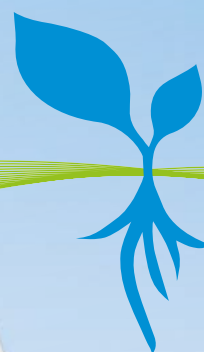


The GROWER

THE TECHNICAL JOURNAL FOR HORTICULTURE

AHDB

Issue No. 237
Dec/Jan 18



XYLELLA: A COLLECTIVE RESPONSIBILITY

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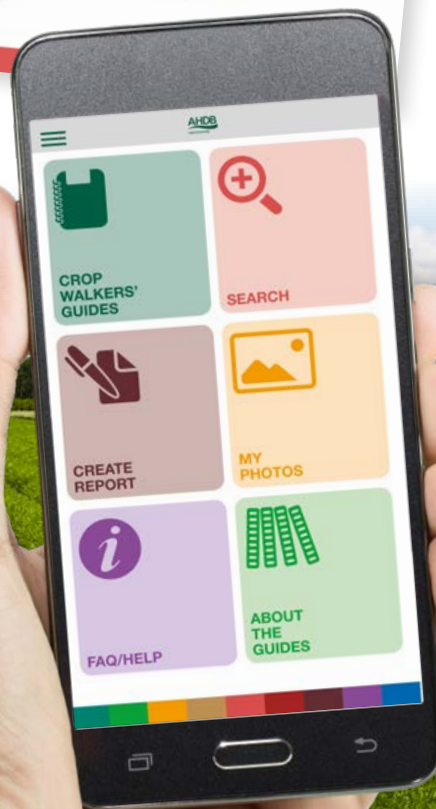


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ACKNOWLEDGEMENTS

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LOOKING TO THE PAST FOR A LEAN FUTURE

It is almost 18 months since the 23 June 2016 referendum and Brexit is still the word on everyone's lips. Yet despite the ongoing political negotiations and incessant public debate, the shape of what is to come still does not look any clearer.

In this issue we're focusing on labour. Labour is the largest variable cost most growers face; they are also more and more concerned about finding enough skilled full-time and seasonal workers to maintain output if it becomes impossible or less attractive for people from other countries to come to the UK to work. Some companies are already feeling the pressure as numbers of foreign workers drop in anticipation of potential closure of our 'open borders'.

'Lean', covered on page 28, is a concept devised by Japanese car manufacturer Toyota in the 1930s, which is all about smoothing out business processes and workload to maximise efficiency and minimise waste. Whether the UK has one foot in Europe, both feet out, or continues doing the hokey-cokey round the negotiating table, streamlining your business to get the most out of your workforce makes sense right now.

AHDB also plays an important role in facilitating industry awareness and uptake of automation and robotics technologies as they are developed in the longer term. Several AHDB projects are already looking at some interesting opportunities. Please tell us what you think about this and find out what others are saying on page 35.



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CONTRIBUTORS

Discover more about the people who have helped to contribute to this issue of The Grower magazine.

ROSEMARY COLLIER



Rosemary Collier trained as an entomologist and has worked on pest insects such as cabbage root fly and carrot fly for many years, most recently at Warwick Crop Centre, which is part of the School of Life Sciences at the University of Warwick. Her main research interest is in the development and application of Integrated Pest Management strategies for horticultural crops. This includes putting together the AHDB Pest Bulletin, which contains information on the activity of a range of pests of vegetable and salad crops grown outdoors.

Rosemary needs your help to get to grips with migrating pests on page 18

ABI DALTON



Abi Dalton FdSc is a Trials Manager at FAST LLP. She joined FAST LLP in 2014 and is responsible for the overall and day-to-day management of the Trials Department and site. She completed an FdSc in Sustainable Land Management and has an HD in Administration and Secretarial Procedures. Abi worked at East Malling Research for seven years, latterly as a Senior Scientific Assistant, and contributed to a range of irrigation and nutrition projects. She has over nine years' horticultural and agricultural research experience plus over 13 years' management experience in health and legal environments. She holds PA1, PA6 and PA9 certificates. Abi regularly speaks at conferences including FAST and AHDB; she contributes to AHDB publications and The Fruit Grower, among others.

