective on a range of pests, including thrips.
    - Minimal impact on beneficial insects.
- No additional insecticides are available for the control of *Helicoverpa* in beans and peas via permit.

Growers are reporting that some insecticides are less effective and tolerance is suspected. Growers are trying to manage this issue with the selective use of insecticides and increasing reliance on beneficial insects. Growers would like insecticides that are currently registered for use on *Helicoverpa* registered for all lepidoptera species.

## Bean Pod Borer (*Maruca vitrata*)



Daff Qld website, accessed 14 March 2014

Bean podborer shelters within the plant canopy during the day then feeds at night on buds and flowers, boring into the developing pod to eat the seeds. Sesbania is a favoured weed host.

Bean pod borer is considered by some growers as a major pest of beans as it is difficult to distinguish the damage it causes from heliothis when they are both present.

- Insecticides registered for the control of been pod borer:
  - Methomyl (various) - Group 1A contact and ingestion insecticide
    - Registered in beans only.
    - Occasionally used in some regions .
    - Very effective on a range of pests, including thrips.
    - Moderately disruptive to beneficial insects.
- Potential insecticides for the control of been pod borer:
  - Pesticides effective against *Helicoverpa* (except *Helicoverpa virus*) will most likely control been pod borer
- IPM strategies:
  - IPM strategies need to be employed. The use of broad spectrum insecticides before flowering will reduce the populations of natural predators so should be avoided. However, if the bean pod borer numbers are above about 10 per square metre beneficials are unlikely to control the population.
  - Targeting insecticide use to the time after egg hatch and before larvae enter pods can minimise the amount of insecticide needed
  - Rotation with other crops
  - Control of weed hosts

## Thrips

including Bean Blossom Thrips, Western Flower Thrips (*Megalurothrips usitatus*, *Frankliniella occidentalis*)



Thrips species found in Green Bean crops  
(Source J. Duff DAFF(Qld))

While thrips can cause direct damage to foliage and fruit, their role as vectors disease is also of concern. They are weak fliers but are capable of infesting large areas of crop as they are easily blown by wind.

A number of thrips species impact beans and peas. Recent research identifies bean blossom thrips causing much more damage than WFT. In peas, onion thrips are the most likely to cause damage. Thrips cause damage by discolouring, scaring and deforming leaves as they feed. They are fast breeders when the weather is warm but not too hot and are capable of producing 12-15 generations per year with optimal conditions. Females live for up to 90 days and are capable of reproducing after approx 15-20 days.

WFT do not cause as much damage to bean pods as Bean Blossom Thrips *Megalurothrips usitatus*. It only takes 1 *Megalurothrips* to cause up to 50% pod damage while up to 5 WFT may only cause less than 20% pod damage. (HAL, 2012)

- Thrips are considered a major / moderate problem in most states except Tasmania where they have not been reported.
  - All insecticides are used in alternation due to rapid resistance development to many commonly used insecticides.
  - Growers find it difficult to distinguish difference between thrips species with the naked eye due to their very small size. 13 species of thrips have been identified from bean flowers alone (Project final report VG07017)
  - WFT develop resistance more easily than other thrips species.
  - Growers need multiple options and a better understanding of the damage the various species cause if any.
  
- Insecticides registered for the control of Western flower thrips in beans and peas are:
  - Dimethoate (various) – Group 1B contact and systemic insecticide.
    - Occasionally used for the control of a range of pests.
    - It is reported to still be effective.
    - This treatment is disruptive to beneficial insects in an IPM situation.
  
  - Esfenvalerate (various) – Group 3A
    - For the control of Plague thrips
    - Not IPM compatible
  
  - Methomyl (various) - Group 1A contact and ingestion insecticide
    - Registered in French beans and in peas for control of pea thrips.
    - Effective on a range of pests, including thrips.
    - Moderately disruptive to beneficial insects.
  
  - Paraffinic oil / petroleum oil (various) – contact insecticide
    - General thrips claim.
    - Moderately harmful to some beneficial insects.
  
  - Potassium salts (various) – contact biological insecticide
    - Also controls some other pests.
    - Minimal impact on all beneficial insects.
  
  - Pyrethrins+piperonyl butoxide (various) – Group 3A contact insecticide
    - Knockdown.
    - General thrips claim
    - Harmful to beneficials.
  
  - Spinetoram (SUCCESS NEO<sup>^</sup>) - Group 5A contact and ingestion insecticide
    - Registered in legume vegetables for WFT.
    - Commonly used in some regions.
    - Very effective on a range of pests, including helioverpa.
    - Moderately disruptive to beneficial insects.
    - Growers want rotation products to minimise chance of creating resistance.
  
  - Spirotetramat (MOVENTO<sup>^</sup>) – Group 23 contact and systemic
    - Registered for beans / tomato thrips, WFT
    - Very effective.
    - Reported as expensive.
    - Also controls other pests.
    - Moderately harmful to some beneficial insects.

