

# **Leafy vegetables think tank**

Dr Alison Anderson  
ARRIS Pty Ltd

Project Number: VG09057

## **VG09057**

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**Leafy Vegetables Think Tank,  
Adelaide,  
30<sup>th</sup> November & 1<sup>st</sup> December, 2009**

Dr Alison Anderson  
Arris Pty Ltd

Project Number: VG09057



## **Author Contact Details**

Dr Alison Anderson  
Arris Pty Ltd  
PO Box 206  
HIGHGATE SA 5063  
AUSTRALIA

Phone: (02) 9576 5449  
Mobile: 0400 600 628  
Email: [aanderson@arris.com.au](mailto:aanderson@arris.com.au)

## **HAL Project Number VG09057**

This final report details the outcomes of a one and a half day workshop held in Adelaide, 30 November and 1 December, where leafy vegetable growers, researchers, industry development officers, processors, seed companies and consultants determined the priorities for future investment of national vegetable levy funds in leafy vegetable research and development (R&D) projects.

Arris appreciates the time given by growers away from their farms and consultants away from their businesses to contribute to the workshop. Arris also acknowledge State Departments of Primary Industries and Agriculture and other employers for granting their staff the time to attend the workshop to contribute their knowledge and expertise.

This project was facilitated by HAL in partnership with AUSVEG and was funded by the National Vegetable Levy. The Australian Government provides matched funding for all HAL's R&D activities.

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## **MEDIA SUMMARY**

The Leafy Vegetables Think Tank was held in Adelaide on 30 November and 1 December, 2009 and was funded by the National Vegetable Levy and Australian Government through HAL. Comprised of 13 growers (including 1 grower/processor), 11 researchers from State Departments of Primary Industries/Agriculture, 2 Vegetable Industry Development Officers, 2 Processing company representatives, 1 Seed company representative, 3 consultants/research providers (including the facilitator), 2 representatives from the Vegetable Industry Development Program and 1 HAL representative delegates discussed current and past HAL projects and issues facing the Australian leafy vegetable industry.

The Think Tank presented an opportunity to improve dialogue and working relationships between growers, research providers and other industry people.

Information was presented by research providers on current and recently completed HAL projects being undertaken on leafy vegetables. Delegates discussed issues facing the Australian leafy vegetable industry and determined the priorities for future research and development investment. These recommendations for future research and development investment in leafy vegetables will be communicated to HAL, AUSVEG, the Vegetable Advisory Groups and the Vegetable Industry Advisory Committee.

The following were considered by Think Tank delegates to be the most important issues that need to be addressed to ensure the sustainability of the Australian leafy vegetable industry:

1. Consumer education and marketing;
2. Linking HAL Costing Tool (HAL project VG08021) to realistic costs (testing and validation);
3. Soil and plant nutrition;
4. Revegetation by design;
5. Postharvest management of pink and browning in lettuce (= 5<sup>th</sup>);
6. Dealing with isolation of growers – uptake of R&D outcomes (Communication & Extension) (=5<sup>th</sup>);
7. Supply chain empowerment (Communication & Extension) (= 5<sup>th</sup>);
8. Control of Anthracnose in lettuce (= 8<sup>th</sup>);
9. Understanding the role of soil carbon in encouraging predatory mite populations (= 8<sup>th</sup>);
10. Extension of water use efficiency/irrigation scheduling information (Communication & Extension) (= 8<sup>th</sup>).

Delegates recommended that a Leafy Vegetables Think Tank be held every two years to set priorities for industry investment.

## RECOMMENDATIONS FOR FUTURE R&D INVESTMENT

The issues identified for the Australian leafy vegetable industry were discussed and prioritised by Think Tank delegates. It is recommended that these priorities be used by HAL, AUSVEG, the Vegetable Advisory Groups and the Vegetable Industry Advisory Committee to determine Research & Development (R&D) investment in leafy vegetables.

Some of the priorities for R&D investment are leafy vegetable specific and others are general to all vegetables. It is likely that these general priorities would be considered a priority for R&D investment by the whole vegetable industry.

The issues that were considered of highest priority for R&D investment (refer to Table 2 in the 'Identified issues for the leafy vegetables industry' section) were discussed in more detail than is presented in Table 2 by delegates and considerations for future projects in these areas are given below.

Please note that 'Control of Western Flower Thrips' was considered the same priority level as issues indicated as being = 11<sup>th</sup> below. It is not listed here as it was not discussed in more detail than is presented in Table 2.

In addition to the priorities discussed here delegates asked that it be recommended that a Leafy Vegetables Think Tank be held every 2 years to plan leafy vegetable R&D investment, discuss current issues and to ensure grower and industry input in setting R&D priorities for leafy vegetables. A range of suggestions for the format of future Think Tanks was provided by delegates and they are discussed later in this report.

### 1. Consumer education and marketing (1<sup>st</sup>)

Research and development into consumer education and marketing was considered a very high priority and was by far considered the highest priority for R&D investment by leafy vegetable growers. There were a range of issues that require investigation and attention that would contribute to improved consumer education and marketing. The issues would be best addressed by a number of projects investigating:

- Consumption patterns by commodity (e.g. what are the trends in purchasing pre-packed lettuce ready for use versus whole head lettuce, what are the popularity trends for different lettuce varieties) – is this work part of the VIDP or has other research been done and if so communication is the key component required to address this issue);
- How the industry can increase vegetable consumption by leveraging marketing opportunities (e.g. cooking shows, schools/education, demonstrations at markets) – new lines as well as staples should be considered;
- How the industry can educate young people and can this be done in conjunction with Government or other programs such as the Stephanie Alexander farms in schools program
  - Quantifying the flow on benefits to health cost savings
  - Growers and industry representatives need to know how they can volunteer to educate young people (can they be involved in farms in schools programs)
  - Case studies and their communication to industry
  - Role of AUSVEG
  - Needs to be part of the school curriculum
  - Take note of outcomes of VG08002, "Increasing children's liking for and consumption of vegetables: the effects of exposure, modelling and reward"
  - There is a US study looking at adolescents and vegetable consumption;
- Increasing the awareness and understanding of produce that is grown using Integrated Pest Management (IPM)
  - Consumer identification of IPM logo
  - How can the industry sell the IPM good news story?

- What are the best ways to promote IPM to consumers?
- Develop appropriate case studies on IPM and distribute them to the popular media
- Investigate methods used to promote IPM grown produce overseas (in Europe it is a whole supply chain process)
- What is being done overseas at retail level with regards to IPM education – look into the point of sale information for IPM schemes in the USA
- Scoping of IPM point-of-sale documents overseas – what works and how can it be applied in Australia
- Educating the consumer to wash before you use vegetables (to remove insects) and why insects would be found on vegetables grown with IPM
- Understanding people's association with different insects (consumer might be happy to see a ladybird but not another type of insect)
- Tap into the home gardener;
- Consumer attitudes to vegetables
  - Consumer survey
  - Who are we trying to target and where should industry focus promotion of vegetables?
  - Focus groups to pull apart attitudes to vegetables
  - Consumers are saying that supermarket produce is not of good quality – need to understand what is happening post-harvest (quality is the responsibility of the whole supply chain) and also growers need to know how in-field decisions impact on post-harvest quality (for lettuce see information in booklet produced by project VG06034 “Best practice manual & training for the Australian lettuce industry”)?
  - Outcomes of project VG08002, “Increasing children’s liking for and consumption of vegetables: the effects of exposure, modelling and reward” to be communicated to industry and other relevant bodies.

One group suggested that a calendar be produced to promote the men and women behind vegetable production, which could also be used to promote practical information about vegetable production and preparation. All delegates thought it was an idea that should be seriously considered and investigated by AUSVEG.

## **2. Linking HAL Costing Tool to realistic costs (testing and validation) (2<sup>nd</sup>)**

The HAL Costing Tool is a current project: VG08004, “Grower friendly tool for comparing management and profitability of vegetable crops” and VG08021, “VegBIZ – Vegetable Enterprise Decision Support Systems”. The tool was developed in VG08004 by Scholefield Robinson Horticultural Services and is being further developed and demonstrated to industry by Industry & Investment NSW (previously NSW Department of Primary Industries) through VG08021.

There was much interest in the tool by delegates and its testing and validation was seen as a high priority so as to link it to realistic costs. Delegates would like to be involved in trialling the tool so as to provide feedback for further development.

It was considered by delegates that the tool would be useful for future R&D and advocacy work in order to drive down the costs of production. By using the tool industry will be able to determine if prices received are matching the true costs of production and where improvements can be made. It will be a very useful business tool for vegetable producers.

The tool needs to consider all farming inputs and also be regionally adaptable if required.

Tools that are already in use should be investigated for useful features (e.g. stonefruit in the USA).

Once fully developed delegates would like to see it be used to benchmark best practice (e.g. yield, fertiliser inputs). An anonymous website should be developed so that farming



businesses can benchmark themselves against a set of criteria (e.g. crop type, region, soil type).

### **3. Soil and plant nutrition (3<sup>rd</sup>)**

Increasing the knowledge of soil and plant nutrition was considered a high priority. A project in this area should address:

- Determining the true plant nutrient requirements for leafy vegetables for different regions/soil types – do scientists and industry really know and understand the nutrient requirements of leafy vegetable crops?;
- Appropriate nutrient management strategies need to be determined for different regions in order to reduce risk to groundwater;
- Education about how to manage nutrients to minimise leaching and risk to groundwater (see what has been achieved in WA projects VG04018, “Enhancing fertiliser use efficiency for transplanted vegetables” and VG07036, “Developing guidelines for environmentally sustainable use of mineral fertilisers” – 3Phase fertiliser method);
- Better capturing of tools for monitoring and measurement of soil and plant nutrition – what is available?;
- Increasing the skills and knowledge of growers and their advisors about soil nutrient management (e.g. workshops).

At the conclusion of the Think Tank one participant also suggested that the role of soil amendments (e.g. composted green organics) in improving nutrient use efficiency and water use efficiency should be assessed, along with potential disease and pest management advantages and potential financial benefits if carbon trading in some form is established and improved soil carbon can be demonstrated. However these suggestions were not discussed and considered by all participants.

### **4. Revegetation by design (4<sup>th</sup>)**

Expanding the recently completed revegetation by design project (VG06014, “Revegetation at property scale – designing the ‘right’ biodiversity for sustainable vegetable production”) nationally was considered a high priority as it has the potential to make an important contribution to IPM. An expanded project would need to:

- Identify suitable species for a range of climates and regions and produce guidelines;
- Provide a database of native species that might be detrimental to vegetable production through harbouring pests;
- Provide a database of native species that are suitable for promoting beneficials;
- Identify whether native species suggested cause other issues (e.g. becoming a weed);
- Give an understanding of growing requirements of species in the database (e.g. preferred soil conditions);
- Promote indigenous species – put together a list of local contacts such as Councils and Landcare groups which can assist growers to do their own research on suitable species.

### **5. Postharvest management of pink and browning in lettuce (= 5<sup>th</sup>)**

Investigating the postharvest management of pink and browning in lettuce and its affect on shelf-life was considered a priority. The key question is “what is responsible for causing it?” It was suggested that nutrition (in particular nitrogen) and its role in pink and browning be researched. Delegates felt that a literature review to find out what has already been researched is required initially.