Abi explains all on page 12

GRACIE EMENY



Gracie studied a BSc in Zoology and a Masters of Research in Biosciences at Cardiff University before joining AHDB in 2012. For the past three years, she has been the Knowledge Exchange Manager responsible for protected edible vine crops and narcissus, and has recently also taken on the KE delivery for mushrooms. Gracie is involved with developing new AHDB work including campaigns to address labour concerns, skills training and Lean management. Key roles for Gracie involve conference and event planning, publication production, and liaison with relevant grower associations. She is also involved with the AHDB crop health and protection team and has represented horticulture at EU C-IPM (Coordinated IPM in Europe) meetings as well as managing the KE delivery on the AHDB-funded AMBER biopesticides project.

Gracie helps your business get Lean on page 28

NEIL FEDDEN



Neil is the Owner and Managing Director of Lean business specialists Fedden USP, which was formed in 2007. He has over 20 years' experience using best practice within various organisations including manufacturing, engineering, automotive, electronics and plastic/rubber companies. In recent years he has brought Lean into the retail and service sectors, with extensive work in horticulture.

Neil is a Chartered Electronics Engineer and has completed an MBA.

Make your business leaner with Neil on page 27

NEWS & UPDATES

IN BRIEF

NEW LETTUCE DISEASE OUTBREAK REPORTED IN THE UK

An outbreak of lettuce wilt and root rot caused by *F. oxysporum* f. sp. *lactucae* was reported in the UK for the first time in early October 2017 in Lancashire. The pathogen was identified as 'Race 4', which is a particularly aggressive strain of the fungus, with no known treatment or varietal resistance available to date. Growers are advised to review their production protocols, particularly regarding crop hygiene. Prompt diagnosis is recommended and available through most lettuce breeding companies and several UK research organisations.

ENDING WATER ABSTRACTION LICENSING EXEMPTIONS

Following consultation, Defra has confirmed it is ending licensing exemptions for significant water abstraction in England and Wales. Applications for new licences, managed by the Environment Agency and Natural Resources Wales, will open on 1 January 2018.

FIRST FOOD SAFETY GUIDE FOR FRESH PRODUCE

A new guide, developed by industry experts, including AHDB, and recognised by the Food Standards Agency and Food Standards Scotland, will share both legal obligations and best practice recommendations to watercress growers. 'The Industry Guide to Good Hygiene – Watercress' is the first FSA guide for fresh produce.

HELP SHAPE CROP PROTECTION TRIALS

Consultation is now taking place to inform the 2018 trials for crop protection programme SCEPTREplus, which aims to deliver applied research on high-priority disease, pest and weed problems in horticulture. Please get in touch with joe.martin@ahdb.org.uk if there are control issues you would like the programme to help address.

SCEPTRE GIVES GROWERS ACCESS TO ANOTHER NEW PLANT PROTECTION PRODUCT

“We hope this product can support a gap in the market for growers as more herbicides continue to get withdrawn”

UK growers of field vegetable crops who are struggling with weed control options may welcome the new extension of authorisation for minor use (EAMU) granted for the bioherbicide 'Finalsan'.

Tested as part of SCEPTRE, a four-year plant protection research programme funded by AHDB Horticulture, 'Finalsan' showed particularly promising results as a control option for groundsel and fat hen.

The EAMU has been approved as an inter-row horticultural herbicide on a variety of root, tuber and bulb vegetables. The product will be launched by Certis in spring, with growers able to apply the product from March to September, according to the application requirements.

The product has also secured on-label approval for use on a large range of top fruit and soft fruit species, applied around the crop, ensuring the product doesn't make contact with the canopy. Within the SCEPTRE trials, where the product was tested with tank mixing and in alternative applications with carfentrazone-ethyl, the product showed promising results on both strawberry runners and between strawberry beds.

Vivian Powell, Crop Protection Senior Scientist at AHDB, said, "SCEPTRE has already delivered 10 on-label approvals and 12 EAMUs for growers, and we're pleased to see Finalsan also now getting EAMU approval after performing well in the trials.

"We hope this product can support a gap in the market for growers as more herbicides continue to get withdrawn."