- No insecticides are listed for control of Western flower thrips in beans and peas via permits.
- Potential insecticides for control of thrips.
  - chlorantraniliprole + thiamethoxam + (DURIVO<sup>^</sup>) - Group 4A + 28 contact and systemic insecticide
    - Registered in other vegetables as a seedling drench or soil drench for aphids, lepidoptera, whitefly and thrips.
    - Effective but moderately harmful to some beneficial insects.
  - Sulfoxaflor (TRANSFORM<sup>^</sup>) – Group 4C insecticide
    - Thrips registrations in a range of vegetables
    - May have adverse effects on parasitic wasps in IPM situations.
- IPM strategies
  - It is important to try and control thrips before flowering as once the flowers open and thrips and inside the flowers then chemical control is very difficult and bean and pea flowers are not as open as other crop flowers.
  - Thrip populations fluctuate throughout the growing season with numbers highest during the spring/summer dropping off during autumn, so the knowledge of population dynamics is important
  - It would be important to look at the range of thrips species and the damage that they cause to the plant and pods in particular as not all those found in flowers would be causing damage or significant damage.

#### **4.2.2 Summary**

There are a considerable number of insecticides registered for use in beans and peas. However it would be helpful if a number of registrations in specific pea and bean crops could be extended to beans and peas more broadly. It would also be helpful if registrations for Helicoverpa covered Lepidoptera more extensively.

Some soft chemistry is available but growers would welcome registration of others to use in alternation, particularly as the use of the older, broader spectrum chemistry is disruptive to beneficials that are important for control of Helicoverpa and as resistance is a risk.

IPM is practiced widely and includes strategies of pest monitoring, spray timing, protection of beneficials and control of weed hosts.

#### **Currently available insecticides**

| <b>Insects</b>       | <b>Active</b>                                | <b>Crop</b>                         | <b>WHP, days</b> | <b>Chemical group</b> |
|----------------------|--|-------------------------------------|------------------|-----------------------|
| African Black Beetle | Chlorpyrifos<br>(PER14074, expires Mar 2014) | Beans, Snow Peas, Sugar Snap Peas   | NR               | 1B                    |
| Ants                 | Pyrethrins+Piperonyl Butoxide                | Vegetables                          | 1                | 3A                    |
| Aphids               | Dimethoate                                   | Beans, peas                         | 7                | 1B                    |
|                      | Methidathion                                 | Beans, peas (Qld, Vic, Tas, SA, WA) | 7                | 1B                    |
|                      | Paraffinic oil, petroleum oil                | Beans                               | 1                |                       |
|                      | Potassium Salts Of Fatty Acids               | Vegetables                          | NR               | -                     |
|                      | Pyrethrins+Piperonyl Butoxide                | Vegetables                          | 1                | 3A                    |

| Insects                         | Active  | Crop  | WHP, days   | Chemical group |
|---------------------------------|---|---|-------------|----------------|
| Aphid – Green Peach             | Spirotetramat (MOVENTO <sup>^</sup> )         | Beans, peas                                     | 7(H), 7(G)  | 23             |
| Aphid - Cow pea aphid (NSW, WA) | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
| Armyworm                        | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
| Bean fly                        | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
|                                 | Methomyl                                      | French beans                                    | 1           | 1A             |
| Bean pod borer                  | Methomyl                                      | French beans                                    | 1           | 1A             |
| Cabbage Moth                    | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
|                                 | Trichlorfon                                   | Vegetables                                      | 2           | 1B             |
| Cabbage White Butterfly         | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
|                                 | Trichlorfon                                   | Vegetables                                      | 2           | 1B             |
| Caterpillars                    | Pyrethrins+Piperonyl Butoxide                 | Vegetables                                      | 1           | 3A             |
| Caterpillar - Cluster           | Methomyl (PER13395, expires Sep 2014)         | Flower Bean, Snake Bean, Faba Bean, Winged Bean | 3           | 1A             |
| Cucumber fly                    | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
| Cucumber Moth                   | Spinetoram (SUCCESS NEO <sup>^</sup> )        | Beans, peas                                     | 3(H), 14(G) | 5              |
| Cutworms                        | Trichlorfon                                   | Beans, Peas (Qld, NT only)                      | 2           | 1B             |
| Fruit fly                       | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
| Green Vegetable Bug             | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
|                                 | Methomyl                                      | French beans                                    | 1           | 1A             |
|                                 | Trichlorfon                                   | Vegetables                                      | 2           | 1B             |
| Helicoverpa                     | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
|                                 | Chlorantraniliprole (CORAGEN <sup>^</sup> )   | Legume vegetables                               | 1           | 28             |
|                                 | Esfenvalerate                                 | Beans, peas                                     |             | 3A             |
|                                 | Methomyl                                      | French Beans, Peas                              | 3           | 1A             |
|                                 | Nuclear Polyhedrosis Virus                    | Beans, Peas                                     | -           | -              |
|                                 | Permethrin 40:60                              | Beans, Peas                                     |             | 3A             |
|                                 | Spinetoram (SUCCESS NEO <sup>^</sup> )        | Beans, peas                                     | 3(H)14(G)   | 5              |
| Jassids                         | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
| Leaf hoppers                    | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
|                                 | Paraffinic oil, petroleum oil                 | Beans   | 1           |                |
|                                 | Pyrethrins+Piperonyl Butoxide                 | Vegetables                                      | 1           | 3A             |
| Leafmining fly                  | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
| Lightbrown Apple Moth           | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
| Loopers                         | <i>Bacillus thuringiensis subsp. kurstaki</i> | Vegetables                                      | NR          | 11             |
|                                 | Methidathion                                  | Peas (Qld, Vic, Tas, SA, WA)                    | 7           | 1B             |
|                                 | Methomyl                                      | French Beans, Peas                              | 1           | 1A             |
| Mealybug                        | Potassium Salts Of Fatty Acids                | Vegetables                                      | NR          | -              |
| Mites                           | Dimethoate                                    | Beans, peas                                     | 7           | 1B             |
|                                 | Paraffinic oil, petroleum oil                 | Beans   | 1           |                |

