

**Managing a greenhouse capsicum crop –
an interactive DVD demonstration and
resource package**

Trevor Linke
BizWize

Project Number: VG09070

VG09070

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Level 7
179 Elizabeth Street
Sydney NSW 2000
Telephone: (02) 8295 2300
Fax: (02) 8295 2399

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Horticulture Australia

Final Report

“Managing a greenhouse capsicum crop”

An interactive DVD demonstration and resource package

ABOUT THIS RESOURCE | HOW TO USE THIS RESOURCE | ABOUT PHUONG'S FARM

GROWING HEALTHY, PRODUCTIVE CAPSICUM CROPS

A resource package based on the successful practices
of Virginia Capsicum grower PHUONG VO

Module 1:	Module 2:	Module 3:	
<p>A foundation of essential knowledge about plant needs, efficient low-tech greenhouse design, irrigation and salinity management, soil health, and pest and disease management.</p> <p>(English, Vietnamese)</p> <p>Fact sheets with links to other resources</p>	<p>Key practices used by Phuong to set up for his new crop by repairing and preparing his soil and careful planting of the seedlings for a long and productive life.</p> <p>(English, Vietnamese)</p> <p>download Module 2</p>	<p>Key practices used by Phuong to manage his crop for maximum production and identify and deal with likely challenges and threats</p> <p>(English, Vietnamese)</p> <p>Fact sheet with links to other resources</p>	

Cost Benefit Calculator

Click here to find out how productive Phuong's farm is and what improvements have helped him.
Enter some changes and estimated costs and work out how much more yield you would need to make a profit from these changes.

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Completion date: 30/4/13

Project Title: “Managing a greenhouse capsicum crop – interactive DVD demonstration and resource package”

Author: Tony Burfield (Integrated Farming Services)

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Project Leaders:

- Trevor Linke (BizWize)
trevor@bizwize.com

Other Key Personnel:

- Tony Burfield (Integrated Farming Services) – Research Provider
Mob: 0401 120 857;
E-mail: tony@integratedfarmingservices.com.au
- Phuong Vo - Case Study grower
Mob: 0402 700 887

Purpose of the report:

This report presents a detailed summary of the outcomes from a levy funded project that was based on an in depth case study of champion Virginia capsicum grower, Mr. Phuong Vo. The aim of the project was to create “An interactive DVD demonstration and resource package on Managing a Greenhouse Capsicum Crop” to assist capsicum producers working in low tech, soil based, greenhouse systems to improve their production practices and results in all respects. The information and practices covered have significant relevance for other greenhouse ‘vine’ crops, including those grown in low-tech or semi-hydroponic systems.

Acknowledgment of funding sources and collaborators:

- This project has been funded by HAL using the vegetable industry levy and matched funds from the Australian Government
- Mr. Phuong Vo provided unlimited access to his time and knowledge
- Adelaide and Mount Lofty Ranges NRM Board (via the Gawler regional office team) provided access to extensive NRM resource materials, technical support and soil pit video opportunity



Date of the report: 30/4/13

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1. Media Summary



The management practices of recognised champion greenhouse grower Phuong Vo from the Vietnamese community in Virginia, have been captured in text and video as an illustrative case study of Best Practice in soil based capsicum farming. The case study of Mr. Vo has been supplemented with additional technical resources to give more detail and scope to the suite of information.

This resource has been created to provide an integrated, one stop shop of farm focused information suited to the needs of capsicum producers growing in low-tech, or conventional structures. No such resource has previously existed to match Australian conditions. Other knowledge support options are

increasingly limited due to state government budget reductions in horticulture extension, and the discontinuous and partial nature of most other funded programs. Key resources have also been translated into Vietnamese to improve access by the largest CALD community of growers in Virginia and other regions in Australia.

The web page style resource is intended to assist growers to:

1. Identify agronomic issues more clearly and gain insight into how to achieve improved yields/reduce costs by changing specific practices
2. Estimate the costs and benefits of changing specific practices so they can assess the economic pros and cons of making changes to their production program

The resource is presented in an interactive web page style with four main sections:

1: Essential Knowledge; *Covers plant needs, optimal use of low-tech greenhouse design, irrigation and salinity management, soil health and pest and disease management.*

2: Preparing & Planting; *Key practices used by Mr. Vo to repair and prepare his soil, matched by careful planting of seedlings for a long and productive life.*

3: Managing The Crop; *Key practices used to manage his crop for maximum production and identify and deal with likely challenges and threats to his plants and fruit*

4: Cost Benefit Calculator: *Demonstrates how productive Mr. Vo's farm is and estimates the cost and benefit of his improvements. Enables other growers to prepare a hypothetical costed scenario of changes and potential benefits.*

Each of these modules has links to additional supporting information including farm videos and fact sheets.