## **6. Dealing with isolation of growers – uptake of R&D outcomes (Communication & Extension) (=5<sup>th</sup>)**

Communication and Extension in general received a lot of attention and generated much discussion at the Think Tank. In particular, dealing with the isolation of growers and how to improve the uptake of R&D outcomes was seen as a priority. Largely, isolation was considered as being geographically isolated. However, isolation could also come through language barriers, being unable to read or write, not being connected with local grower groups or a lack of time to attend meetings and workshops (or meetings and workshops held at inappropriate times).

Being geographically isolated (e.g. Alice Springs, Kununurra) is not the only reason growers do not have access to activities such as workshops. Many workshops that are part of vegetable levy-funded projects are only delivered to a small number of regions or, if a national project, to only 1 or 2 locations within a State. Delegates felt that if resources were being developed (a major cost of a project) then they should be more fully rolled out nationally. Additionally, a system should be put into place to keep them up-to-date as technology and production information evolves and readily available to new growers (e.g. the lettuce workshops delivered through project VG06034, “Best Practice Manual and Training for the Australian Lettuce Industry”).

To overcome some of the difficulties presented by grower isolation, a project or projects should:

- Use tailored resources (e.g. CDs, DVDs, YouTube, other modern technology) as not all growers want to access information in the same way;
- Translate resources relevant to growers from a non-English speaking background;
- Allocate funding for researchers to present field days/on-farm visits to disseminate information (facilitated through InnoVeg) – often funding is not included in projects for extension and appropriate funding and responsibility for delivery needs to be determined;
- Ensure that there is funding in InnoVeg to employ research providers who are no longer funded through a vegetable project to speak at workshops and up-date information they developed;
- Put workshops on DVDs/online so that they are accessible to more than the growers who attended (voiceover in different languages also a possibility);
- Put information and videos online but do not rely purely on it as a communication channel – a lot of people still only have dial-up connection (but everyone has a TV and DVD player).

Additionally, delegates strongly supported the scoping study for national registration of vegetable growers currently underway (VG09021, “Grower registration scoping study”) as they believe that this would go a long way towards ensuring that all of industry is communicated with using practical and appropriate channels.

## **7. Supply chain empowerment (Communication & Extension) (= 5<sup>th</sup>)**

A sub-component of Communication & Extension focussing on supply chain empowerment was considered a priority. A project to facilitate groups to work more closely together should be funded. This would improve networks within the vegetable industry, particularly grower networks. Participants noted that networks need to be maintained, such as the group at the Leafy Think Tank. A project would cover:

- Networking and relationship building;
- Branding;
- Marketing groups.

## **8. Control of Anthracnose in lettuce (= 8<sup>th</sup>)**

Anthracnose in lettuce is becoming an increasingly more important disease in southern Australia in winter/early spring in nurseries and commercial fields and therefore was considered a priority. A project needs to address:

- Why it is currently appearing;
- Is data from the USA relevant to Australia;
- Gaining a better understanding of the disease;
- Epidemiology;
- Effective controls;
- Alternatives to chemical control as there is only one available;
- Communication.

Victor Galea (University of Queensland) completed a PhD about 20 years ago on Anthracnose – need to discuss his modelling research with him.

Note that Anthracnose is not found in Queensland and therefore not a priority for growers there.

## **9. The role of soil carbon in encouraging predatory mite populations (= 8<sup>th</sup>)**

Investigating the role of soil carbon in encouraging predatory mite populations was considered a priority.

## **10. Extension of water use efficiency/irrigation scheduling information (Communication & Extension) (= 8<sup>th</sup>)**

There have been resources and workshops developed for the vegetable industry (VG06136, “Water Use Efficiency – interpretation and training in the use of soil moisture data”) and several projects completed covering these areas. As discussed previously (Priority 6) funding is required for keeping resources up-to-date and for delivery of workshops in all growing areas (plus putting presentations and activities online for geographically isolated growers and for growers who prefer individual learning or cannot attend a workshop and for review of workshop learning’s). It was suggested that VG06136 (plus other relevant information) be further extended.

## **11. Weed control (= 11<sup>th</sup>)**

Weed control, in particular stinging nettle in baby leaf production and weed control in wild rocket was seen as a very important issue to address. There are no herbicides available for use in wild rocket. A project dealing with weed control should include:

- Making available herbicide options for wild rocket (there is no herbicide option to control stinging nettle);
- Control of stinging nettle in baby leaf and lettuce production;
- Communication of best management practices;
- The role of crop rotations in weed control;
- A review of research in the USA on weed control
  - Alternatives to pre-plant chemical control
  - Tillage at night time
  - Mechanical control
  - Microwaving?
  - Steaming too expensive;
- Look at what has been done by industry for brassica vegetables with regards to weed control (believe that there has been a recent weed control project for brassica vegetables but there is also VG98107, “Weed management in brassicas – improving postharvest quality”);
- Look at outcomes of VG02062, “Weed management in lettuce”.

## **12. Control of slugs, snails and earwigs (= 11<sup>th</sup>)**

The control of slugs, snails and earwigs continues to be a major problem for leafy vegetable growers. There has been a project on slug control and there is one underway; VG00030, "A preliminary model for slug control in vegetable crops" and VG08152, "Control of slugs in the Australian Vegetable Industry". Participants highlighted the need for communication to industry about the work that has been done and what is underway. A project on the control of slugs, snails and earwigs should include the role of soil biology, farm hygiene and organic matter in their control.

## **13. Control of leaf miner in spinach and baby leaf crops (= 11<sup>th</sup>)**

The control of leaf miner in spinach and baby leaf crops was raised as an important issue. A project should include:

- Gaining an understanding of the biology of leaf miner;
- Research into IPM and biological controls;
- Monitoring and scouting protocols.

There is some data available from VG04032/DAN233J, "Asian vegetable IPM".

## **14. Update of lettuce best management training course and delivery (= 11<sup>th</sup>)**

As discussed previously it was considered very important that training courses are kept up-to-date and new information delivered to growers. It is also important that new growers and industry stakeholders have best management practice information made readily available to them. Industry needs to be able to make the most out of resources developed. A lettuce best management training course was developed and delivered in key lettuce growing regions through VG06034, "Best Practice Manual and Training for the Australian Lettuce Industry". Participants suggested that the manual and workshop need to be updated and repeated every 2 to 3 years. The workshops were very well received and those at the Think Tank that had attended said that the presentation style was excellent (practical and clear and data was not too detailed). Future workshops could be held as a "roadshow", including research providers with new outcomes from projects for the leafy vegetable industry.

## THINK TANK DELEGATE LIST

### Leafy Vegetable Growers

William Allen	SA	woodie@wildsalad.com.au
Steve Newman	SA	stnewman@bigpond.net.au
Don Ruggiero	SA	ruggiero@lm.net.au
Paul Gazzola	Victoria	paul@gazzolafarms.com.au
Eddie Galea	NSW	werombifarmproduce@bigpond.com
Kerry Galea	NSW	werombifarmproduce@bigpond.com
Damien Rigali	Western Australia	de.rigali@bigpond.com
Maureen Dobra	Western Australia	mdobra@looseleaf.com.au
Max Durham	Queensland	max.durham@bardenproduce.com.au
Lisa Crooks	Queensland	lisa@riverviewherbs.com.au
Michael Gierke	Queensland	m.kfarms@bigpond.net.au
Peter Rand	Tasmania	prand@houstonfarm.com.au
Murray McCosker	Northern Territory	territory.lettuce@activ8.net.au

### Government Departments

Sandra McDougall	Industry & Investment NSW	sandra.mcdougall@industry.nsw.gov.au
Len Tesoriero	Industry & Investment NSW	len.tesoriero@industry.nsw.gov.au
Sophie Parks	Industry & Investment NSW	sophie.parks@dpi.nsw.gov.au
Greg Baker	SARDI, SA	Baker.Greg@sa.gov.au
Tony Burfield	SARDI, SA	Tony.Burfield@sa.gov.au
Cate Paull	SARDI, SA	Paull.Cate@sa.gov.au
Glenys Wood	SARDI, SA	Glenys.Wood@sa.gov.au
Liz Minchinton	DPI, Victoria	liz.minchinton@dpi.vic.gov.au
Robert Dimsey	DPI, Victoria	robert.dimsey@dpi.vic.gov.au
Aileen Reid	Agriculture & Food, WA	aileen.reid@agric.wa.gov.au
David Carey	Qld Primary Industries & Fisheries	david.carey@deedi.qld.gov.au

### Consultants/Seed/Processors

Alison Anderson	Arris Pty Ltd, NSW (Facilitator)	aanderson@arris.com.au
Paul Horne	IPM Technologies, Victoria	ipmtechnologies@bigpond.com
Chris Burge	GSF Australia, NSW	cburge@gsfaus.com.au
Stuart Grigg	Salad Fresh, Vic	sgrigg@saladfresh.com.au
Harry Turna	Rijk Zwaan, Vic	hturna@rijkszwaan.com.au
Gordon Rogers	Applied Horticultural Research, NSW	gordon@ahr.com.au

### Vegetable Grower Associations

John Shannon	vegetablesWA	fieldofficer@vegetableswa.com.au
Ken Orr	Victorian Vegetable Growers Association	idowest@vgavic.org.au

### Vegetable Industry Development Program/HAL

Dianne Fullelove	People Development Sub-Program	diannefullelove@optusnet.com.au
Ian James	Economics Sub-Program	idea@jiskapark.com.au
Sarah Sullivan	HAL	sarah.sullivan@horticulture.com.au

### Apologies

Joe D'Anastasi	Grower, NSW	glenoriehydroponics@idx.com.au
Andrew Bulmer	Grower, Victoria	andrewbulmer@bigpond.com
Allison Clark	Houston's Farm, Tasmania	aclark@houstonfarm.com.au
Barbara Hall	SARDI, SA	Hall.Barbara@sa.gov.au
Will Gordon	HAL	will.gordon@horticulture.com.au
Mike Titley	Applied Horticultural Research, NSW	mike@ahr.com.au
Katie Fisher	Victorian Vegetable Growers Association	katiefisher@optusnet.com.au
John Said	Fresh Select, Victoria	john.said@freshselect.com.au
Andrew Mathews	Industry Advisory Committee, SA	mathewsa@chariot.net.au
Robert Premier	Salad Fresh, Vic	rpremier@saladfresh.com.au
Steve Skopilianos	Grower, Victoria	steve@ladybirdorganics.com.au
Dino Musolino	Grower, South Australia	hitech@musogroup.com.au

## **THINK TANK DETAILS**

### **Agenda**

A summary of the think tank agenda is presented below and the agenda as sent to delegates prior to the think tank is given in Appendix 1.

1. Welcome and aims of the think tank
2. Introduction to the Vegetable Industry Development Program (Dianne Fullelove and Ian James)
3. Outline of past and current leafy vegetable R&D
4. Research summaries outlining key outcomes and gaps in knowledge
  - Sophie Parks: Residues in hydroponic lettuce and nitrate/nitrite studies in leafy vegetables
  - Len Tesoriero: Management of root diseases in hydroponic lettuce and spinach, Asian vegetables IPM
  - Liz Minchinton: Disease management projects for lettuce, celery and parsley
  - Gordon Rogers: Best Practice Manual for the Australian Lettuce Industry
  - Glenys Wood: Revegetation by design
  - Sandra McDougall: Lettuce IPM
  - Rob Dimsey: Best management practices in leafy vegetables
  - Paul Horne: IPM in lettuce, baby leaf and celery
  - Aileen Reid: Enhancing fertiliser use efficiency for transplanted vegetables
  - Cate Paull: Diamondback moth management in leafy brassicas
5. Break-out sessions in small groups to identify key leafy vegetables R&D issues
6. Discussion of identified issues and grouping
7. Voting to identify the priority areas for future R&D
8. Discussion about the top R&D priorities

### **Aims**

The aims of the Leafy Vegetables Think Tank were:

1. Gain an understanding amongst participants of vegetable levy funded leafy vegetable (R&D) projects – past and present
2. Bring together growers and a diverse group of stakeholders who can best identify issues and R&D priorities throughout the value chain;
3. Identify strategic issues, needs and drivers for future leafy vegetable R&D in Australia;
4. Develop project definitions for R&D priorities;
5. Build relationships amongst think tank participants.