| Insects                         | Active   | Crop  | WHP, days   | Chemical group |
|---------------------------------|--|---|-------------|----------------|
| Mite – Two Spotted (Red Spider) | Bifenazate (PER12906, expires Mar 2018)            | Snake Beans                                   | 1(H), *(G)  | UN             |
|                                 | Potassium Salts Of Fatty Acids                     | Vegetables                                    | NR          | -              |
|                                 | Propargite   | Beans, vegetables                             | 7           | 12C            |
|                                 | Sulphur  | Vegetables                                    | NR          |                |
| Mite - Red legged earth         | Dimethoate   | Beans, peas                                   | 7           | 1B             |
| Plant parasitic nematodes       | 1,3-Dichloropropene + Chloropicrin                 | Vegetables                                    | NR          | 8B             |
| Rutherglen Bug                  | Trichlorfon  | Vegetables                                    | 2           | 1B             |
| Symphylans (garden centipedes)  | 1,3-Dichloropropene + Chloropicrin                 | Vegetables                                    | NR          | 8B             |
| Thrips                          | Dimethoate   | Beans, peas                                   | 7           | 1B             |
|                                 | Methyl bromide (PER10145, 11092, expires Oct 2014) | Food Producing Plants (Not Persons Generally) | 3           | 8A             |
|                                 | Paraffinic oil, petroleum oil                      | Beans   | 1           |                |
|                                 | Potassium Salts Of Fatty Acids                     | Vegetables                                    | NR          | -              |
|                                 | Pyrethrins+Piperonyl Butoxide                      | Vegetables                                    | 1           | 3A             |
| Thrips - Pea                    | Methomyl   | French Beans, Peas                            | 1           | 1A             |
| Thrips - Plague                 | Esfenvalerate                                      | Beans, peas                                   |             | 3A             |
| Thrips - Tomato                 | Spirotetramat (MOVENTO^)                           | Beans   | 7(H), 7(G)  | 23             |
| Thrips – Western flower         | Spirotetramat (MOVENTO^)                           | Beans   | 7(H), 7(G)  | 23             |
|                                 | Spinetoram (SUCCESS NEO^)                          | Beans, peas                                   | 3(H), 14(G) | 5              |
| Vegetable Weevil                | Chlorpyrifos (PER14074, expires Mar 2014)          | Beans, Snow Peas, Sugar Snap Peas             | NR          | 1B             |
| Vine Moth                       | <i>Bacillus thuringiensis subsp. kurstaki</i>      | Vegetables                                    | NR          | 11             |
| Whiteflies                      | Pyrethrins+Piperonyl Butoxide                      | Vegetables                                    | 1           | 3A             |
|                                 | Potassium Salts Of Fatty Acids                     | Vegetables                                    | NR          | -              |
| Whitefly - Greenhouse           | Botanical oil                                      | Vegetables                                    | NR          |                |
| Whitefly-Silverleaf             | Spirotetramat (MOVENTO^)                           | Beans, peas                                   | 7(H), 7(G)  | 23             |
|                                 | Bifenthrin (PER12947, exp Apr 2015)                | Beans   | 2(H), *(G)  | 3A             |
| Wingless grasshoppers           | Dimethoate   | Beans, peas                                   | 7           | 1B             |
| Wireworms                       | 1,3-Dichloropropene + Chloropicrin                 | Vegetables                                    | NR          | 8B             |
|                                 | Chlorpyrifos (PER14074, expires Mar 2014)          | Beans, Snow Peas, Sugar Snap Peas             | NR          | 1B             |
| Wireworms - False               | Chlorpyrifos (PER14074, expires Mar 2014)          | Beans, Snow Peas, Sugar Snap Peas             | NR          | 1B             |