The case study content of modules 2, 3 and 4 clearly demonstrates the potential to substantially increase production and quality in greenhouse capsicum soil crops through overcoming, or reducing serious common production issues, in particular through improved soil health and pest and disease management. ***Mr. Vo's changed practices over 5 years have added up to an additional 66.5 % in yield per crop, which in one block of greenhouses (1,200m²) yields an additional \$21,546 at 1.80/kg farm gate prices. This was achieved with a negligible increase in expenses because the modified farming practices significantly shifted the balance toward healthier more productive soils. Improved soil condition in turn assisted fertilizer and water uptake, and reduced root and foliar disease levels.***

This resource will be distributed to the Australian protected cropping industry as a limited number of USB packs (approx 250) and promoted nationally through relevant publications advertising the web site version of the resource at www.growingcapsicums.com.au. The web site will invite comment and feedback from growers and service providers over the next 6 months (May – October 2013) to ensure that any minor corrections and fine tuning that can improve this resource can be implemented.

The following recommendations are made on the basis of this case study, and Mr. Vo's success in transferring his knowledge to his immediate peers in Virginia:

- That growers, governments and the supply chain recognise the potential for improved productivity, quality and economic outcomes from low tech protected cropping systems
- That the horticulture industry, funding bodies and industry service providers recognise the close relationship between improved strategic management of natural resources – soil, water and bio-diversity – and the resulting economic benefits of Best Practice farming
- That the potential for industry optimisation is recognised by industry service providers, researchers and funding bodies through further investment in R D & E, to build on the knowledge gained from this case study in regard to soil health, greenhouse climate control, IPM and assessment of improvements in yields and fruit quality
- That the successful focus on representative champion growers like Mr. Vo is recognised as the most relevant source of input on industry issues and capacity, ranging from production, to farm economics, to market development and as a benchmark for relevant R&D into the future.

2. Introduction

Background

Most of Australia's 2,000 or more greenhouse growers, including the study farm in Virginia, grow their crops in low tech protected cropping structures averaging 2.0m -3.5m to the gutter. The majority of these growers lack comprehensive formal training in horticultural practice. Their production practices have developed around 'over the counter' sales of pesticides and fertilisers with negligible farm focused planning and monitoring from agronomists and other skilled consultants. Some have attended short training courses and have benefited from targeted IPM related Veg Levy funded programs. Around 50 growers in Virginia received formal Horticultural classroom based training to Diploma level about 10 years ago. Another 40 or so have received similar training over the last 3 years. Several other vegetable levy funded projects (see **8. Other Veg Levy R&D outputs with relevance**) have sought to address the relationship between production systems, greenhouse design, climate and disease management issues. The focus in these projects has been mostly on cucumber crops, and once again only partially addressed the crop cycle and supporting system of management practices. So growers have only had access to a disconnected sequence of classroom based training and farm based R & D & E focusing on several key issues. While this has been very helpful, growers have often expressed their disappointment that there has not been a 'demonstration/teaching farm' that can combine relevant technology with a clear economic appraisal to drive practice change. In particular they often ask for knowledge and information that covers a complete cropping cycle.

Discussion with leading Vietnamese, Cambodian and European growers in Virginia confirmed that they are disappointed that there has not been wider adoption of improved practices in IPM, soil health and general plant health management. They are very concerned about increasing soil degradation, water quality issues and pesticide resistance and the impact this is having on yields and fruit quality. Industry leaders attribute this to a lack of ongoing support for continuous learning and transfer of Best Practice to others growers that they can view with confidence for its relevance to their systems and needs.

A comprehensive greenhouse production resource based on a champion grower

By conducting a case study of the growing practices of a recognised champion grower I hoped to partially address this deficit. Phuong Vo was selected as the focus grower for this study because he is recognised by industry as a skilled early adopter of improved farming practices. He has accumulated considerable expertise from his own observation driven learning. He has also regularly extended his learning through additional training and attracted expert support for improving his pest and disease management, and has hosted on-farm compost R&D trials by SARDI with subsequent on-farm demonstrations by the local NRM team. This has enabled Phuong to tackle key issues with considerable success and to influence many of his peers to change their practices to incorporate compost and improve salinity management.