### **Expected Outcomes**

The outcomes expected from the Leafy Vegetables Think Tank are:

1. The Vegetable Advisory Groups and the Industry Advisory Committee are clear on the priorities of the Australian leafy vegetables industry, leading to strategic R&D investment and more effective and efficient Advisory Group meetings (R&D plans from specific crop groups will enhance their knowledge and resources available to them);
2. Ownership and confidence in the R&D investment process by leafy vegetable industry representatives;
3. Research providers will understand the priorities and needs of Australian leafy vegetable growers;
4. Enhanced relationships between industry representatives from across the supply chain;
5. Industry representatives who are knowledgeable about leafy vegetables R&D projects, their outcomes and the process for R&D investment who can then communicate this information with other industry representatives in their regions.

## Proposed Outputs

The key output of the Leafy Vegetables Think Tank will be strategic research recommendations for the Australian leafy vegetables industry.

## Method

The facilitator (Alison Anderson, Arris Pty Ltd) invited delegates to the Think Tank based on their involvement in the Australian leafy vegetables industry. Input was given by research providers, industry associations, processors and leafy vegetable growers as to suitable delegates. The aim was to obtain representation from each state and territory growing leafy vegetables and from across the supply chain. Additionally the aim was to involve growers who had not previously been involved in industry committees or workshops as well as growers who had representative experience. Originally it was hoped that up to 30 delegates would be able to attend the Think Tank. Due to a keen interest in the Think Tank from industry there were 35 delegates at the think tank (including the facilitator).

Industry representatives who were invited to the Think Tank, but were unable to attend were given the opportunity to provide input and their R&D priorities were considered alongside those that were raised at the Think Tank.

Each delegate was provided with the agenda, a list of current HAL vegetable projects and final report summaries of HAL leafy vegetable projects prior to the Think Tank. The final report summaries were for projects working in lettuce (field and hydroponic), baby leaf, spinach, silverbeet, celery and parsley.

At the Think Tank researcher providers were asked to give a 10 – 15 minute presentation outlining their current or recently completed leafy vegetable project/s, including key outcomes and identified gaps in knowledge. These presentations enabled delegates to gain an understanding of the type of projects that have been funded in the past or are currently funded and what the outcomes of these projects are, or are expected to be. Highlighting knowledge gaps also allowed delegates to begin considering what might be identified as issues and R&D priorities for the leafy vegetable industry in the future. Additionally delegates learned about the new Vegetable Industry Development Program through presentations by Dianne Fullelove (People Development) and Ian James (Economics).

Following project presentations delegates were divided into 4 groups for 80 minutes to discuss key leafy vegetable industry issues. The aim was to have a mix of research providers, growers and other industry representatives in each group and to not have a group with everyone from the same State. The facilitator of the Think Tank did not join a specific group and Ian James provided input into each group. The groups were as follows:

### Group 1

John Shannon  
Damien Rigali  
Michael Gierke  
Lisa Crooks  
Greg Baker  
Glenys Wood  
David Carey  
Chris Burge

### Group 2

Ken Orr  
Steve Newman  
Paul Gazzola  
Max Durham  
Cate Paull  
Liz Minchinton  
Rob Dimsey  
Harry Turna

### Group 3

Dianne Fullelove  
Peter Rand  
Don Ruggiero  
Paul Horne  
Len Tesoriero  
Tony Burfield  
Stuart Grigg  
William Allen

### Group 4

Sarah Sullivan  
Maureen Dobra  
Murray McCosker  
Aileen Reid  
Sophie Parks  
Gordon Rogers  
Sandra McDougall

To assist the groups they were asked to consider:

- Production – pests, diseases, soil health, integrated crop management, environment
- Consumers and Markets;
- Postharvest;
- Processing;
- People and business development;
- Communication and knowledge transfer.

The groups were asked to put each identified issue on a separate large sticky note (different coloured notes used for each group). Following group discussions, all of the issues were placed on one wall for delegates to discuss as a whole. Delegates were asked to group like issues.

Following grouping of issues delegates were asked to vote for the issues they thought were of the highest priority; that is those issues they would most like to see future R&D investment in. Each delegate received 5 votes. Votes for growers, processors and seed companies were identifiable from votes made by other delegates. Sarah Sullivan (HAL), Ian James (Vegetable Industry Development Program) and one delegate from a Government Department did not cast votes.

Once the priorities for R&D investment were decided some discussion was had by the delegates on what would be included in a project to address those priorities. During this discussion delegates were asked to consider:

- What is the problem?
- How should it be investigated?
- What outcomes are we seeking?
- How should it be delivered?
- Who would investigate it and deliver the outcomes?
- How will it be implemented on-farm?



## SUMMARY OF RESEARCH PRESENTATIONS

Below are the key points from presentations made by research providers at the Think Tank to give delegates a summary of current and recently completed HAL leafy vegetable projects. Of particular importance to the Think Tank were the research gaps identified by the presenters. These gaps are summarised in Table 1. Also given are the key points from presentations about the Vegetable Industry Development Program (VIDP) by Dianne Fullelove and Ian James.

### **Nitrate accumulation and nutrition management; Pesticide residues in NFT hydroponic systems and produce**

*Presented by Dr Sophie Parks, Industry & Investment NSW*

- With food safety the key consideration, both nitrate accumulation and nutrition management and pesticide residues in NFT (nutrient film technique) hydroponic systems and produce have been investigated.
- Nitrate accumulation and nutrition management: Nitrate and nitrite in vegetables on the Australian market (VG04019, completed 2007); Nutrition management of leafy Asian vegetables (VG07153, "Nutrient management of Asian vegetables", current).
- Excessive fertiliser use = nitrate accumulation in leafy vegetables; has been alarmist articles in the media on excess nitrate in the diet = questioning of effects on nitrate on health (diseases related to insulin resistance, including Alzheimers and Parkinsons).
- Preventing nitrate accumulation in leafy vegetables project work includes: efficient fertiliser use; determining the nitrogen requirements of leafy vegetables; evaluating tools for nitrate analysis; developing on-farm plant nitrate test protocols; delivery and uptake of information on soil and plant analysis.
- Pesticide residues in NFT hydroponic systems and produce: Review of Australian hydroponic lettuce systems for the prevention of pesticide residues (VG02017, completed 2006); Evaluation of pesticide persistence in hydroponic lettuce (VG07165, completed 2008).
- Pesticide residues in NFT hydroponic systems and produce work focuses on understanding the movement of pesticides through hydroponic systems: Procymidone and methomyl residues in lettuce (HAL, Cleanfresh); worst case scenario residue research (AgAware Consulting); committee for pesticide priorities in protected cropping.

### **Management of root diseases in hydroponic lettuce and spinach; Asian vegetable IPM**

*Presented by Len Tesoriero, Industry & Investment NSW*

- Completed and current projects: VG04012, "Effective management of root diseases in hydroponic lettuce" (completed 2008); VG04032/DAN233J, "Asian vegetable IPM" (completed 2008); VG07125, "Best-practice IPM strategies for control of major soilborne diseases of vegetable crops throughout Australia" (to be completed 2010); VG07128, "Integrated viral disease management in vegetable crops" (to be completed 2010); VG08026, "Identification of IPM strategies for Pythium induced root rots in Apiaceae vegetable crops" (to be completed 2010).
- Root pathogens of hydroponic crops: *Pythium* (several species); *Phytophthora* (two species); *Thielaviopsis basicola* (Black Root Rot); *Ovipodium* sp. (spreads Big Vein and Ring necrosis); *Rhizoctonia* (in North Queensland); *Rhizomonas* ([bacterial] Corky Root Rot).
- Hydroponic lettuce project achievements: identified important pathogens; determined the importance of crop and farm hygiene; evaluated commercial biological controls (*Bacillus subtilis*) for *Pythium* and *Phytophthora*; determined limitations of chemicals and disinfectants for use in production units; assessed water disinfection strategies.
- Asian vegetable IPM team was: Len Tesoriero and Victor Rajakulendran (NSW); Robert Dimsey, Slobodan Vujovic and Livinia Zirnsak (Victoria).

- Asian vegetable project challenges: working with LOTE (Language Other Than English) growers (Chinese, Vietnamese and Cambodian); rapid/continuous cropping cycles; soil-borne disease management (lack of registered chemicals and strategies); emerging technologies and products (hydroponics and baby-leaf production).
- Asian vegetable project outcomes: key pests and diseases have been identified; root rots (*Pythium* spp., *Phytophthora* spp., *Rhizoctonia* spp., and *Fusarium* spp.) – efficacy of chemical seed dressings; developed monitoring and action threshold strategies; diamondback moth – control with monitoring and *Bt* at low pest pressure; developed several extension resources.
- Extension outputs: IPM card game; pest and disease factsheets in English, Vietnamese and Chinese; posters on monitoring and pest and disease recognition.
- Asian vegetable knowledge gaps: thrips, Rutherglen bugs and leaf-miners are difficult to control with IPM; Clubroot and Downy mildew have become more prevalent in soil crops in NSW; Turnip mosaic virus and White leaf spot of leafy brassicas need further study; monitoring and action threshold strategies will take time to validate and will require further support.

### **Disease management projects for parsley, celery and lettuce**

*Presented by Dr Liz Minchinton, Department of Primary Industries Victoria*

- Integrated management of sclerotinia (VG07126, “Integrated management of soilborne pathogens”): survey/economic analysis; alternative fungicide options; biocontrol studies; soil amendment studies; in vitro screening volatile products; project team is Oscar Villalta, Denise Wite, Ian J. Porter.
- When investigating alternative fungicide options the percentage of lettuce drop caused by *S. minor* was less with treatments of Switch, Shirlan and Filan than with treatments of Folicur, Perika and untreated samples.
- The biological control *C. minitans* (Contans™) was investigated in a pot trial.
- Long-term control with organic amendments (biological soil disinfestations) was investigated in a field trial at Heatherton in Victoria in autumn 08 – autumn 09.
- Also investigated was the potential of volatile products (2% (v/v) diallyl disulphide – DADS) with biocidal activity reducing inoculums survival.
- Management of parsley root rot (VG04025, “Scoping study to investigate management of root-rot diseases in parsley” and VG06046, “Identification and management of parsley root rot”): symptoms in cool wet weather, after heavy rain ~ 7 days; national surveys for diseases – NSW, Qld, Vic, Tas; field trials – chemicals, biological and varieties.
- Pathogenicity tests showed that most *Phytophthora* and *Pythium* spp. pathogenic and *P. oligandrum* non pathogenic and eubiticious in market gardens.
- A biocontrol was identified in pot trials: A pot trial to test the efficacy of *Pythium oligandrum* to control *Pythium sulcatum* at 10°C; commercial *P. oligandrum* had no efficacy in the field and was not active < 15°C.
- A range of treatments were tested for their effect on mean percentage of parsley lost to dieback at week 16.
- Publications for growers were developed: *Guide to Common Diseases and Disorders of Parsley* booklet and *Major Diseases of Parsley* poster.
- A disease predictive model to manage Septoria late blight (VG04016, VG06047) to address celery being sprayed weekly (≥16 sprays per crop): TomCast (Madden *et al.* 1978); sporulation model; temperature and leaf wetness; model generates DSV; accumulate to a threshold → spray; model does not operate < 13°C.
- Testing the efficacy of the TomCast disease predictive model to manage Septoria Late Blight (winter 2007) showed that up to 8 sprays could be saved.
- Celery Late Blight model available on CD.