### **4.3 Weeds of beans and peas**

- Registered herbicides that are used in beans and peas:
  - Acifluorfen (BLAZER<sup>^</sup>) – Group G in-crop herbicide.
    - For beans only to control Amaranthus.
    - Occasionally used.
    - Considered very effective.
  - Bentazone (various) – Group C broadleaf selective post-emergent herbicide.
    - For beans only.
    - Occasionally used.
    - Considered very effective.
    - Controls many weeds.
  - Clomazone (various) – Group F pre-emergent residual herbicide.
    - For beans only.
    - Occasionally used.
    - Considered very effective.
    - Controls many broadleaf weeds.
  - Cyanazine (various) – Group C broadleaf selective pre or post-emergent herbicide
    - For peas only.
    - Occasionally used.
    - Considered very effective.
    - Controls most weeds.
  - Chlorthal-dimethyl (various) – Group D pre or post-emergent herbicide
    - Occasionally used.
    - Considered very effective.
    - Controls most weeds.
  - Dimethenamid-P (various) – Group K at sowing residual herbicide.
    - For beans and peas.
    - Occasionally used.
    - Considered very effective.
    - Controls most weeds.
  - Fluazifop-P as butyl (various) – Group A grass selective post-emergent herbicide
    - Peas, beans
    - Commonly used.
    - Considered very effective.
    - Controls most grass weeds. Does not control Winter grass (*Poa annuum*).
  - Glyphosate (various) – Group M pre-plant general knockdown herbicide
    - Commonly used.
    - Works well in non-resistant populations.
  - Metolachlor/ S-Metolachlor (various) - Group K pre-plant residual herbicide
    - For beans only.
    - Commonly used.
    - Considered effective.
    - Controls many broadleaf and some grass weeds.
  - Metribuzin (various) – Group C in-crop residual herbicide
    - For peas only.
    - Commonly used.
    - Some crop phyto issues in some situations.
    - Considered effective.
    - Controls many broadleaf weeds.

- Pendimethalin (various) - Group D residual herbicide
  - For beans and peas.
  - Occasionally used.
  - Growers comment that does not control all weeds that occur.
- Quizalofop-P-ethyl (various) - Group A grass selective post-emergent herbicide
  - For beans and peas.
  - Commonly used.
  - Considered very effective.
  - Controls most grass weeds. Does not control Winter grass (*Poa annuum*).
- Sethoxydim (various) - Group A grass selective post-emergent herbicide
  - For beans and peas.
  - Occasionally used.
  - Used to spot spray grass weeds post-emergent.
- Terbutryn (various) – Group C in-crop residual herbicide
  - For peas only.
  - Rarely used.
  - Some crop phyto issues in some situations.
  - Controls many broadleaf weeds.
- Trifluralin (various) – Group D pre-emergence pre-sowing herbicide
  - For beans and peas.
  - Glyphosate (various) – Group M pre-plant general knockdown herbicide
  - Commonly used.
  - Works well as a pre-crop spray.
- Paraquat + diquat (various) - Group L pre-plant general knockdown herbicide
  - Occasionally used.
  - Works well as a pre-crop spray.
- The herbicides listed for control of weeds in beans and peas via permits:
  - Bentazone (various) (PER12392, expires Sep 2014) – Group C broadleaf selective post-emergent herbicide
    - For peas only.
    - Occasionally used. Commonly used in Tas in processing peas.
    - Considered very effective.
    - Controls most weeds.
  - Diflufenican (various, includes PER14035, expires Mar 2023) – Group F early post-emergence.
    - For peas only.
    - Occasionally used.
    - Considered very effective.
    - Controls most weeds.

Growers generally use a pre-plant weed control (general knockdown herbicides) to prepare the paddock. Growers then either alternate the herbicides used or use them in combination for effective weed control. All the herbicides registered are either pre-emergent herbicides or early post-emergent herbicides.

Most weeds can be controlled with currently available herbicides.

No weeds were identified as a high priority for control.

## **5. References**

### **Information:**

Australasian Biological Control website.  
Australian Bureau of Statistics, Agricultural Commodities website.  
Australian Horticultural Statistics Handbook.  
Australian Pesticide and Veterinary Medicines Authority website.  
Ausveg 'Domestic Vegetable Industry Snapshot' (2009) website.  
<http://ausveg.businesscatalyst.com/resources/statistics/domestic-industry/vegetable-production.htm>  
Ausveg 'Fresh Vegetable Exports' (2011) website.  
Biobest website.  
Codex MRL database website.  
Cornell University website.  
Daff website: <http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/a-z-insect-pest-list/bean-podborerDiseases> of Vegetable Crops.  
Department of Primary Industries Queensland. Accessed 14 March 2014.  
Horticulture Australia Limited. VG07017. Thrips management in the green beans industry. 2012  
IOBC Working Group - Classification of side effects to beneficial insects website.  
Infopest, Department of Primary Industries and Fisheries, Queensland Government, July 2012.  
IPM Technologies final report. Project: Pesticide effects on beneficial insects and mites in vegetables.  
IR-4 Project website.  
Managing Insects and Mites in horticultural crops, QLD DPI, 1994.  
McMaugh, 'What garden pest or disease is that?' published 1989.  
New South Wales Department of Primary Industries websites.  
Pest management strategy documents for Queensland's fruit and vegetable industries, Queensland Fruit and Vegetable growers, 2003 & 2008.  
USA Foreign Ag Service website.  
Vegetable IPM Coordinator draft report 2011. Sandra McDougall NSW DPI.