The project set out to track Phuong Vo's crop cycle through an entire season, interviewing him about his practice and underpinning knowledge, and filming key stages in the life of the crop. The aim was to create a comprehensive resource based on an expert grower producing capsicums in a low tech greenhouse. His greenhouses are very low (1.8m to the gutter) and covered with glass rather than plastic sheeting so he really has no technical advantage over any other growers except perhaps better light transmission in winter. Industry experts were to be approached to create/source/review additional technical information to give more detail and scope to the suite of information in the final product.

Anticipated benefits for the low tech protected cropping industry

A resource has been created to reflect Phuong's farming practices as intended, containing information, videos and tools that will assist growers to:

- Identify agronomic issues more clearly and gain insight into how to achieve improved yields/reduce costs by changing specific practices
- Estimate the costs and benefits of changing specific practices so they can assess the economic pros and cons

The resource is organised under the following themes:

1. Essential Knowledge, at an introductory level, of plant needs, optimal use of low-tech greenhouse design, irrigation and salinity management, soil health, and pest and disease management.
2. Preparing & Planting a crop, based on the key practices used by Phuong to repair and prepare his soil, matched by careful planting of the seedlings for a long and productive life.
3. Managing The Crop, also based on key practices used by Phuong to manage his crop for maximum production and identify and deal with likely challenges and threats to his plants and fruit
4. Cost Benefit worksheets that demonstrates how productive Mr. Vo's farm in which he allocates his benefits against practice change and costs. There is a second worksheet set that enables other growers to prepare a hypothetical costed scenario of changes and potential benefits.

ATTACHMENT 1. provides a list of all resources contained within the package.

Prior to commencing this study Phuong's practice improvements and resulting benefits were recognised as laudable, but the extent of his economic achievements were not fully analysed or appreciated. The decision to work with Phuong has proven to be more than justified in every respect. ***Phuong's changed practices over 5 years have added up to an additional 66.5 % in yield per crop, which in one block of greenhouses (1,200m²) is worth an additional \$21,546 at 1.80/kg farm gate prices. This was achieved with a negligible increase in expenses because the modified farming practices significantly shifted the balance toward healthier more productive soils. Improved soil condition in turn assisted fertilizer and water uptake, and reduced root and foliar disease levels.***

Other growers and service providers will now be able to access and use this resource via a web page (www.growingcapsicums.com.au) and about 250 USB copies distributed via industry networks. It is hoped that it will stimulate similar practice change to that adopted by Phuong with increased confidence in underpinning technical knowledge and systematically generated Cost-Benefit estimates.

3. Technology transfer strategy and methodology/activities

There has been significant 'extension' within a limited circle of growers via industry workshops and training programs, enabling trialing of key elements of the package as they were completed. The video clips on managing soil and benefits of compost, and various IPM resources including two bio-control farm videos have been used in two greenhouse training programs (40 growers), Step Up Soil Condition workshops (7 growers) and a compost industry marketing lunch (7 growers) with very positive responses on every occasion regarding the content and presentation.

Technology transfer proper begins with completion and promotion of the resource package and includes:

- USB distribution of 250 copies in NSW, WA and SA via identified networks including Jeremy Badgery-Parker NSW DPI and John Shannon (vegetablesWA)
- Direct e-mailing of the web link to 50+ growers from the Hortex database.

A press release (ATTACHMENT 2.) is promoting the resource widely to the following media outlets with a direct interest in the Horticulture industry:

- AUSVEG
- ABC Radio Country Hour
- SA Grower
- Good Fruit and Vegetables
- Hortex web site news feature.

From here it is anticipated that other interested parties will pick up on the news stream and add their efforts to promoting the resource.

This resource will also be directly promoted to and through industry service providers in Virginia including:

- Four chemical resellers
- Seed companies representatives
- The packing sheds in Virginia – who are often growers in their own right
- Various other commercial agronomists and consultants, eg Domenic Cavallaro (Stoller Australia), Keith Webb (Freshways)
- Adelaide and Mount Lofty Ranges NRM Gawler (AMLR NRM) who both fund and promote best practice farming in the horticultural region
- Local councils (Playford, Mallala and Two Wells)
- IPM consultants including Biological Services and Manchil Services who are currently providing biologically based IPM services to around twenty growers with an anticipated annual doubling in clients.

The web page contains an invitation for growers and service providers to ask questions and provide feedback until late November 2013 to aid corrections and limited fine tuning of the package. It is hoped this will generate an ongoing engagement for that time period at least.

Additional funding is being sought to expand the pool of case study growers and create additional translations of the resources in this package. If successful it is recommended that some of the outputs, especially additional translated material be added to the web page.