- Disease predictive models to manage Downy mildew on lettuce (VG07070, “Benchmarking predictive models, nutrients and irrigation for management of downy and powdery mildews and white blister”): evaluating and benchmarking DownCast model, BremCast model, weekly sprays, soft options.
- Models reduced the number of sprays by 4.
- Validation of Downy mildew models for lettuce: monitoring, weather, sporulation and infection in the field; post field treatment of lettuce seedlings in the growth chamber.
- Project team: Liz Minchinton, Lindsay Trapnell and Des Auer (DPI Victoria), Victor Galea (UQ), Heidi Martin (QDPI&F), Len Tesoriero (I&I NSW).
- Proposed project (VG10003) will deliver disease predictive models to industry.

### **Lettuce agronomy and postharvest workshops**

*Presented by Dr Gordon Rogers, Applied Horticultural Research (AHR)*

- Project VG06034, “Best Practice Manual and Training for the Australian Lettuce Industry”: aim to ensure that the same quality that is produced in the field at harvest reaches the consumer at the retail end.
- 11 X 1 day workshops held in 2007-8.
- Objective: to effectively communicate the outcomes of a lettuce agronomy and postharvest VC-funded project VG03092, “Agronomic and postharvest improvement in iceberg and cos lettuce to extend shelf life for fresh cut salads”, specifically how to increase yield, reduce the amount of crop not harvested and improve shelf-life and quality especially lettuce for processing.
- Strategy to effectively communicate results of lettuce project: develop a high quality agronomic manual; train lettuce growers in their growing regions; train crop consultants and other allied agronomic staff.
- Workshops: AHR conducted training across the main lettuce growing regions in Australia; one day workshops (8 am – 4.30 pm, lunch included) in major growing regions; 187 participants; focus on how growers could manage their inputs to maximise both yield and quality of head lettuce for processing or the fresh market.
- Presentation outline: postharvest; irrigation; nutrition; harvesting; planting density; variety types and scheduling; risk management.
- Almost all participants rated the workshop as very beneficial or beneficial.
- When asked to rate the value of each session they were ranked as follows (from greatest value to least value): postharvest; crop nutrition; crop scheduling; plant density; varieties; harvest time; irrigation; risk management.
- Some feedback from participants: anyone who has a genuine interest in the quality of iceberg or cos lettuce should attend the course; good value, showed how each process in the growing period affected postharvest; as a producer it helped remind me to think outside the circle (tunnel vision) of plant – grow – harvest.

### **Revegetation at property scale – designing the ‘right’ biodiversity for sustainable vegetable production**

*Presented by Glenys Wood, SARDI*

- This project (VG06014, “Revegetation at property scale – designing the ‘right’ biodiversity for sustainable vegetable production”) concentrates on a major problem on the Northern Adelaide Plains (NAP): TSWV (tomato spotted wilt virus) that is introduced largely by onion thrips and then transmitted through the crop, mainly by WFT (western flower thrips).
- The disease and pest thrips persist in many annual weeds and control with chemicals and/or bare earth buffers is elusive: using managed re-vegetation with endemic plants that do not harbour the disease or pest vectors to replace weeds can provide an integrated natural resources and pest management solution.

- What has been found: weeds, especially brassicas harbour reproducing populations of pest thrips and virus; endemic plants, especially saltbushes rarely have pest thrips; so far TSWV has not been isolated from any of the plants tested and then recommended; judicious placement of endemic plants near horticultural facilities has the potential for benefitting pest management.
- Given increasing chemical resistance issues and the patchy effectiveness of bare earth buffers (that do not support/provide natural enemies) it is thought that managed native re-vegetation has potential as a pre-emptive tool to reduce crop pest and disease risk.
- Two publications have been produced and are available from [www.sardi.sa.gov.au/pestsdiseases/research\\_projects2/research\\_projects/revegetation\\_by\\_design](http://www.sardi.sa.gov.au/pestsdiseases/research_projects2/research_projects/revegetation_by_design): 'Revegetation by design guidebook' and 'Guide to using native plants on the Northern Adelaide Plains to benefit horticulture'.
- A proposed project (VG09047) will investigate biosecurity in action: endemic biodiversity to strengthen biocontrol and crop biosecurity.

### **Lettuce IPM**

*Presented by Dr Sandra McDougall, Industry & Investment NSW*

- Lettuce Integrated Pest Management (IPM): VG05044, "Further developing integrated pest management for lettuce" to VG07076, "The delivery of IPM for the lettuce industry – an extension to VG05044".
- Currant Lettuce Aphid (CLA) project team (past and present projects): Sandra McDougall, Virginia Brunton, Tanya Shaw & Robin Troidahl (Industry & Investment NSW); Lionel Hill (Tas DPWIE); Greg Baker & Peter Crisp (SARDI); Sonia Broughton (DAFWA); Paul Horne & Jessica Page (IPM Technologies); David Carey, John Duff & Austin McLennan (Qld DEEDI).
- Lettuce IPM Project History: VG98048, Hay & Gatton – Pests, beneficial and diseases (monitoring, efficacy trials – caterpillars, Sclerotinia, spray application); VG01028, "Improving lettuce IPM – NSW and SE Qld", Hay & Gatton – Pests (monitoring, efficacy trials – caterpillars, efficacy trials – Silverleaf whitefly, aphids); VG05044/VG07076, Tas, Vic, NSW, Qld, WA, SA – Pests and beneficial (weeds monitoring, monitoring – aphids/thrips, efficacy trials – thrips, soil amendments, cereals as insectaries, beneficial monitoring).
- Across the history of the lettuce IPM projects the 'Lettuce Leaf' newsletter has been produced and other activities have occurred or publications produced: Lettuce IPM information guide; ute guide; lettuce conferences (Hay, Gatton, Werribee); Grower surveys; IPM Demonstrations.
- A list of past crop protection/IPM projects in lettuce was given.
- Related current projects: CLA PhD (Craig Feutrill); Western Flower Thrips/Tomato Spotted Wilt Virus (WFT/TSWV) – Hydroponic lettuce WFT/TSWV (Leigh Pilkington, Industry & Investment NSW) and IPM consultant service projects in Sydney Basin, WA and Tasmania; Revegetation by design (Glenys Wood, SARDI and Nancy Schellhorn, CSIRO Brisbane); Greenhouse sanitation project (Jeremy Badgery-Parker, Industry & Investment NSW and Tony Burfield, SARDI); IPM integration of disease and pest recommendations (Rob Dimsey, DPI Vic and David Carey Qld DEEDI).
- Key to success of IPM: Good growers; Broad involvement and collaboration; Communication using a range of media/techniques; Range of options; Availability of crop consultants/control options.
- Barriers to success of IPM: Growers happy with current practices; Market specifications; Fragmented industry; Researchers working in isolation; Risk/fear/uncertainty of adoption; Benefits can't or haven't been articulated; Availability of crop consultants.

- Project components (2X2 years): IPM demonstrations in Tas, Vic, NSW, SA, WA, Qld; Predatory mite research (survey 2006, trials 2007); IPM consultant survey (2006) and grower survey (2008); IPM and non-IPM case studies (2006/7); Markets and IPM; Attitudes and barriers of IPM post farm-gate; Newsletter.
- Project approach/assumptions: Access to chemicals will be limited (resistance or regulation); IPM approach as the most sensible long term pest management solution; Not all growers are going to adopt a biological IPM strategy; All can benefit from the tools developed.
- Key questions for lettuce IPM: Alternative hosts for CLA (not finding CLA on weeds, 2008/9 not finding in susceptible lettuce in SA, WA, NSW, seen again in August 2009); How do we ensure beneficials are in the system when we need them? (cereals as nurseries?); How do we best manage WFT and TSWV? (how do we improve sanitation practices on-farm, demonstrations of movement from a source [Leigh Pilkington], which are the worst weeds, are Bion® or Movento® chemical options).
- Predatory mite – compost trial at Newman’s (SA) showed that composted lettuce plots were harvested 1 week earlier than standard, more consistent head size and quality and high populations of *Pergamasus* sp. (predatory mite).
- Cereal trial (2008 & 2009): Purpose was to provide habitat and food for beneficials during autumn/winter – possible CLA management method; Question was which cereals and planting times boost cereal aphid and beneficial insect numbers during autumn? Oats and barley were the best options in Sommersby and Yanco trials respectively.
- Issues to be addressed: Market pull for IPM; Disinfestations (preharvest, washing); Rutherglen bug.

### **Leafy vegetable projects**

*Presented by Robert Dimsey, DPI Victoria*

- Projects: Best management production practice (VG07110, “Best practice production models (lettuce, brassicas)”); Improving lettuce insect pest management – Victoria (VG01038, “Improving lettuce IPM”); Integrated management strategies for Asian vegetables (VG04032); Best management production models (lettuce and brassicas) (VG98082, “Lettuce – Best management production practice to meet market requirements of consistent product quality and shelf life”).
- Best management production practice: Lettuce production quality issues – tipburn (nutrient management, irrigation management, cultivars, IPM – Helicoverpa).
- Best management production practice: relationship between growth rate, sap calcium and tipburn; critical management methods; foliar applications not beneficial; soil levels of calcium did not affect uptake; cultivars, crop management, nutrient and irrigation critical; there is potential to manage tipburn better.
- Improving lettuce insect pest management – Victoria: focus on IPM in lettuce (Helicoverpa management, Current Lettuce Aphid).
- Integrated management strategies for Asian vegetables: IPM in Asian baby leaf vegetables (identify key problems, scouting and monitoring methods, IPM strategies, best management options [BMO] including IPM more effective than conventional control programs).
- Best management production models (lettuce and brassicas): IPM employs a range of pest control options in combination to contain or manage pests below their economic threshold level; Options include biological control, cultural and management control, pest prediction models, varietal selection and chemical control; A well developed IPM strategy includes all pests such as weeds, nematodes, pests and diseases.
- Background: A large amount of work has been done in the last 10 years on IPM; Control strategies have tended to be developed in isolation for each specific pest or discipline area; Control practices for one pest can affect the incidence of other pests and beneficials.

- The objective is to combine the current knowledge developed on pest control into a whole of crop approach for lettuce and brassica crops: What has been done? Collating information on key pests and diseases; Determining the format to present information (testing formats); Formats identified and being developed.
- Next steps: Review and refine information; Develop formats; Check formats and details with industry and experts.
- Products that provide a framework and directions for a whole of crop strategy; Supporting detailed and targeted information to back the strategy from existing and past projects in an accessible format; Identify gaps and conflicts in existing IPM strategies.