Images:

Google images

### **Acronyms**

|                   |  |
|-------------------|--|
| APVMA .....       | Australian Pesticides and Veterinary Medicines Authority                         |
| DPI .....         | Department of Primary Industries   |
| HAL .....         | Horticulture Australia Ltd   |
| IPM .....         | Integrated pest management   |
| IR-4 .....        | Interregional Research Program 4 (USA)   |
| MRL .....         | Maximum residue limit (mg/kg or ppm)   |
| Plant pests ..... | Diseases, insects, nematodes, viruses, weeds, etc                                |
| Pesticides .....  | Plant protection products (fungicide, insecticide, herbicide, nematocides, etc). |
| SARP .....        | Strategic Agrichemical Review Process  |
| WHP .....         | Withholding period   |

Australian states and territories: NSW (New South Wales), NT (Northern Territory), Qld (Queensland), SA (South Australia), Tas (Tasmania), Vic (Victoria), WA (Western Australia)

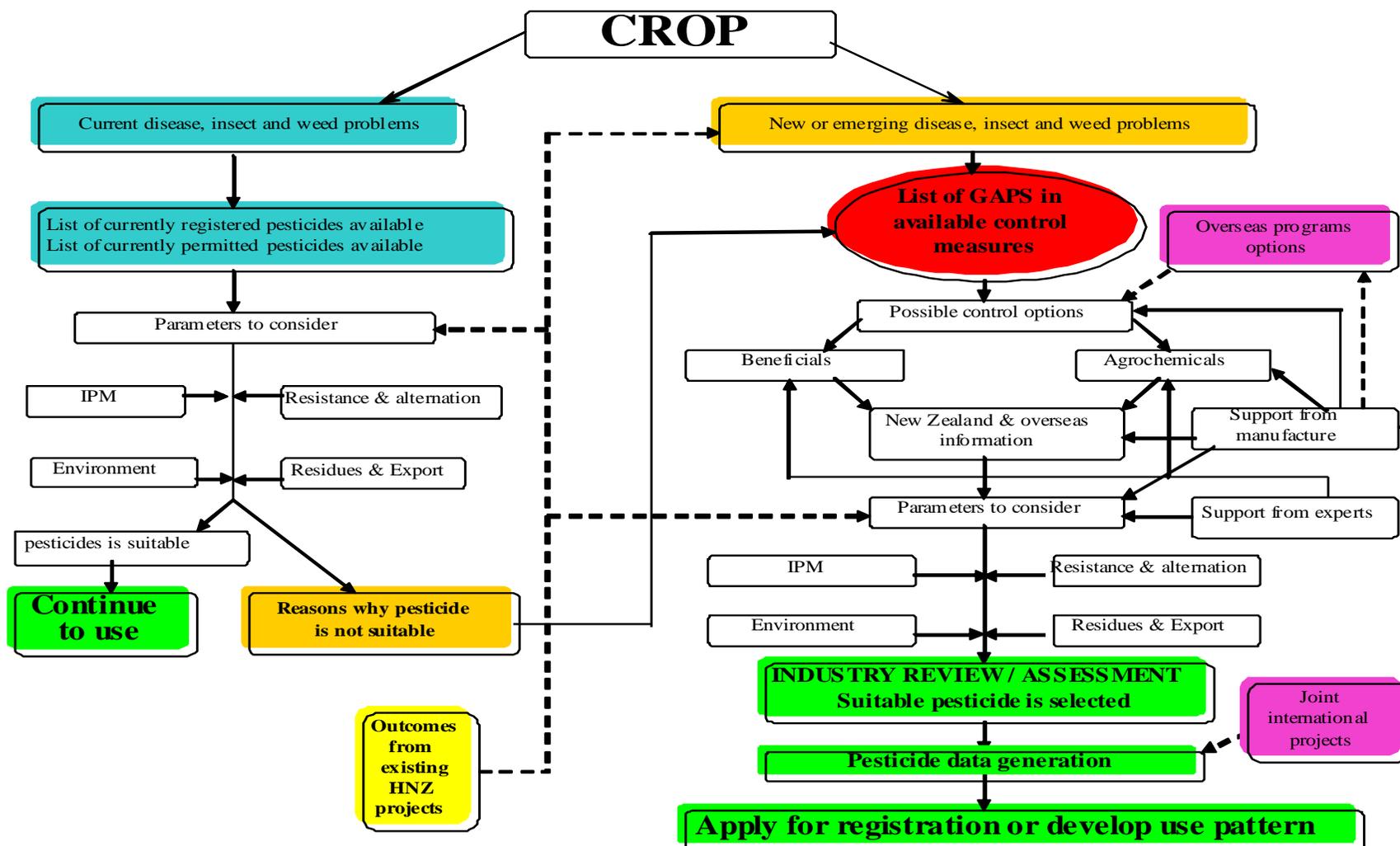
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^Trademark