4. Evaluation and measurement of outcomes - impact and adoption

Review process during creation of the package

The resources were developed within a continuous feedback loop with the Case study grower (Phuong Vo), his neighbour (Andrew Mathews) and technical experts in the areas of plant agronomy and soil health, irrigation and salinity management and business economics.

In particular:

- Domenic Cavallaro has reviewed various sections including plant nutrition, climate control, and the fumigation video clip
- Phil Barnett from Pro Ag Soil Management has reviewed the salinity management fact sheet and soil test interpretation advice
- Noel Johnston from Irrigation Management Training has also reviewed the salinity fact sheet and provided resources for measuring salinity and on-farm soil testing resources
- Tony Fox from the AMLR NRM board has also reviewed the salinity and irrigation management fact sheets
- Phuong, his grower neighbour (Andrew Mathews) and business consultant (Trevor Linke) have reviewed the calculation of Phuong's yields per square meter and agree that the conclusions of a 66.5% improvement in yields over the last 7-8 years is valid
- Nhieu Nguyen who has considerable experience interpreting and translating for the local industry was engaged to translate the primary fact sheets in each of the four modules.

In addition the video clips on managing soil and using compost have been used in two greenhouse training programs (40 growers) and Step Up Soil Condition workshops (7 growers) and a compost industry marketing lunch (7 growers) with very positive responses on every occasion regarding content, relevance and presentation.

Review of final draft versions

Three leading growers (Hung Nguyen, Vyras Thac and Andrew Mathews) were approached to comment on the package at final draft in terms of the scope and relevance of the content, the presentation concept and the Cost Benefit calculator.

The following selection of comments is provided as representative of their response to the final draft package:

Hung Nguyen (Hort Dip., early 20's, works on family farm & his own independent farm)

Consider including a web link to Virginia weather station (can be done via the Hortex web page)

Noted that this resource compares well to the Diploma in Horticulture (greenhouse) course he finished a year ago, but improves or adds to it by focusing on input from a champion grower

He said he will show it to friend thinking of changing to capsicums next year, as a resource that can assist him

He said it will be interesting to see how other growers respond to so much information. Will they be overwhelmed, or see it as a valuable resource ?

Vyras Thac (late 20's working on family farm with a very progressive approach)

*Great tool for new farmers who want some information on what is involved in farming
Can find out what it takes to make money using the calculator, ie the economics of farming so they can figure out how well you are doing*

Gives a way to work out both the technical and financial side together

Vyras saw this as very important because without clear, realistic aims growers can get overwhelmed by the work and problems of farming.

Both growers raised issues of interest (re using fine insect exclusion mesh, related ventilation issues, thrips pupae persisting in soil, interest in bio-control etc.) which are all included in the package! They hope it will be a springboard to incite learning/adoption/further research by growers who access this package. They can't wait to see it fully operational and critique it more fully as a working resource. They are very keen to give ongoing feedback via the web site and personal contact

Andrew Mathews (grains researcher, capsicum grower and ex IAC member)

Commented on greenhouse height being the easiest and cheapest way to improve crop performance according to Keith Gazzoli – gets rid of micro-climates. (not emphasized in this package due to the low structures of the case study grower)

Commented that a local reseller had trialed double doors on his demonstration greenhouse and swears by their impact in excluding whitefly (concur with advice in the package)

Commented on the value of HAF fans (horizontal air flow), (this advice is included in the package)

Very happy to see something bringing all the resources together (eg re managing salinity)

Saw the Cost-Benefit calculator as a very useful tool.

Suggested the package was useful for doing an annual review to see how the priority rating for causes of yield loss changes as issues are dealt with.

Like the idea that the web site is open to input from growers. There could be some kind of annual review of industry access and implementation, at least a measure of the hits on the web site. This will occur

His final comment - 'Brilliant!'

I encountered no negativity or skepticism during the grower reviews, only a few suggestions and a lot of optimism and interest for seeing how it performs. Throughout its development this project has had strong support from growers and substantial pro-bono contributions from technical experts. As an exercise it has served to build awareness about the achievements of local champion growers and has already motivated efforts to commit more resources to promoting Best Practice amongst the Adelaide Plains industry via the Hortex Alliance (www.hortexalliance.com.au) and AMLR NRM board.

Post completion review by the wider industry:

The completed package will exist both as a stand-alone web page, and will be distributed on a USB to about 250 greenhouse growers around Australia. The web site will continue to be promoted as a point of contact with the project team to provide feedback and comment.