### **IPM in leafy vegetables**

*Presented by Dr Paul Horne, IPM Technologies Pty Ltd*

- Recent (and current) work includes IPM in celery (VG99070, “Development of an IPM program in celery”), IPM to deal with Lettuce Aphid (Tas and Vic), enhancement of cultural controls in leafy vegetables (VG05008, “Development of cultural control methods for pests of leafy vegetables”), development of an IPM service in Tasmania (VG06088, “Providing an IPM Advisory Service for Tasmania”), effects of pesticides on beneficial species, IPM adoption.
- IPM in celery: Aphids; Heliothis – 2 species; Cutworm; Loopers; Earwigs; Vegetable weevil; Earthmite.
- Lettuce aphid and IPM: slow; demonstrated in Tas and Vic; every year, commercial growers in Werribee and Cranbourne using IPM (no Confidor); Tas starting (Houston’s and Harvest Moon).
- Field days to assist commercial adoption of IPM: one grower in Vic (Peter Schreurs & Sons) has never used Confidor drench as has used IPM.
- IPM logo for use on boxes by accredited IPM growers.
- Peter Schreurs & Sons have no significant TSWV (tomato spotted wilt virus) yet other growers “over the road” have 80% of plants affected by TSWV: WFT (western flower thrips) and TSWV will be the driver for IPM in the near future.
- Jessica Page (IPM Technologies) carried out a survey project (VG06086) on who is adopting IPM, why and why not: the main reason given for not adopting IPM (approximately 70%) was given as ‘current methods OK’.
- Why do all growers not adopt IPM? Simple answer is ‘not broken – no fix needed’.
- Can IPM be adopted without a crisis? Yes – see “When will IPM be adopted” by Horne, Page and Nicholson (2008) in Australian Journal of Experimental Agriculture 48, 1601 – 1607.
- Specific adoption of IPM see “Using IPM on farm” by Peter O’Sullivan and Paul Horne in Proceedings of the Potatoes 2000 Conference, pp. 93 – 96.
- Outside of HAL funded projects carry out work on IPM in baby leaf (leaf-mining flies), endive, parsley and herbs.
- Disincentives to IPM: wholesale buyers demands for “zero insects”; broad-spectrum sprays just before harvest; lose beneficials for other plantings.
- IPM marketing example from NZ ([www.nzhothouse.co.nz](http://www.nzhothouse.co.nz)): “Some growers reduce insects using sprays. We reduce sprays using insects. When it comes to looking after our tomatoes, we use predatory insects for pest control. Known as beneficial, these are the good guys of the insect world and actively seek out and eliminate pests that may damage our plants. This results in the best quality and tastiest tomatoes in NZ. So next time you’re shopping for tomatoes ask for NZ Hothouse tomatoes.”

## **Enhancing fertiliser use efficiency for transplanted vegetables**

*Presented by Aileen Reid, Department of Agriculture & Food WA*

- Project (VG04018, “Enhancing fertiliser use efficiency for transplanted vegetables”) team of Dennis Phillips, Aileen Reid, Dave Gatter and Gavin d’Adhemar (Department of Agriculture & Food, WA).
- Project VG07036, “Developing guidelines for environmentally sustainable use of mineral fertilisers”.
- Now called the 3Phase fertiliser method; timing fertiliser application with growth stage; placement – put the fertiliser where the plants can get it; product – use the right product for the growth stage; practical, low cost application methods.
- Phase 1 – placement all important; growth lost in this phase cannot be made up; fertilise 1 – 2 times a week with nitrogen (N) and potassium (K); uniform application critical – spray or broadcast; 14 to 35 days depending on crop and time of year.
- Weekly banding to row closure; granular NPK products best – labour saving; number of bandings depends on crop and time of year; banding rate can be decreased below 500 kg/ha for some crops; latest trials have some treatments with no banding.
- In Phase 3 weekly application is enough; some crops have no Phase 3 in summer (e.g. lettuce); only nitrogen may be required – celery needs K as well; spray and ‘wash off’ or fertigation; broadcasting with wash off may work for some crops.
- Getting it wrong leads to significant nitrogen leaching. Getting it right with 3Phase results in a much reduced amount of nitrogen leaching.
- The impact of poultry manure: No poultry manure – 172 kg/ha average N leached per crop and 60% of applied N leached; With poultry manure – 642 kg/ha average N leached per crop and 96% of applied N leached; 3Phase method – 126 kg/ha average N leached per crop and 45% of applied N leached. These figures are for N leached from commercially grown and ‘3Phase’ method (Medina Research Station) head lettuce crops from bed formation until harvest for crops monitored 2006 – 2009.

## **Integrated Crop Management (ICM) for Brassica vegetables**

*Presented by Dr Cate Paull, SARDI*

- Project number VG07030, “Developing sustainable solutions for integrated brassica crop management”.
- Diamondback Moth (DBM) is a global pest and despite years of research is still the number one pest in Brassicas; basically the problem remains the same for leafy or harder Brassica vegetables; DBM has the ability to develop resistance to insecticides.
- Previous projects contributed to understanding the biology and ecology of DBM and showed that good sampling and monitoring are the keys to successful IPM.
- Outputs of previous projects include an electronic sampling plan, work books, integrated crop management CD, insecticide resistance management strategy.
- Current DBM project is made up of a number of smaller projects and include: Screening national populations of DBM to monitor the development of resistance to insecticides (Greg Baker, SARDI); Indicating if any and how rapidly DBM are becoming resistant to insecticidal chemistries; Informing growers in different regions about the effectiveness of specific chemicals (this part of the project is investigating the mechanisms within DBM that are responsible for resistance); DNA analysis of predatory insects to determine which have greatest impact on DBM (PhD student Chris McIntyre, Adelaide University); Impact of predators and parasitoids on early season brassica pests in Qld (Dr Lara Senior, Qld DEEDI); Roll out of Brassica Integrated Crop Management CD (David Carey, Qld DEEDI); Communication – National IPM Brassica newsletter; Identifying the multiple benefits of compost by quantifying the effect compost has on yields, diseases and affect of compost on decomposition rate of harvested crop residue.’

- Future research and development (R&D) for IPM in Brassica vegetables: Current project allowed project team to identify specific gaps in IPM for Brassica vegetables – little evidence of adoption of use of sampling plans, development calculators and decision making tools; new insecticide chemistries which are IPM compatible beginning to be used prophylactically (this will increase the likelihood of resistance making these insecticides ineffectiveness in a very short time).
- Future R&D: Increase communication between growers, researchers and industry; Continue insecticide resistance monitoring – protect new IPM compatible insecticides; How many predators/natural enemies do I need? (developing more effective ways for growers to quantify natural enemies and their impact on pests in vegetables); How can I encourage natural enemies to colonise my vegetable crops? (crop rotation as refuges for natural enemies); Managing early season influx of DBM using the parasitoid *Diadegma semiclausum*.
- Future R&D: Developing IPM strategies for snails, slugs and earwigs; New spray technology (increase the efficacy of spraying); New digital technology (integrating existing IPM-ICM tools, Well-N® optimise nutrients).
- Addressing these issues will not only help to further develop IPM for pests, such as DBM but increase the reliability of IPM strategies.
- Ideas presented here for future R&D are closely associated with the research areas outlined as important for improving IPM (Orr, 2009) and for the control of DBM (Furlong *et al.*, 2009); they are also closely aligned with Industry and Government priorities for sustainable production; the control of insect pests and diseases remains the highest R&D priority for Australian vegetable producers (ABARE, 2009).
- IPM: A pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilises all suitable techniques and methods in a compatible manner as possible and maintains the pest population at levels below those causing economic injury (FAO, 1968).

### **National Vegetable Industry Development Program (VIDP)**

*Presented by Dianne Fullelove, Dianne Fullelove & Associates Pty Ltd (People Development Sub-program of VIDP)*

- VG09145, “Vegetable Industry Development People Development Sub Program”.
- What is industry development all about? The VIDP is designed to address low uptake of innovation; develop and value add to research; form better communication products and information that is commercially relevant and easily accessible by industry.
- VIDP objectives: Communicate the benefits and qualities of Australian vegetable products to consumers; Create market driven decision making; Have growers actively seeking new business and marketing opportunities; Increase application of market and technical R&D; Have industry using research to formulate policy and promote industry; Create a new generation of leaders to lead and capture gains across the industry.
- VIDP structure: National Co-ordination (VG09144) – Rural Directions; Sub-programs – Knowledge Management, VG09147 (Freshlogic), Consumers and Markets, VG09146 (Freshlogic), People Development, VG09145 (Dianne Fullelove & Associates), Economics, VG08040 (Industry Data Economic Analysis), InnoVeg, VG09149 (RMCG).
- The National Co-ordination Team will ensure that VIDP: functions effectively as a whole and aligned to strategic plans; sub-programs meet their contractual obligations; evolves over time to meet changing needs of industry; works effectively with key stakeholder groups (IAC, State organisations); collaborates and integrates with other HAL research, development and extension activities; has a productive working relationship with HAL, AUSVEG and other industry groups.



- Knowledge Management: Create a sustainable “e” platform to get vegetable industry development information out to industry; Create a central access point for tailored information packages that meet the needs of growers and others; Full access to R&D results – in a form industry can use; Create a two-way feedback and update process.
- Consumers & Markets: Collect and store marketplace data from traders and consumers to develop a market information system; Provide insights and information about market and consumer trends; Improve business decision making.
- Economics: Increase grower understanding of economic, business and market issues affecting their business; Providing data and research to assist industry promotion and policy formation; Undertake economic research on key issues; To provide industry leaders with economic understanding.
- InnoVeg: Develop partnerships with local organisations and individuals to deliver innovations to industry (service providers = local grower or state based groups, input suppliers, local advisors, supply chain agents, etc.); Use partner’s networks to deliver industry development products to growers; Heavy utilisation of the Knowledge Management system to access information and products for delivery.
- People Development: Growing Leaders – manage the transition of emerging leaders into leadership roles supported by mentors and regional champions; Business Clubs – for vegetable growers to improve linkages, networks and opportunities for business improvement; A web-based knowledge and information hub of case studies, programs, courses and training accessed via the Knowledge Management system.
- Leadership: Growing Leaders – National Vegetable Industry Leadership Program (In 2010, Growing Leaders will be held in Brisbane 2 – 4 March, Melbourne 8 – 10 June, Canberra 31 Aug – 2 Sept); Nuffield Farming Scholarship (2 candidates in 2010 and applications taken in June 2010); Australian Rural Leadership Program (applications taken in June 2010).
- Business Clubs: Business Clubs are groups of vegetable growers with a common purpose to make better decisions and achieve better results in their businesses; Outcomes – groups of vegetable growers who discuss industry issues and topics of common interest, facilitation of groups to form strategic alliances, improved linkages and networks within the vegetable industry, opportunities for business improvement; Group leaders to facilitate the Business Club; Meet regularly – up to 3 times per year with Guest Speaker and Discussion Session with key issues and opportunities identified by the group who will share ideas and experiences about that issue; Teleconferences – to further discuss industry or business issues; Skill development – leadership, business management and innovation.

### **Thinking outside the box**

*Presented by Ian James, Vegetable Industry Economist & Industry Data Economic Analysis (Economics Sub-program of VIDP)*

- VG08040, “Economic Research Services for the Vegetable Industry”.
- Snapshot of the Australian Vegetable Industry: The vegetable industry is Australia’s fourth largest agriculture industry with production valued at \$3.36 billion in 2007/08; Compared to other cropping industries vegetable production is domestically focused; Vegetables with value of production in excess of \$100m are potatoes, tomatoes, mushrooms, onions, carrots, lettuce, capsicums and Asian vegetables; Official statistics show 6,360 growers with 70% deriving the majority of their income from vegetables and 20% producing undercover; Qld is the largest vegetable producing state with 30% of the national figure by value.
- Cash receipts in 2005/06 were \$431,133 (86% from vegetables), 2006/07 \$569,549 (88%) and 2007/08 \$570,089 (83%).
- Cash costs/Farm cash income/Farm business profit in 2005/06 - \$303,084/\$128,049/\$46,043; 2006/07 - \$397,555/\$171,994/\$82,292; 2007/08 - \$403,992/\$166,097/\$74,889.
- Farms with negative cash income/Farms with negative business profit in 2005/06 – 18%/54%; 2006/07 – 17%/59%; 2007/08 – 13%/56%.