## 6. Appendices

### APPENDIX 1: The Strategic Agrichemical Review Process



**Appendix 2 – currently available fungicides in beans and peas.**

| Active   | Crop                                  |   | WHP, days   | Chemical group |
|--|---------------------------------------|---|-------------|----------------|
| 1,3-Dichloropropene + Chloropicrin   | Vegetables                            | Soil borne diseases incl Fusarium, Verticillium wilts, Rhizoctonia, Pythium           | NR          | –              |
| Azoxystrobin (PER13123, expires Mar 2014)  | Beans                                 | Sclerotinia   | 1           | 21             |
| Bitertanol (BAYCOR)  | Beans                                 | rust  | 3           | C              |
| Boscalid (PER13897, expires Jun 2014)  | Beans - Green Pods And Immature Seeds | Sclerotinia   | 7           | 7              |
| Chlorothalonil   | Pea                                   | Downy mildew  |             | M1             |
| Chlorothalonil (PER11451, expires Jun 2018)  | Garden Peas                           | Black Spot (Ascochyta Pisi, Mycosphaerella Pinodes, Phoma Medicaginis Var. Pinodella) | 7(H), *(G)  | M5             |
| Copper Ammonium Complex, Copper Oxide, Copper Sulphate   | Beans                                 | Bacterial brown spot  | 1           | M1             |
| Copper Oxychloride, Copper Ammonium Complex Copper Ammonium Complex, Copper Oxide, Copper Sulphate | Beans                                 | Blight - Halo   | 1           | M1             |
| Copper Oxychloride, Copper Ammonium Complex, Copper Oxide, Copper Sulphate                         | Beans                                 | Blight - common   | 1           | M1             |
| Copper Oxychloride, Copper Ammonium Complex, Copper Oxide  | Beans                                 | Chocolate spot - Botrytis   | 1           | M1             |
| Copper Oxychloride, Copper Ammonium Complex  | Beans                                 | Chocolate spot - Botrytis   | 1           | M1             |
| Copper Oxychloride, Copper Ammonium Complex, Copper Oxide, Copper Sulphate                         | Peas                                  | Bacterial spot / bacterial blight   | 1           | M1             |
| Copper Oxide, Copper Sulphate  | Beans                                 | Rust  | 1           | M1             |
| Copper Oxide, Copper Sulphate  | Peas                                  | Ascochyta blight  | 1           | M1             |
| Cyprodinil+fludioxonil (SWITCH^)   | Green Peas                            | Grey mould ( <i>Botrytis cinerea</i> )  | 14          | 9+             |
| Mancozeb   | Beans, Peas                           | Ascochyta blight / late blight  |             | M3             |
| Mancozeb   | Beans, Peas                           | Chocolate spot - Botrytis   |             | M3             |
| Mancozeb   | Beans, Peas                           | Rust  | 7(H), 14(G) | M3             |
| Mancozeb   | Beans, Peas                           | Anthraco nose   | 7(H), 14(G) | M3             |
| Mancozeb   | Beans, Peas                           | Angular leaf spot   | 7(H), 14(G) | M3             |
| Metalaxyl / Metalaxyl-M  | Peas                                  | Damping-off   |             |                |

| Active  | Crop   |  | WHP, days | Chemical group |
|---|--|--|-----------|----------------|
| Metalaxyl / Metalaxyl-M                       | Peas (NSW, Tas, SA, WA)                              | Downy mildew   |           |                |
| Metiram (POLYRAM^)                            | Beans  | Rust   | 7         | M3             |
| Metiram                                       | Beans  | Anthraco   | 7         | M3             |
| Oxycarboxin (PLANTVAX^)                       | Beans  | Rust   | 7         | G              |
| Phosphorous Acid (PER11951, expires Mar 2015) | Processing Peas                                      | Downy Mildew   | NR        | –              |
| Sulphur                                       | Vegetables   | Powdery mildew   | NR        | M2             |
| Sulphur                                       | Vegetables   | Bean rust  | NR        | M2             |
| Sulphur                                       | Vegetables   | Mite – Two spotted (red spider)  | NR        |                |
|   |  |  |           |                |
| Tebuconazole                                  | Beans  | Rust   | 3(H, G)   | 3              |
| Tebuconazole                                  | Peas   | Powdery mildew   | 3(H, G)   | 3              |
| Thiram  | Beans, Drench (Qld Only)                             | Damping off  | 7         |                |
| Thiram  | Peas, Beans, Seed Treatment (Qld, Vic, Tas, SA Only) | Damping off  |           |                |
| Thiram  | Peas, Beans, Seed Treatment (Qld, Vic, Tas, SA Only) | Deed decay, seedling rot   |           |                |
| Thiram  | Peas, Beans, Seed Treatment (Qld, Vic, Tas, SA Only) | Damping off  |           |                |
| Thiram+Thiabendazole                          | Peas, Seed Dressing                                  | Black spot (leaf and pod spot and collar rot)                            | NR        | M3+1           |
| Thiram+Thiabendazole                          | Peas, Seed Dressing                                  | Seedling root rots (Fusarium spp, pythium spp., Macrophomina phaseolina) | NR        | M3+1           |
|   |  |  |           |                |
| Triadimefon                                   | Peas   | Powdery mildew   | 14        | C              |
| Zineb   | Beans  | Anthraco   | 7         | Y              |
| Zineb   | Beans  | Rust   | 7         | Y              |
| Zineb   | Peas   | Downy mildew   | 7         | Y              |
| Zineb   | Beans  | Anthraco   | 7         | Y              |