The web site will also contain a feedback 'forum' for growers to make comments and seek limited assistance in the form of simple Q&A and referral where practical. This will be managed by Tony Burfield and the project's network of experts. This communication will be active for at

least 6 months and feedback will be used to fine tune the existing content and functionality of the web site. In December 2013 a summary of industry input, assistance provided and insights gained on the value of this type of resource will be sent to Horticulture Australia Limited.

A focus group from the Virginia greenhouse industry will be organised and guided through the two main intended pathways for using the resource, ie:

- To assist capsicum growers to identify agronomic issues more clearly and gain insight into how to achieve improved yields/reduce costs by changing specific practices.
- To enable growers to estimate the costs and benefits of changing specific practices so they can assess the economic pros and cons.

This will provide another exercise to more directly gauge the usefulness and likely impact of this resource and to fine tune the content and design of the web page. A report on industry feedback and any changes made will be forwarded to Horticulture Australia Limited in December 2013.

5. Discussion

The exercise proved entirely successful in terms of capturing Best Practice in clear detail and identifying very substantial economic benefits that flowed from these changes.

Expert input was pretty comprehensive and a limit had to be set on what could realistically be achieved with this effort. I would have liked more expert input concerning what drives plant needs at a physiological level but both time and money ran out!

The exercise was interrupted by crop damage in the first season due to severe chemical burn caused by ambiguous advice on a company fact sheet about rates for a foliar penetrant. This put the projects completion under pressure as other commitments arose in the second year. In the light of these challenges I am particularly grateful for the patience and accommodation afforded to me by Horticulture Australia Limited for more than one extension, enabling me to complete this project on behalf of its contributors and investors.

It was challenging to design an integrated package with numerous internal cross-referenced linkages and novel components, especially the Cost Benefit calculator and video clips, but the end result appears to work well, pending the launch and feedback on the working version. Undoubtedly some fine tuning will be indicated over the next few months.

6. Recommendations

The following recommendations are made on the basis of this case study, and Mr. Vo's personal success in transferring his knowledge to a number of his peers in Virginia:

- That growers, governments and the supply chain be encouraged through articles and professional networks to recognise the potential for improved productivity, quality and economic outcomes from low tech protected cropping systems

- That the horticulture industry, funding bodies and industry service providers recognise the close relationship between improved strategic management of natural resources – soil, water and bio-diversity – and the resulting economic benefits of Best Practice farming. In particular noting the potential for repairing degraded soils, reducing salinity levels, fertiliser and pesticide inputs and saving water
This could be quantified more fully through further case studies of growers using similar practices. Indeed funding has already been sought from the local NRM board for this purpose
- That the potential for industry optimization is recognised by industry service providers, researchers and funding bodies through further investment in R D & E, to build on the knowledge gained from this case study in regard to soil health, greenhouse climate control, IPM and assessment of improvements in yields and fruit quality
- That the successful focus on representative champion growers like Mr. Vo is recognised as the most relevant source of input on industry issues and capacity, ranging from production, to farm economics, to market development and as a benchmark for relevant R&D into the future.

It is also recommended that the www.growingcapsicums.com.au resource is extended by:

- Resourcing and maintaining the web site, and updating it from time to time depending on industry interest and relevant technical and economic information becoming available, (the extent of web site use will be recorded and reported to HAL at the end of 2013)
- Additional case study based work being undertaken to extend/expand this resource to other levy paying greenhouse crops (cucumbers and egg plants) grown in low tech structures
This could be done as a technical supplement focusing on the specific environmental, cultural and nutritional and crop protection requirements of these crops that differ from capsicums. Phuong Vo is considered to possibly be the regions best egg plant grower and could serve as an excellent case study for this crop as well.

7. Acknowledgments

The following people and organisations are gratefully acknowledged for their assistance in creating and helping to distribute www.growingcapsicums.com.au:

Phuong Vo who has been an exemplary Champion Grower, both in his farming practice and his ability and patience for communicating the necessary details to me in a usable form and then reviewing my work.

Andrew Mathews, Phuong's neighbour, has been a valued second opinion as someone looking over Phuong's fence and dealing with much the same issues. Andrew provided an important additional guarantee that the messages were on track.