- Rate of return ex capital gain/Rate of return inc capital gain in 2005/06 – 2.5%/9.8%; 2006/07 – 4.2%/7.7%; 2007/08 – 4.0%/4.1%.
- Vegetable growers at the forefront of innovation, environment and community: The industry is 45% bigger than the wool and lamb industries, more than double the size of the wine and poultry industries, and almost triple the size of the sugar and cotton industries; Vegetable growers voted to pay a levy at the first point of sale to finance R&D into the industry; Vegetable growers use sophisticated production methods usually involving computerised release of water and other inputs; Vegetable growers are quick to respond to new economic production techniques and adapt and invest in response to changing consumer demands n.b. new vegetables and packaging; Vegetable growers have a keen interest in protecting the environment by reducing chemical use, the undertaking of integrated pest management programs and signing up to an industry devised EnviroVeg program; Vegetable growers donate seconds to Food Bank and other community organisations involved with assisting the under privileged.
- Threats to profitability include imports and pricing.
- Imports: Imports of fresh vegetables remain low and generally of a counter seasonal nature; The most immediate threat is to growers producing for the processing sector; However the Chinese pose a potential future threat as they move resources into intensive agriculture; Korea has just gained phytosanitary clearance to export capsicums produced undercover into Australia; Global sourcing of vegetables is here and likely to accelerate.
- Pricing: Vegetables are dirt cheap and long term retail prices have not kept pace with other food and goods in the economy; Vegetable growers can provide endless supplies of vegetables at cheap prices; Vegetable growers operate in a classical economics free market where the market determines price; If anything vegetable growers are squeezed between a concentrated retail sector and near monopoly control over inputs; So vegetable growers need to look closely at markets in order to get better rates of return.
- Policy issues for the industry include: Key input issues; Carbon pollution reduction scheme; Market access; Consumers right to know.
- Key input issues: Water – Vegetable growers rate of return per megalitre of water is the highest in agriculture (so let the market decide who gets available water); Biosecurity – Critical that Australia preserves its image of green, clean and responsible pest control; Labour costs – The Horticulture Industry Award.
- The carbon pollution reduction scheme (CPRS) – Vegetable production has low carbon emissions mainly through the use of nitrogen fertiliser; The final scheme agreed to between the Government and Opposition was a win for vegetable growers and the vegetable industry will be excluded from the scheme but can earn credits for practices designed to decrease carbon emissions; At the same time Australia will push for the post Kyoto agreement to enable credits to be earned for sequestering of carbon in the soil which is a natural by-product of vegetable production; Growers will be impacted by increased input costs with early economic modelling suggesting increases in costs of production between 2% and 4% but these are now likely to be less due to increased compensation to carbon polluting industries in the revised scheme; Costs will vary depending on the nature of operations – field, greenhouse, packing houses, processing.
- Market access: Increased exports are a key factor in the industry achieving the goals of its strategic plan VegVision 2020; The industry remains concerned that while there is open access to vegetable imports that the same does not apply to our exports; We are particularly concerned at recent moves to exclude existing Australian exports from markets due to biosecurity concerns; Nor are we happy with the bilateral Free Trade Agreements that Australia has signed (all too often they are not 'free' with the removal of tariffs on Australian vegetable exports to be phased out over a long period of time); However the industry has made some gains with the joint parliamentary committee on treaties recommending closer consultation with industry and more attention to be paid to horticulture in future negotiations.

- Consumers right to know: The fundamental economic underpinning of an efficient market is the assumption of informed consumers; To this end the vegetable industry has fought long and hard to have country of origin labelling on vegetable products so that consumers know the source of the vegetable they are buying; This now applies to 'whole loosely displayed products' (but did you know that a processed vegetable can be labelled "made in Australia" even if the vegetable is imported from overseas?); Non inclusion of country of origin labelling is unacceptable as is the "and/or" clause regarding Australian and imported product on packaged vegetables; We have no issue in consumers choosing product from overseas in preference to Australian product but we strongly believe that the consumer needs to make an informed decision.
- Industry opportunities/Marketing: There is not a problem on the supply side – demand is the issue; Vegetable growers will gain most by a whole of supply chain approach that promotes the vegetable industry; At present only 10% of the population intake the recommended 5 vegetables per day, with the national average closer to 2 vegetables per day; Growing obesity and declining health provide a great market opportunity for the promotion of fresh vegetables; Vegetables are not sexy and the industry needs to promote cultural change and to consider how to do this in conjunction with health authorities which have a vested interest in promoting vegetables; Understanding the consumer and targeting markets will assist returns – demographics, organic, local.

**Table 1. Identified research and development gaps from current and recently completed HAL leafy vegetable projects.**

<b>Research Area</b>	<b>Knowledge Gap</b>
Hydroponic production of leafy vegetables	<ul style="list-style-type: none"> <li>• Ongoing R&amp;D into understanding the movement of pesticides through hydroponic systems and extension to hydroponic growers</li> </ul>
IPM (on-farm)	<ul style="list-style-type: none"> <li>• A lot of tools have been developed – how do we get adoption?</li> <li>• Continued on-farm demonstrations</li> <li>• Need to address the barriers, e.g. uncertainty of adoption, not understanding benefits, lack of availability of experienced crop consultants</li> <li>• Management of Rutherglen bug</li> <li>• Ensuring beneficials are in the system when required with the use of nurseries and native vegetation (what crops, e.g. cereals, can be used as nurseries?)</li> <li>• Identifying gaps and conflicts in existing IPM strategies</li> <li>• Ensuring information from existing and past projects is in an accessible format</li> <li>• Continue insecticide resistance monitoring to protect new IPM compatible insecticides Develop IPM strategies for snails, slugs and earwigs</li> </ul>
IPM (marketing and processing)	<ul style="list-style-type: none"> <li>• Addressing the barrier of unrealistic market specifications – demand for “zero insect” can hinder the uptake of IPM by growers</li> <li>• Developing a market for produce grown using IPM</li> <li>• Disinfestation (preharvest and washing)</li> </ul>
IPM (DBM)	<ul style="list-style-type: none"> <li>• Continue insecticide resistance screening</li> <li>• Improve uptake of decision making tools which have been developed for DBM management so as to prolong insecticide resistance (industry cannot rely on new chemistry becoming available)</li> <li>• Managing early season influx of DBM</li> <li>• Develop more effective ways for growers to quantify natural enemies and their impacts on pests</li> <li>• Improve understanding of how to encourage natural enemies to colonise vegetable crops</li> </ul>
Pest and disease management in Asian leafy Brassicas	<ul style="list-style-type: none"> <li>• Validation of monitoring and action threshold strategies</li> <li>• Some pests and diseases need more research if IPM is to be successfully adopted – in NSW they have proven to be difficult to control with IPM (Thrips, Rutherglen bugs, Leaf-miners, Striped flea beetles, Turnip mosaic virus, White leaf spot)</li> <li>• Management of Clubroot and Downy mildew (is becoming more prevalent in soil crops in NSW)</li> </ul>
Disease management	<ul style="list-style-type: none"> <li>• Delivery of disease predictive models to industry</li> </ul>
Revegetation by design	<ul style="list-style-type: none"> <li>• What species are suitable in different growing regions?</li> </ul>
Fertiliser management	<ul style="list-style-type: none"> <li>• Better understanding of the fate of fertilisers required</li> <li>• Getting fertiliser applications correct (crop type, soil type, climatic region)</li> </ul>
Industry access to resources	<ul style="list-style-type: none"> <li>• System needs to be put in place to keep resources developed through the Vegetable R&amp;D Program up-to-date</li> <li>• Delivery of courses and workshops that have been developed for the vegetable industry – they are often only held in a limited number of regions (major cost is in producing resources so improve availability across the industry)</li> <li>• Various types of resources are required (e.g. printed, interactive, web-based)</li> <li>• Determining responsibilities (HAL, AUSVEG, VIDP, service provider) of making resources available to industry</li> </ul>

## IDENTIFIED ISSUES FOR THE LEAFY VEGETABLES INDUSTRY

Issues as identified by each group and by individuals prior to or at the Think Tank are given in Appendix 2. Table 2 shows the issues, following grouping like issues by delegates. The grouped issues have been prioritised based on the votes given to each issue. Total votes given to each issue are shown as well as how many votes were given by “growers” (including processing and seed company representatives) and by “other” workshop delegates (researchers, consultants, other).

When grouping like issues delegates requested that a range of issues be placed together under the heading “Communication and Extension”. They then either voted for all “Communication and Extension” issues in general or voted for subsections of “Communication and Extension”. Issues placed under the “Communication and Extension” priority are marked by C&E in brackets after the specific issue in Table 2.

The 3 issues that were of the highest priority by all delegates are:

1. Consumer education and marketing
2. Linking HAL costing tool to realistic costs (validation)
3. Soil and plant nutrition.

The issues that were of the highest priority to growers (including processing and seed company representatives) are:

1. Consumer education and marketing
2. Linking HAL costing tool to realistic costs (validation) (Equal 2<sup>nd</sup>)
3. Postharvest management of pink and browning in lettuce (Equal 2<sup>nd</sup>).

The issues that were of the highest priority to research providers, consultants and others are:

1. Soil and plant nutrition
2. Supply chain empowerment (C&E)
3. Consumer education and marketing (Equal 3<sup>rd</sup>)
4. Dealing with isolation of growers – uptake of R&D outcomes (C&E) (Equal 3<sup>rd</sup>)

The research and information needs of the leafy vegetables industry are spread over a range of issues that if addressed will help improve competitiveness.

It is important to consider priorities of both growers and other industry stakeholders. Varying skills and day-to-day activities allow different groups to be able to identify a range of requirements for future R&D by the leafy vegetables industry, all equally valid.

All participants were given five votes each, and there was no restriction on how votes were distributed, allowing more than one vote per person per issue.