Selchuk Kurtev, IPM Manager at Certis, said, "The SCEPTRE, and now the SCEPTREplus project, benefit both growers and manufacturers, as they increase our knowledge of the potential options and help us deliver what growers need.

"Working closely with AHDB and the crop panels gives manufacturers a better understanding of the challenges growers will face in the future and we can then work to address any gaps. It's important that, as an industry, we're not working in isolation, so we can focus on delivering new products that will make the biggest difference to growers."

Finalsan was coded 116 in SCEPTRE and you can read the trial results in the final grower summary report available on the AHDB Horticulture website.

Building on the success of SCEPTRE, SCEPTREplus is a new four-year project to help secure the approval of plant protection products for the horticultural industry. Eighteen crop protection companies have contributed over 65 products for the trials, and 23 novel products will be screened.

To find out more about the programme, visit horticulture.ahdb.org.uk/sceptreplus

INNOVATIVE FARMERS TAKE PIONEERING APPROACH TO IMPROVE SOILS IN SHARED ROTATIONS

Three arable and horticultural farmers, who each grow different crops in a shared rented land rotation, are pioneering a collaborative approach to improving the long-term health of their soils.

Jepco, Lovedon Estates and Worth Farm introduced overwintering cover crops into their shared rotations to improve organic matter and soil health and to assess the impact on yields and quality of their cash crops – sugar beet, potatoes and lettuce.

The collaboration is part of the AHDB GREATsoils programme and early anecdotal feedback indicates the farmer-led trial is already starting to reap rewards.

Nick Sheppard, Jepco, said, “We have found an increase of almost 8% in lettuce yield after overwintering cover crops, compared to bare soils. We also perceived a reduction in fuel use in soil cultivations and better water infiltration after heavy rainfalls in the lettuce fields that had an overwintered cover crop, compared to fields which were ploughed or left as an overwinter stubble.”

Jerry Alford, Arable and Soils Adviser for Soil Association, said, “Traditionally, growing in a shared rotation has meant that soil health is of secondary importance because there is no incentive to improve the soil for someone else’s benefit.

“In this field lab, cover crop choice now has to work for all three businesses because the risks, as well as any benefits, affect them all.”

Three new publications are now available from the GREATsoils programme; visit horticulture.ahdb.org.uk/publications

FRUIT AGRONOMISTS BRIEFED ON LATEST AHDB RESEARCH AT NIAB EMR

Over 50 industry agronomists had the opportunity to view the current AHDB-funded fruit projects and discuss future research requirements at an event at NIAB EMR, Kent, in September.

Michelle Fountain, a researcher at NIAB EMR, informed delegates about a new weevil pest found in pear orchards and the suggested control options based on its lifecycle.

Other tree fruit projects presented included maximising dry matter content of apples to improve storage life post-harvest, control options for canker and powdery mildew in apples, and fruit pollination by solitary bees.

Soft fruit agronomists were updated on current spotted wing drosophila research, strawberry powdery mildew control, new approaches to spider mite control in raspberry and a new monitoring device for western flower thrips and their predators.

There was also the opportunity to visit the new NIAB EMR WET (Water Efficient Technologies) Centre, which offers a demonstration site for nutrient and irrigation management.

Richard Harnden, Berry Gardens Growers, who attended the event, said, “There is no substitute for getting out into the field to view the research in progress, rather than hear about the work in a PowerPoint presentation. I congratulate AHDB in changing the arrangements for this year’s event. Our own agronomists, who also attended, welcomed the opportunity to discuss current problems in the field with NIAB EMR’s scientists and identified a number of practical issues and factors, which the scientists can incorporate into their projects as they continue into next year.”

The latest research was also presented to growers at the AHDB/EMR Soft Fruit Day in Kent on 21 November and presentations are available on the event page: horticulture.ahdb.org.uk/events

“There is no substitute for getting out into the field to view the research in progress”

NEW AHDB HORIZON REPORT ASSESSES UK HORTICULTURE'S BOTTOM LINE

The UK's decision to leave the European Union (EU), its Single Market and the Common Agricultural Policy (CAP) has created much uncertainty for the agricultural sector.

AHDB has identified four main areas of concern. These are: trading relationships post-Brexit; domestic agricultural policy; the availability of migrant labour; and the regulatory environment.