I also wish to thank the following growers and other experts for their contributions and support:

- Hung Nguyen and Vyras Thac for their critical feedback
- Domenic Cavallaro for his invaluable review of various fact sheets requiring technical checking of agronomic information derived from the case study grower as interpreted by myself
- Trevor Linke for his excellent support to develop the central innovation in the project, the Cost-Benefit worksheets for linking practice change to production outcomes and economic value
- Nhieu Nguyen for providing his skills in translating some rather demanding documents to ensure they were clear and meaningful to Vietnamese growers

- Tony Fox AMLR NRM board for his various roles in supporting the project from featuring in a video clip to approving use of NRM resources and reviewing several fact sheets
- Noel Johnston for reviewing several fact sheets and kindly making available several resources from his professional stores
- Phil Barnett from Pro Ag Soil Management for making his grower fact sheets on managing salinity and soil types available and for reviewing the salinity fact sheet
- Kaylee Maitland and Jessica Collins from Lavaworks for incredibly patient and skilled interpretation of my word files etc into the interactive web style format I sought to achieve
- Jim Kelly (ARRIS) for permission to use the capsicum nutritional symptoms poster.

8. Other Vegetable Levy R&D outputs with relevance

Several other vegetable levy funded projects (*) that have not been included in this package are recommended as additional resources of value including:

Published resource of general value

Pests, diseases, disorders and beneficials in greenhouse vegetables	Field identification guide – very practical and popular. Can be ordered from NSW DPI bookshop http://www.dpi.nsw.gov.au/aboutus/resources/bookshop	TL00171
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Project reports related to greenhouse (and farm) design and productivity issues

PROJECT TITLE	COMMENT	PROJECT CODE
Improving greenhouse systems and production practices (greenhouse technology systems component)	Compares the cost-benefit of various strategies, particularly in regard to environmental control	VG07145
Integrated management of greenhouse vegetable diseases: Development of microbial bio-controls and biorational chemical strategies	Combines a number of management strategies to determine the most effective disease control options.	VG05084
Keep it Clean OR “Build capacity of greenhouse growers to reduce crop loss through adoption of preventative disease management practices”	Farm Hygiene fact sheets & Workbook. Excellent profiling of pests and diseases characteristics and appropriate prevention practices	VG07118
Sustainable integrated control of foliar diseases in GH vegetables	Investigates disease incidence, predisposing conditions> Looks at management of diseases via Variety trials and pesticide strategies Produced a series of fact sheets, newsletters and disease identification poster as follows ...	VG05094

The following fact sheets from VG05094 can be downloaded from:

http://www.sardi.sa.gov.au/pestsdiseases/horticulture/horticulture_pathology/foliar_diseases_of_greenhouse_vegetables

- Foliar Diseases in Greenhouse Vegetables Issue 1 March 2007 (English)
- Foliar Diseases in Greenhouse Vegetables Issue 1 March 2007 (Vietnamese)
- Foliar Diseases in Protected Crops Poster September 2007
- Foliar Diseases in Greenhouse Vegetables Issue 2 December 2008 (English)
- Greenhouse Vegetable Foliar Diseases Identification (English)
- Greenhouse Vegetable Foliar Diseases Identification (Vietnamese)
- Australian Hydroponic and Greenhouse Industry Conference poster June 09
- Foliar Diseases in Greenhouse Vegetables Issue 3 January 2010
- Foliar Diseases in Greenhouse Vegetables Issue 4 August 2010
- Foliar Diseases in Greenhouse Vegetables Issue 5 August 2010
- Managing Leaf Diseases (AHGA Presentation - K Ferguson)

ATTACHMENTS

ATTACHMENT 1. Press Release



Growing Healthy, Productive Capsicum Crops

Vegetable Levy Funding Assists Greenhouse growers through.. A resource package based on the successful practices of Virginia Capsicum grower PHUONG VO



The management practices of recognised champion greenhouse grower Phuong Vo from the Vietnamese community in Virginia, have been captured in text and video as an illustrative case study of Best Practice in soil based capsicum farming. The case study of Mr. Vo has been supplemented with additional technical resources to give more detail and scope to the suite of information.

This resource has been created to provide a one stop shop of farm focused information suited to the needs of low-tech greenhouse growers. No such resource has previously existed to match Australian conditions.

The web page style resource is intended to assist growers to 1) Identify agronomic issues more clearly and gain insight into how to achieve improved yields/reduce costs by changing specific practices and 2) Estimate the costs and benefits of changing specific practices so they can assess the economic pros and cons.

The resource is presented in an interactive web page style with four main sections:

- 1: Essential Knowledge about plants and greenhouses
- 2: Preparing the Soil and Planting Seedlings
- 3: Managing The Crop for maximum production
- 4: A Cost Benefit Calculator which demonstrates how productive Mr. Vo's farm is and enables other growers to prepare a hypothetical costed scenario of changes and potential benefits.