**Table 2. Identified issues and their rankings.**

Issue *	Grower votes	Other votes	Total votes
<p>Consumer education and marketing:</p> <ul style="list-style-type: none"> <li>• Consumption patterns by commodity</li> <li>• Leverage marketing opportunities to increase vegetable consumption (cooking shows, schools/ education, demonstrations at markets, new lines as well as staples)</li> <li>• Educating young people (industry input, case studies, economic benefits, health cost savings, AUSVEG)</li> <li>• Increasing awareness and understanding of produce that is IPM produced (logo stating that it is environmentally friendly)</li> <li>• Selling the IPM good news story</li> <li>• Increasing the understanding of vegetables produced using IPM</li> <li>• How can industry promote IPM consumers?</li> </ul>	17	6	23
<p>Linking HAL Costing Tool (being developed by NSW Industry &amp; Investment) to realistic costs (validation):</p> <ul style="list-style-type: none"> <li>• Information on all inputs</li> <li>• Regionally adapted</li> <li>• Benchmarking best practice</li> <li>• Business tool</li> <li>• R&amp;D and advocacy work to drive down costs of production (are prices received matching true costs of production?)</li> </ul>	8	5	13
<p>Soil and plant nutrition:</p> <ul style="list-style-type: none"> <li>• Plant nutrient requirements need to be determined for different regions</li> <li>• Need to manage nutrients to minimise risk to groundwater</li> <li>• Better capture of tools for monitoring and measurement of soil and plant nutrition</li> </ul>	1	10	11
<p>Revegetation by design:</p> <ul style="list-style-type: none"> <li>• Expand to be a national project</li> <li>• Identification of suitable species for a range of climates/regions</li> </ul>	4	5	9
<p>Postharvest management of pink &amp; browning in lettuce:</p> <ul style="list-style-type: none"> <li>• Shelf life</li> <li>• Nutrition</li> <li>• Nitrogen</li> </ul>	8	0	8

<p>Dealing with isolation of growers – uptake of R&amp;D outcomes (<b>C&amp;E</b>):</p> <ul style="list-style-type: none"> <li>• Many growers not in regions where activities usually held (e.g. Alice Springs) and many workshops are only held in 1 or 2 locations within a State</li> <li>• Use of tailored resources (CDs, DVDs, You Tube, modern technology)</li> <li>• Allocation of funding for researchers to present/run field days/on-farm visits to disseminate information (facilitated through InnoVeg)</li> <li>• Support scoping study for national registration of vegetable growers</li> </ul>	2	6	8
<p>Supply chain empowerment (<b>C&amp;E</b>):</p> <ul style="list-style-type: none"> <li>• Networking/Relationships</li> <li>• Branding</li> <li>• Marketing Groups</li> <li>• Funding to facilitate groups to work more closely together</li> </ul>	1	7	8
<p>Control of Anthracnose in lettuce:</p> <ul style="list-style-type: none"> <li>• Why is it currently appearing?</li> <li>• A disease of increasing economic importance in southern Australia in winter/early spring in nurseries and in commercial fields</li> <li>• Is US data relevant to Australia?</li> </ul>	4	2	6
<p>Understanding the role of soil carbon in encouraging predatory mite populations</p>	2	4	6
<p>Extension of water use efficiency/irrigation scheduling information (<b>C&amp;E</b>):</p> <ul style="list-style-type: none"> <li>• Courses are available but funding is required to deliver them in all growing regions</li> </ul>	1	5	6
<p>Weed control:</p> <ul style="list-style-type: none"> <li>• Stinging nettle in baby leaf</li> <li>• Weed control in wild rocket</li> </ul>	5	0	5
<p>Control of slugs, snails and earwigs:</p> <ul style="list-style-type: none"> <li>• Major pest problems</li> <li>• What work has been done and communication of outcomes to industry?</li> <li>• What role do farm hygiene, organic matter and soil biology have in their control?</li> </ul>	3	2	5

Control of leaf miner in spinach and baby leaf crops: <ul style="list-style-type: none"> <li>• More IPM and biological control research required</li> <li>• Monitoring and scouting protocols</li> <li>• Understanding of the biology of leaf miner</li> </ul>	2	3	5
Update of lettuce best management training course (developed by Applied Horticultural Research) and delivery (C&E): <ul style="list-style-type: none"> <li>• Needs to be regularly updated and updates provided to those that have completed past courses</li> <li>• Make available to new growers/industry stakeholders</li> </ul>	2	3	5
Control of WFT: <ul style="list-style-type: none"> <li>• Naturally occurring predators</li> <li>• Open field production</li> </ul>	0	5	5
Assistance to field growers to implement IPM (C&E)	3	1	4
<b>Communication and Extension – C&amp;E (in general)</b>	2	2	4
Control of Pythium in field-grown spinach: <ul style="list-style-type: none"> <li>• Need control methods particularly in summer</li> </ul> (Note: Len Tesoriero has some seed dressing information from Asian vegetable project)	2	1	3
Plant scheduling: <ul style="list-style-type: none"> <li>• Long-term temperature data</li> <li>• Transplanting and harvesting</li> <li>• Heat units and leaf counts</li> <li>• Use leaf development rate to predict lettuce harvest date, i.e. leaf counts to predict maturity during crop development (more reliable than heat units, especially in winter/spring)</li> <li>• Look into modelling work done by CSIRO and Craig Henderson at Qld Primary Industry and Fisheries</li> </ul>	1	2	3
IPM: <ul style="list-style-type: none"> <li>• Control of early season pests in brassica crops</li> <li>• Use of crop rotation as refuges to increase colonisation of predators</li> <li>• On-farm nurseries for the parasitoid <i>Diadegma semiclausum</i></li> </ul>	0	3	3



Postharvest management of baby leaf: <ul style="list-style-type: none"> <li>• Transport</li> <li>• Harvesting techniques</li> <li>• Better growing systems</li> <li>• Management of browning</li> <li>• Postharvest research</li> <li>• Education</li> </ul>	2	0	2
IPM assistance in remote locations: <ul style="list-style-type: none"> <li>• What can be done to assist growers in remote locations or in regions without any crop consultants that deliver IPM services</li> </ul>	2	0	2
Chemical access for hydroponic production of leafy vegetables (including lettuce and Asian leafy brassicas) <ul style="list-style-type: none"> <li>• Need to increase access to safer chemicals that can be used in hydroponic production</li> <li>• Need easier access to minor use permits</li> </ul>	2	0	2
Thrips management: <ul style="list-style-type: none"> <li>• In Sydney Basin high populations of thrips are difficult to control with soft chemistry on Asian leafy vegetable crops (In Victoria thrips are easier to manage with IPM, but pest pressure likely to be not as great)</li> </ul>	1	1	2
Management of Big vein disease and ring necrosis in lettuce: <ul style="list-style-type: none"> <li>• Need better understanding of disease and its biology/vectors, still a lot not known</li> <li>• Need to determine an action plan</li> </ul>	0	2	2
Long-term weather forecasting for management within crop (see new BOM service)	0	2	2
Control of Downy Mildew: <ul style="list-style-type: none"> <li>• Need control for wild rocket</li> <li>• Need a chemical with a short (1 day) WHP for lettuce</li> </ul>	1	0	1
Discussions (round table) with supermarkets with regards to acceptability of : <ul style="list-style-type: none"> <li>• Common ground issues</li> <li>• IPM</li> <li>• QA specifications</li> </ul> Develop relationships with the major 2 supermarkets	1	0	1

One national QA system which is accepted by all buyers/supermarkets	1	0	1
Need people working closely with growers – as industry development officers did in the past (C&E)	1	0	1
Protecting farmers' right to farm: <ul style="list-style-type: none"> <li>Promoting the value of local growers</li> </ul>	1	0	1
Management of trap crops (for pests): <ul style="list-style-type: none"> <li>Likely native species</li> <li>Management techniques</li> <li>Crop timing</li> <li>Location timing</li> </ul>	0	1	1
Processing: <ul style="list-style-type: none"> <li>Disinfestation (what are processors accepting, which insects wash out, seasonal variability, differences in systems)</li> <li>Water quality tests (food safety issue, development of a quick test)</li> <li>Removing contaminants from crops before processing (disinfestations, washing, need to research international practices)</li> </ul>	0	1	1
Disease prediction modelling in lettuce: <ul style="list-style-type: none"> <li>Ring necrosis</li> <li>Anthracoise</li> <li>Olpidium</li> <li>Continuing downy mildew work</li> </ul>	0	1	1
Precision Agriculture (C&E): <ul style="list-style-type: none"> <li>Look at recommendations of vegetable levy funded scoping study</li> <li>Awareness and training (establishing beds, planting, fertiliser application, spraying)</li> </ul>	0	1	1
Education and promotion of IPM (C&E) within industry: <ul style="list-style-type: none"> <li>IPM benefits on-farm</li> <li>Selling good news</li> <li>Sells well in the UK</li> <li>Ethical</li> <li>Environmental</li> </ul>	0	0	0

<p>Tipburn (C&amp;E):</p> <ul style="list-style-type: none"> <li>• Information products</li> <li>• Extension of work that has already been done</li> </ul>	0	0	0
<p>Registration of disease outbreaks (within Australia) (C&amp;E):</p> <ul style="list-style-type: none"> <li>• Origins</li> <li>• Region</li> <li>• Anonymous reporting</li> <li>• How can industry capture the data and then communicate nationally</li> <li>• For example an outbreak of Anthracnose in lettuce growing region x and other growers in the region and other regions can be forewarned</li> <li>• There are models for this in broadacre crops</li> <li>• Industry needs to discuss the benefits of this process</li> </ul>	0	0	0
<p>Need to match MRL's that APVMA approves with those used by Food Standards:</p> <ul style="list-style-type: none"> <li>• Major supermarkets are not accepting APVMA MRL's</li> </ul>	0	0	0
<p>Climate change and varieties:</p> <ul style="list-style-type: none"> <li>• Genetics</li> <li>• Varieties tolerant of heat, cold, moisture</li> <li>• Crop management in extreme climatic events (e.g. irrigation)</li> </ul>	0	0	0
<p>Economics and profitability:</p> <ul style="list-style-type: none"> <li>• Cost of production</li> <li>• Improving efficiency in processes</li> <li>• Costs structure (labour)</li> <li>• Mechanisation</li> <li>• Programs to assist growers (e.g. what is going to happen in Northern Tasmania)</li> </ul>	0	0	0
<p>Soil health:</p> <ul style="list-style-type: none"> <li>• Look at patterns of disease</li> </ul>	0	0	0
<p>Movement of silverleaf whitefly to southern regions:</p> <ul style="list-style-type: none"> <li>• An emerging issue</li> <li>• Monitoring required to determine if it will become a problem</li> <li>• Raise awareness amongst industry</li> </ul>	0	0	0

Control of Clubroot in leafy brassicas, especially in the Sydney Region	0	0	0
Control of flea beetle in Asian leafy brassicas and wombok (Chinese cabbage)	0	0	0
Control of Sclerotinia in lettuce: <ul style="list-style-type: none"> <li>New chemical registration needed</li> </ul>	0	0	0
Bacterial leaf spot in lettuce: <ul style="list-style-type: none"> <li>Control methods required for different strains</li> </ul>	0	0	0
Men and women of vegetables calendar <ul style="list-style-type: none"> <li>AUSVEG Board should consider</li> </ul>	0	0	0
Are rebates (right to supply costs) legal?	0	0	0
Human health: <ul style="list-style-type: none"> <li>Quantifying what human nutrition benefits are in different vegetables</li> </ul>	0	0	0

\* Abbreviations:

APVMA – Australian Pesticides and Veterinary Medicines Authority

BOM – Bureau of Meteorology

C&E – Communication and Extension

HAL – Horticulture Australia Limited

IDO – Industry Development Officer

IPM – Integrated Pest Management

MRL – Maximum Residue Limit

QA – Quality Assurance

R&D – Research & Development

WFT – Western Flower Thrips

WHP – Withholding Period

## **COMMON THEMES BETWEEN THE LEAFY AND BRASSICA THINK TANKS**

A Brassica Vegetables Think Tank (VG07106) was held in August 2008 and facilitated by Alison Anderson (then NSW Vegetable Industry Officer) and Melissa Fraser (then SA Vegetable Industry Development Officer).

There were several common themes and priorities between the Leafy and Brassica Think Tanks (e.g. control of pests and diseases, role of plant nutrition on product quality and shelf life, communication and training, management of natural resources, consumer trends). Some of the high priority issues for both groups are discussed below.