### Appendix 3 – currently available insecticides in beans and peas.

| Active  |                              | Crop                              |  | WHP, days  | Chemical group |
|---|------------------------------|-----------------------------------|--|------------|----------------|
| 1,3-Dichloropropene + Chloropicrin            |                              | Vegetables                        | Plant parasitic nematodes                                    | NR         | 8B             |
| 1,3-Dichloropropene + Chloropicrin            |                              | Vegetables                        | Symphylans (garden centipedes)                               | NR         | 8B             |
| 1,3-Dichloropropene + Chloropicrin            |                              | Vegetables                        | Wireworms  | NR         | 8B             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Armyworm   | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Cabbage Moth   | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Cabbage White Butterfly                                      | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | <i>Helicoverpa armigera</i> (Corn Earworm / Cotton Bollworm) | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | <i>Helicoverpa punctigera</i> (Native Budworm)               | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Lightbrown Apple Moth  | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Loopers  | NR         | 11             |
| <i>Bacillus thuringiensis subsp. kurstaki</i> |                              | Vegetables                        | Vine Moth  | NR         | 11             |
| Botanical oil                                 |                              | Vegetables                        | Greenhouse whitefly  | NR         |                |
| Bifenazate                                    | (PER12906, expires Mar 2018) | Snake Beans                       | Mites-Two Spotted  | 1(H), *(G) | UN             |
| Bifenthrin                                    | (PER12947, expires Apr 2015) | Beans                             | Whitefly-Silverleaf  | 2(H), *(G) | 3A             |
| Chlorantraniliprole (CORAGEN <sup>^</sup> )   |                              | Legume vegetables                 | Helicoverpa  | 1          | 28             |
| Chlorpyrifos                                  | (PER14074, expires Mar 2014) | Beans, Snow Peas, Sugar Snap Peas | African Black Beetle   | NR         | 1B             |
| Chlorpyrifos                                  | (PER14074, expires Mar 2014) | Beans, Snow Peas, Sugar Snap Peas | False Wireworms  | NR         | 1B             |
| Chlorpyrifos                                  | (PER14074, expires Mar 2014) | Beans, Snow Peas, Sugar Snap Peas | Vegetable Weevil   | NR         | 1B             |
| Chlorpyrifos                                  | (PER14074, expires Mar 2014) | Beans, Snow Peas, Sugar Snap Peas | Wireworms  | NR         | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Aphids   | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Jassids  | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Miles  | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Leaf hoppers   | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Green vegetable but  | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Thrips   | 7          | 1B             |
| Dimethoate                                    |                              | Beans, Peas                       | Wingless grasshoppers  | 7          | 1B             |

| Active                         |                              | Crop  |   | WHP, days | Chemical group |
|--------------------------------|------------------------------|---|---|-----------|----------------|
| Dimethoate                     |                              | Beans, Peas                                   | Cow pea aphid (NSW, WA)                       | 7         | 1B             |
| Dimethoate                     |                              | Beans, Peas                                   | Bean fly                                      | 7         | 1B             |
| Dimethoate                     |                              | Beans, Peas                                   | Red legged earth mite (NSW, Vic, Tas, SA, WA) | 7         | 1B             |
| Dimethoate                     |                              | Beans, Peas                                   | Leafmining fly                                | 7         | 1B             |
| Dimethoate                     |                              | Beans, Peas                                   | Cucumber fly                                  | 7         | 1B             |
| Dimethoate                     |                              | Beans, Peas                                   | Fruit fly                                     | 7         | 1B             |
| Esfenvalerate                  |                              | Beans, Peas                                   | Thrips - plague                               |           | 3A             |
| Esfenvalerate                  |                              | Beans, Peas                                   | Helicoverpa                                   |           | 3A             |
| Methidathion                   |                              | Beans, Peas (Qld, Vic, Tas, SA, WA)           | Aphids  | 7         | 1B             |
| Methidathion                   |                              | Peas (Qld, Vic, Tas, SA, WA)                  | Loopers                                       | 7         | 1B             |
| Methomyl                       |                              | French beans                                  | Bean pod borer                                | 3         | 1A             |
| Methomyl                       |                              | French Beans                                  | Bean fly                                      | 3         | 1A             |
| Methomyl                       |                              | French Beans, Peas                            | Bean thrip                                    | 3         | 1A             |
| Methomyl                       |                              | French Beans, Peas                            | Helicoverpa                                   | 3         | 1A             |
| Methomyl                       |                              | French Beans, Peas                            | Looper  | 3         | 1A             |
| Methomyl                       |                              | French Beans, Peas                            | Green vegetable bug                           | 3         | 1A             |
| Methyl bromide                 | (PER10145, expires Oct 2014) | Food Producing Plants (Not Persons Generally) | Thrips  | 3         | 8A             |
| Methyl bromide                 | (PER11092, expires Oct 2014) | Food Producing Plants (Not Persons Generally) | Thrips  | 3         | 8A             |
| Nuclear Polyhedrosis Virus     |                              | Beans, Peas                                   | Helicoverpa                                   | -         | -              |
| Permethrin 40:60               |                              | Beans, Peas                                   | Helicoverpa                                   |           | 3A             |
| Paraffinic oil, petroleum oil  |                              | Beans   | Aphids  | 1         |                |
| Paraffinic oil, petroleum oil  |                              | Beans   | Leafhoppers                                   | 1         |                |
| Paraffinic oil, petroleum oil  |                              | Beans   | Mites   | 1         |                |
| Paraffinic oil, petroleum oil  |                              | Beans   | Thrips  | 1         |                |
| Potassium Salts Of Fatty Acids |                              | Vegetables                                    | Aphids  | NR        | -              |
| Potassium Salts Of Fatty Acids |                              | Vegetables                                    | Mealybug                                      | NR        | -              |
| Potassium Salts Of Fatty Acids |                              | Vegetables                                    | Thrips  | NR        | -              |
| Potassium Salts Of Fatty Acids |                              | Vegetables                                    | Two Spotted Mite / Spider Mite                | NR        | -              |
| Potassium Salts Of Fatty Acids |                              | Vegetables                                    | Whitefly                                      | NR        | -              |