This case study clearly demonstrates the potential to substantially increase production and quality in greenhouse capsicum soil crops through overcoming serious common production issues, in particular through improved soil health and pest and disease management. ***Mr. Vo's changed practices over 5 years have added up to an additional 66.5 % in yield per crop, which in one block of greenhouses (1,200m²) yields an additional \$21,546 at 1.80/kg farm gate prices. This was achieved with a negligible increase in expenses because the modified farming practices significantly shifted the balance toward healthier more productive soils. Improved soil condition in turn assisted fertilizer and water uptake, and reduced root and foliar disease levels.***

This resource will be distributed to the Australian protected cropping industry as a limited number of USB packs and promoted nationally through industry publications to access the web site version at www.growingcapsicums.com.au. The web site will invite comment and feedback from growers and service providers over the next 6 months to ensure that any minor corrections and fine tuning that can improve this resource can be implemented.

ATTACHMENT 2. Promotional Flyer



Vegetable Levy Funding Assists Greenhouse growers

Growing Healthy, Productive Capsicum Crops

A resource package based on the successful practices of Virginia
Capsicum grower PHUONG VO



The management practices of recognised champion greenhouse grower Phuong Vo from the Vietnamese community in Virginia, have been captured in text and video as an illustrative case study of Best Practice in soil based capsicum farming. The case study of Mr. Vo has been supplemented with additional technical resources to give more detail and scope to the suite of information.

This resource has been created to provide a one stop shop of farm focused information suited to the needs of low-tech greenhouse growers. No such resource has previously existed to match Australian conditions.

The web page style resource is intended to assist growers to:

3. Identify agronomic issues more clearly and gain insight into how to achieve improved yields/reduce costs by changing specific practices
4. Estimate the costs and benefits of changing specific practices so they can assess the economic pros and cons

The resource is presented in an interactive web page style with four main sections:

- 1: Essential Knowledge about plants and greenhouses
- 2: Preparing the Soil and Planting Seedlings
- 3: Managing The Crop for maximum production
- 4: A Cost Benefit Calculator which demonstrates how productive Mr. Vo's farm is and estimates the cost and benefit of his improvements. It also enables other growers to prepare a hypothetical costed scenario of changes and potential benefits.

This case study clearly demonstrates the potential to substantially increase production and quality in greenhouse capsicum soil crops through overcoming serious common production issues, in particular through improved soil health and pest and disease management. ***Mr. Vo's changed practices over 5 years have added up to an additional 66.5 % in yield per crop, which in one block of greenhouses (1,200m²) yields an additional \$21,546 at 1.80/kg farm gate prices. This was achieved with a negligible increase in expenses because the modified farming practices significantly shifted the balance in favour of healthier more productive soils. Improved soil condition in turn assisted fertilizer and water uptake, and reduced root and foliar disease levels.***

This resource will be distributed to the Australian protected cropping industry as a limited number of USB packs and promoted nationally to access the web site version at www.growingcapsicums.com.au.



ATTACHMENT 3. Resource List

Click to open each item below

- [Home page](#)
- [About this resource](#)
- [Suggestions on how to use this resource](#)
- [Profile of Phuong and his farm](#)

A. Primary Fact Sheets

Click to open each Primary Fact Sheet

- 1: [Essential Knowledge](#)
- 2: [Preparing and Planting](#)
- 3: [Managing The Crop](#)
- 4: [Cost Benefit Summary and Grower Planning Exercises](#)

B. Major Fact Sheets for Sub topics

Click on the Major Fact Sheet below for each topic, or on supporting fact sheets in the tables below

- [Managing Plant Nutrition](#)
- [Greenhouse Design Climate](#)
- [Greenhouse Design – Pest And Disease](#)
- [Soil Health Management](#)
- [Irrigation Management](#)
- [Salinity Management](#)
- [Managing Pests And Diseases](#)