Communication, extension and the uptake of outcomes from R&D projects was seen as a priority for future R&D investment by both groups. Much discussion was had by both groups with regards to the best methods to communicate with growers, particularly those that are isolated. Both groups felt that it was very important that research providers and experts visit vegetable growing regions for workshops and on-farm demonstrations. Participants at the Leafy Think Tank also discussed using a range of resources such as DVD's and online tools for information dissemination. Both groups discussed having a good archive of project information online and keeping resources such as booklets and courses (developed through vegetable levy funds) up-to-date.

Soil fertiliser and nutrition management was also considered a priority by both groups. Highlighted was the need for increasing the knowledge and skills of growers and their advisors with regards to soil nutrient management through workshops for example. The need for tools to help identify nutrient disorders and research to determine true plant nutrient requirements for different regions/soil types was also raised. Participants at the Leafy Vegetables Think Tank also considered managing nutrients to minimise leaching and risk to groundwater a priority while participants at the Brassica Vegetables Think Tank also considered it important to research alternatives to fertilisers and undertake fertiliser versus yield trials.

Also considered a priority by both groups is further investigation into the potential contribution revegetation by design can make to on-farm IPM programs. Participants from both Think Tanks felt that the revegetation by design project should have a national approach.

## **FUTURE LEAFY VEGETABLE THINK TANKS**

The Think Tank participants agreed that meeting to discuss and set priorities for leafy vegetables was a good idea and priorities should be set every two years by representatives of the leafy vegetables industry.

While participants of the Brassica Vegetables Think Tank (VG07106) held in August 2008 felt it was very important to include reports from research providers on current brassica vegetable research (and have more time for discussion) participants at the Leafy Vegetables Think Tank had several comments on the format of future Think Tanks.

There was a mixed response with regards to how much time should be spent hearing about current and past research outcomes. Some thought more would be better, others less. It was commented that information from research providers could be “more targeted”. A suggestion was to start the agenda by asking growers their problems and then ask research providers to comment on any work had been done or is underway to address these problems. There was also mixed feedback as to whether the Think Tank should be held on one day only or over 2 days. Flying in for dinner and having one long day seemed to be the preferred format.

Other individual comments from participants were:

- An important forum;
- Good to discuss ideas together;
- As a researcher it is very good to be able to meet growers;
- Discussing issues in groups too rushed;
- Maybe do some brainstorming prior to Think Tank by email;
- Maybe growers explain their problems to research providers and then they can give growers more information or can find the information for them;
- Good to have written presentations;
- Good to have individuals give their own presentations and good that there is a broad spectrum of participants;
- Need project list provided before Think Tank to be more specific;
- Use technology more as growers cannot leave farms for long.

## APPENDIX 1: MEETING AGENDA



### Leafy Vegetables Think Tank Agenda Monday 30<sup>th</sup> November & Tuesday 1<sup>st</sup> December, 2009 Coach House, Waite Institute, University of Adelaide



#### Monday 30<sup>th</sup> November: 2 – 5 pm

- 1.45 pm Arrive
- 2.00 pm Welcome, introductions and aims of the think tank
- 2.30 pm Outline of Vegetable Industry Development Program and the People Development Sub-program (ongoing opportunities for leafy vegetables industry stakeholders): Dianne Fullelove (Dianne Fullelove & Associates)
- 2.50 pm An economic guide to the vegetable industry: Ian James (Vegetable Industry Economist)
- 3.20 pm Break
- 3.30 pm Leafy Vegetables project summaries – key outcomes and knowledge gaps (10 – 15 min presentations + 5 min question time)  
Sophie Parks (Industry & Investment NSW): Residues in hydroponic lettuce and nitrate/nutrient studies in leafy vegetables  
Len Tesoriero (Industry & Investment NSW): Management of root diseases in hydroponic lettuce and spinach, Asian vegetables IPM  
Liz Minchinton (DPI Victoria): Disease management projects for lettuce, celery and parsley  
Gordon Rogers (Applied Horticultural Research): Optimising crop management & postharvest handling for baby leaf salad vegetables and Best Practice Manual for the Australian Lettuce Industry  
Glenys Wood (SARDI): Revegetation by design
- 5.00 pm Wrap up for day 1
- 5.15 pm Taxis to accommodation (Old Lion Apartments, 9 Jerningham St, North Adelaide, 08 8334 7799)
- 7.00 pm Dinner at Lion Hotel (corner of Melbourne St & Jerningham St)

**Tuesday 1<sup>st</sup> December: 9 am – 3 pm**

- 8.45 am Arrive
- 9.00 am Leafy Vegetables project summaries continued – key outcomes and knowledge gaps (10 – 15 min presentations + 5 min question time)  
Sandra McDougall (Industry & Investment NSW): Lettuce IPM  
Rob Dimsey (DPI Victoria): Best management practices in leafy vegetables  
Paul Horne (IPM Technologies): IPM in lettuce, baby leaf and celery  
Aileen Reid (Agriculture & Food WA): Enhancing fertiliser use efficiency for transplanted vegetables  
Cate Paull (SARDI): DBM management in leafy brassicas
- 10.40 am Morning tea
- 11.00 am Identification of key research themes (e.g. soil, IPM, marketing)
- 11.15 am Break into groups to identify R&D priorities for leafy vegetables in Australia
- 12.10 pm Group leaders to report back to whole group
- 12.30 pm Lunch
- 1.00 pm Collation of R&D priorities (group similar priorities)
- 1.30 pm Voting on key R&D priorities
- 2.00 pm Develop project ideas for the top 5 – 10 R&D priorities  
What is the problem?  
How are we going to investigate it?  
What outcomes are we seeking?  
How will we deliver it?  
How will it be implemented on-farm?
- 2.45 pm Wrap up and close
- 3.00 pm Taxis to the airport



## APPENDIX 2: ISSUES IDENTIFIED BY GROUPS AND INDIVIDUALS PRIOR TO THINK TANK

### Abbreviations:

APVMA – Australian Pesticides and Veterinary Medicines Authority

BOM – Bureau of Meteorology

HAL – Horticulture Australia Limited

IDO – Industry Development Officer

IPM – Integrated Pest Management

MRL – Maximum Residue Limit

QA – Quality Assurance

R&D – Research & Development

WFT – Western Flower Thrips

WHP – Withholding Period

### Group 1

What can be done to assist growers who are remote or are in a region with no crop consultants to assist with IPM	Men and Women of Vegetables Calendar
Linking HAL Costing Tool (being developed by Industry & Investment NSW) to realistic costs – information on all inputs, regionally adapted, benchmarking best practice, business tool	Leverage marketing opportunities to increase vegetable consumption – cooking shows, schools/education, demonstrations at markets, new lines as well as staples

### Group 2

Precision Agriculture – setting out beds, planting, fertiliser, spraying	Education and promotion of IPM within industry – IPM benefits, selling good news, UK sells well, ethical, environmental
Minor use chemicals for hydroponics – need easy access	Managing pink and browning (postharvest) in lettuce – shelf life, nutrition, nitrogen
Postharvest management of baby leaf – transport, harvesting techniques, better growing systems, management of browning, postharvest research, education	Varieties and climate change – genetics, varieties tolerant of heat/cold/moisture, managing in extreme events (e.g. irrigation)
Economics and profitability – cost of production, programs to assist growers (e.g. what are they going to do in Northern Tasmania)	Education of young people about the benefits of consuming vegetables – industry input, case studies, economic benefits, health cost savings, AUSVEG
Control of slugs and earwigs – what role do farm hygiene, organic matter, soil biology have in their control	Leaf miner in spinach and baby leaf crops – monitoring and scouting, biology of the leaf miner
Disease prediction modelling in lettuce – ring necrosis, Anthracnose, <i>Oplidium</i> , continuing downy mildew work	Management of trap crops (for pests) – native species, management techniques, crop timing, location timing
IPM – control of early season pests in brassica crops, use of crop rotation as refuges to increase colonisation of predators, on-farm nurseries for the parasitoid <i>Diadegma semiclausum</i>	

### Group 3

Supply chain empowerment – networking/relationships, branding, marketing groups. Funding to facilitate groups to work more closely together.	Registration of disease outbreaks (nationally) – origins, region, anonymous reporting. Discussions of benefits of this process. Maybe useful for specific diseases (e.g. Anthracnose). There are models for this in broadacre crops.
Tipburn – information products	Soil health – look at patterns of disease
Controlling stinging nettle in baby leaf	Weed control in wild rocket
Profitability of businesses – costs structure (labour), improving efficiencies in processes, mechanisation	Removing contaminants from crops before processing – disinfestations, washing, need to research international practices
Water quality tests for processing – food safety issue, development of a quick test	WFT – naturally occurring predators, open field production
Control of Pythium in field-grown spinach particularly in summer	Role of soil carbon in encouraging predatory mite populations
Control of Downy Mildew in wild rocket	Need a chemical to control Downy Mildew in lettuce with a short (1 day) WHP
Bacterial leaf spot in lettuce – control methods for different strains	Leaf miner in spinach – more IPM research and biological research needed
Nutrition – better capture of tools for monitoring and measurement of soil and plant nutrition	Big vein disease and ring necrosis in lettuce – need better understanding of disease and its biology/vectors and to determine an action plan
Control of Anthracnose in lettuce – why is it appearing currently and is US data relevant to Australia?	Sclerotinia control in lettuce – new chemical registration needed
Consumption patterns by commodity	

### Group 4

Getting information to growers who are isolated – using tailored resources, allocation of funding to researchers to disseminate information through InnoVeg, support national registration of vegetable growers	Have round table discussions with supermarkets to discuss acceptability of – common ground issues, IPM, QA specifications. Develop relationships with the major 2 supermarkets.
Consumer education – awareness and understanding of produce that is IPM produced i.e. logo stating that it is environmentally friendly, selling the good news story	Disinfestation of product for processing – what are processors accepting, which insects wash out, seasonal variability, differences in systems
Human health – quantifying what human nutrition benefits are in different vegetables	

## Issues identified by individuals prior to or at the Think Tank

Extension of water use efficiency information	Assistance to field growers to implement IPM
Update of lettuce training course and delivery	Need people working with growers – as IDOs did in the past
Keep increasing safer chemicals that can be used in hydroponic production	Nutrient management – risk to groundwater, needs to be determined for different regions
One national QA system which is accepted by all buyers/supermarkets	Are rebates legal (right to supply costs)?
R&D and advocacy work to drive down costs of production – are prices received matching true costs of production?	Understanding of IPM product by consumers – how can industry promote IPM to consumers?
Postharvest handling	Weed control
Need to match MRL's that APVMA approves with those used by Food Standards – major supermarkets not accepting APVMA MRL's	Expand revegetation by design to a national project – want identification of suitable species for a range of climates/regions
Long-term weather forecasting for management within crop – see new BOM service	Management of the emerging issue of the movement of silverleaf whitefly to southern regions – monitoring required to determine if it will become a problem, raise awareness amongst industry
Thrips research needed as outlined by Len Tesoriero	Protecting farmers' right to farm by promoting the value of local growers
Control of flea beetle in Asian leafy brassicas and wombok (Chinese cabbage)	Control of Clubroot in leafy brassicas, especially in the Sydney Region
Slugs and snails are a major pest problem – what work has been done and communication of outcomes to industry	Plant scheduling – long term temperature data, transplanting and harvesting, heat units and leaf counts
Control of Anthracnose in lettuce – a disease of increasing economic importance in southern Australia in winter/early spring in nurseries and in commercial fields	Using leaf development rate to predict lettuce harvest date, i.e. leaf counts to predict maturity during crop development (more reliable than heat units, especially in winter/spring)