| Active                        | Crop                       |  | WHP, days   | Chemical group |
|-------------------------------|----------------------------|--|-------------|----------------|
| Propargite                    | Beans, vegetables          | Mites – two spotted (red spider)       | 7           | 12C            |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Ants                                   | 1           | 3A             |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Aphids                                 | 1           | 3A             |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Caterpillars                           | 1           | 3A             |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Leafhoppers                            | 1           | 3A             |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Thrips                                 | 1           | 3A             |
| Pyrethrins+Piperonyl Butoxide | Vegetables                 | Whiteflies                             | 1           | 3A             |
| Spinetoram (SUCCESS NEO^)     | Beans, peas                | Helioverpa Punctigera - Native Budworm | 3(H), 14(G) | 5              |
| Spinetoram (SUCCESS NEO^)     | Beans, peas                | Cucumber moth                          | 3(H), 14(G) | 5              |
| Spinetoram (SUCCESS NEO^)     | Beans, peas                | Thrips - Western Flower Thrips         | 3(H), 14(G) | 5              |
| Spirotetramat (MOVENTO^)      | Beans, peas                | Aphid – Green Peach                    | 7(H), 7(G)  | 23             |
| Spirotetramat (MOVENTO^)      | Beans, peas                | Whitefly – silverleaf                  | 7(H), 7(G)  | 23             |
| Spirotetramat (MOVENTO^)      | Beans                      | Thrips – Western flower                | 7(H), 7(G)  | 23             |
| Spirotetramat (MOVENTO^)      | Beans                      | Thrips - tomato                        | 7(H), 7(G)  | 23             |
| Sulphur                       | Vegetables                 | Mite – Two Spotted (Red Spider)        | NR          |                |
| Trichlorfon                   | Beans, Peas (Qld, NT only) | Cutworms                               | 2           | 1B             |
| Trichlorfon                   | Vegetables                 | Cabbage Moth                           | 2           | 1B             |
| Trichlorfon                   | Vegetables                 | Cabbage White Butterfly                | 2           | 1B             |
| Trichlorfon                   | Vegetables                 | Green Vegetable Bug                    | 2           | 1B             |
| Trichlorfon                   | Vegetables                 | Rutherglen Bug                         | 2           | 1B             |

## Appendix 4 – currently available herbicides in beans and peas.

| Active                                     | Crop            |                                     | WHP, days    | Chemical group |
|--|-----------------|-------------------------------------|--------------|----------------|
| Acifluorfen (BLAZER <sup>^</sup> )         | Bean            | Prince of Wales feather             | 28           | G              |
| Bentazone                                  | Bean            | Broadleaf-Variou                    | 35d          | C              |
| Bentazone (PER12392, expires Sep 2014)     | Processing Peas | Broadleaf-Variou                    | 35d          | C              |
| Chlorthal-dimethyl                         | Beans, peas     | Grass and broadleaf weeds – various |              | D              |
| Clomazone                                  | Beans           | Broadleaf - Various                 |              | Q              |
| Cyanazine                                  | Pea             | Grass and broadleaf - various       | NR           | C              |
| Diflufenican                               | Pea             |                                     |              | F              |
| Diflufenican (PER14035, expires Mar 2023)  | Green Peas      | Broadleaf                           | NR           | F              |
| Dimethenamid-P                             | Beans, Peas     | Grass and broadleaf                 | NR           | K              |
| Fluazifop-P                                | Beans, Peas     | Grass weeds                         | NR           | A              |
| Glyphosate                                 | Pre-crop fallow | Grass and broadleaf                 | NR           | M              |
| Metolachlor / S-Metolachlor                | Bean            | Grass and broadleaf - various       | 70           | K              |
| S-Metolachlor (PER13626, expires Jun 2017) | Green Beans     | Grass And Broadleaf                 | NR(H), 56(G) | K              |
| Metribuzin                                 | Peas            | Grass and broadleaf - various       |              | C              |
| Pendimethalin                              | Bean            | Grass and broadleaf - various       |              | D              |
| Quizalofop                                 | Beans, Peas     | Grass and broadleaf - various       |              | A              |
| Sethoxydim                                 | Beans, Peas     | Grass weeds                         |              | A              |
| Terbutryn                                  | Pea             | Broadleaf                           |              | C              |
| Terbutryn (PER11404, expires Aug 2014)     | Field Peas      | Broadleaf-Label                     | 28(H), 7(G)  | C              |
| Trifluralin                                | Beans, Peas     | Grass and broadleaf                 |              | D              |