Click to open each item below

*** NOTE: Many of the resources below ALSO have links from within more than one fact sheet ! ***

A. Managing Plant Nutrition And General Care	File type	Viet Transln
Managing plant nutrition	Major Fact Sheet	
<i>Comprehensive table of key nutrients and their importance</i>	Supporting F Sht	
<i>Nutrient deficiency and its impacts (Israeli Uni)</i>	Supporting FS	
<i>Capsicum nutrient deficiency and toxicity symptoms (ARRIS)</i>	Supporting poster	
<i>Trace elements – stimulation and interaction chart</i>	Supporting FS	
<i>Summary for the testing and mgment of capsicum nutrients (Hill Labs)</i>	Supporting FS	
<i>Understanding a soil report with recommendations (Pro Ag)</i>	Supporting FS	
<i>Example instructions for sending a soil test for nutrients, organic carbon, salinity etc. (Pro Ag)</i>	Supporting FS	
<i>Example instr. for sending a leaf test to detect nutrient issues (Pro Ag)</i>	Supporting FS	
<i>Phuong demonstrating careful planting - limiting salt around seedlings and encouraging feeder roots</i>	Video	Yes
<i>Healthy young plants</i>	Video	Yes
<i>Fifteen weeks and almost picking</i>	Video	Yes

F. Salinity Management		
Managing salinity	Major Fact Sheet	
<i>Leaching salts - video of Phuong explaining how he leaches before planting</i>	Video	Yes
<i>Measuring soil salinity (IMT Training)</i>	Supporting FS	
<i>Salinity reduction tips (Phil B)</i>	Supporting FS	
Fact sheets from 'Implementing Tools' program		
• <i>Salinity and its measurement</i>	Supporting fact sheets	Yes for all
• <i>Salinity and water sources</i>		
• <i>Soil salinity and sodicity</i>		
• <i>Sodium (Na) in irrigation water</i>		
• <i>Salinity risk and leaching</i>		
• <i>Manage salinity in root zones</i>		

G. Managing Pests And Diseases		
Managing an IPM program	Major Fact Sheet	
Pest and disease knowledge		
• <i>Introduction to IPM and fact sheets for 5 key pests (TB)</i>	Supporting F S	
• <i>Foliar diseases - identification in capsicums and, cucumbers (KF)</i>	Supporting F S	Yes
• <i>Foliar diseases - prevalence and current management in capsicums and cucumbers (KF)</i>	Supporting F S	Yes
• <i>Foliar diseases - management tips for diseases of capsicums and cucumbers (KF)</i>	Supporting F S	
• <i>Foliar disease - variety trials for powdery mildew resistance in capsicums and cucumbers (KF)</i>	Supporting F S	
• <i>Tobamovirus in capsicums (Denis P, DEEDI)</i>		Yes
• <i>Pests, Diseases, Beneficials and Disorders Field Guide</i>	Link to NSW DPI Bookshop)	
• <i>Diseases of Vegetable Crops in Australia (Denis P)</i>	Flyer and order form – CSIRO)	
Farm hygiene		
• <i>Farm hygiene (TB)</i>	Supporting F S	
• <i>Keep It Clean Manual – with detailed key pests and disease info (JBP)</i>	Manual	
• <i>Keep It Clean Manual – with 10 hygiene fact sheets, but no pest & disease info (JBP)</i>	Manual	
Crop monitoring		
• <i>Crop monitoring and WFT result diagnosis (TB)</i>	Supporting F S	
Chemical use		
• <i>Elements of an effective spray program (TB)</i>	Supporting F S	
• <i>Recently permitted/registered pesticides - assists selection and use (TB)</i>	Supporting F S	
• <i>Fumigating with plastic cover</i>	Video	
• <i>Fumigation tips and compliance information</i>	Supporting F S	
• <i>Tips for planning for service vehicles to come onto your farm</i>	Supporting F S	
• <i>Toxicity of pesticides to beneficial insects - options with bio-control programs</i>	Supporting F S	
• <i>Toxicity of pesticide residues on plastic</i>	Supporting F S	
Farm hygiene		
• <i>Farm hygiene (TB)</i>	Supporting F S	
Biological control		

• <i>Successful biological control in a capsicum farm 1</i>	Video
• <i>Successful biological control in a capsicum farm 2</i>	Video
• <i>Bio-control agents</i>	Poster
• <i>Contact details for biological control suppliers and consultants</i> <i>James Altmann - Biological Services; 0427 846 977;</i> <i>info@biological services.com</i> <i>Lachlan Chilman - Manchil Services; 0403 727 252;</i> <i>lachlanchilman@hotmail.com</i>	
• <i>Revegetation by Design Guidebook:</i> http://www.sardi.sa.gov.au/data/assets/pdf_file/0008/44945/reveg_by_design_guidebook.pdf	Web link
• <i>Guide to using native plants on the Northern Adelaide Plains;</i> http://www.sardi.sa.gov.au/data/assets/pdf_file/0005/103469/SAR_DI_Reveg_Guide_2009.pdf	Web link
Identifying IPM priorities <i>IPM checklist for priorities (TB)</i>	Supporting F S