**THIS STUDY
EXPLORES
THESE FOUR
AREAS,
USING THREE
SCENARIOS.**

Scenario one: **Evolution**

This essentially represents a 'business-as-usual' option where policy, regulatory framework and trading relations remain as close to the status quo as is possible given that the UK will no longer be part of the EU's Single Market.

The other two options involve degrees of reduction in support payments to UK farmers and restrictions to migrant labour, plus perhaps the adoption by the UK of a liberal approach to trading.

Scenario two: **Unilateral Liberalisation**

This implies increased competition from imports outside the EU.

Scenario three: **Fortress UK**

In this alternative, trade only takes place under WTO Most Favoured Nation (MFN) tariffs, termed.

Horticultural farm business income increases by approximately £15,000 under 'Scenario one: Evolution', but falls under both 'Scenario 2: Unilateral Liberalisation' and 'Scenario 3: Fortress UK' to £29,632 and £30,890, respectively.

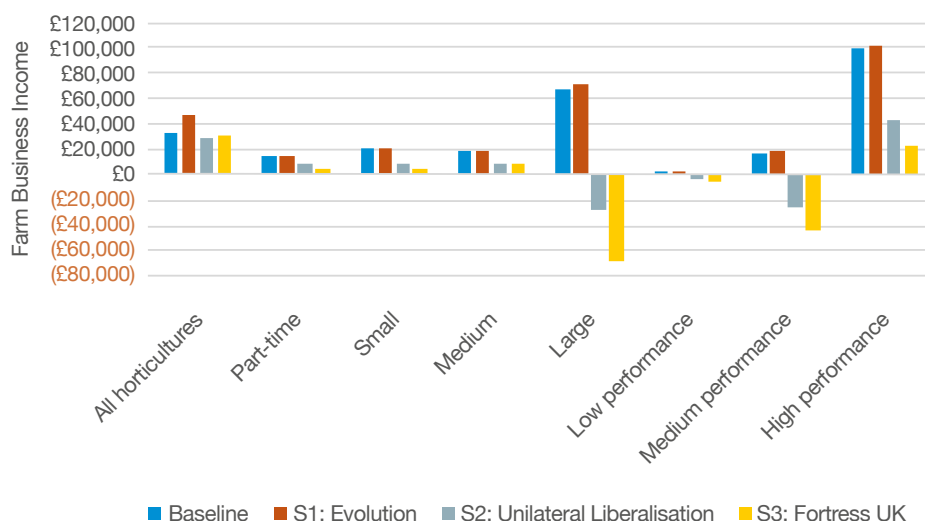
The new report highlights that the reduction in the level of support is not significant for horticulture businesses. However, there are clear opportunities to displace imports under certain scenarios, but limited by the availability of labour.

While results differ on a sector-by-sector basis, the high-performing, top 25% of businesses – regardless of sector and size – would remain profitable under every scenario and best placed to weather the effects of Brexit.

Phil Bicknell, AHDB Market Intelligence Director, said, "This analysis underlines the fact that performance matters. As individual farms, we know that we can't determine policy but we can recognise that performance is key to preparing for the challenges ahead."

They range from a 'business as usual' approach with current levels of support; a liberal approach to trade with tariff-free access to the UK and reduced support; to a cliff-edge Brexit, reverting to WTO regulations and with dramatically reduced support payments.

The model allows AHDB to re-run the scenarios in future as more detail of policy decisions in those key areas emerge, to form a more accurate picture for the industry. AHDB will also later publish specific results for Scotland using Farm Business Survey data.



“The model allows AHDB to re-run the scenarios in future as more detail of policy decisions in key areas emerge”

Under the three scenarios outlined in the report, changes in the UK's trade relationships will impact farmers' bottom lines when the UK leaves the Single Market, whether or not a Free Trade Agreement is negotiated with the EU.

Policy decisions also leave sectors where direct support has been a key part of farm revenues, such as beef, lamb and cereals, particularly vulnerable.

All AHDB's analysis on the implications of Brexit for UK agriculture and horticulture can be downloaded from www.ahdb.org.uk/brexit



ARE YOU **READY TO START** **EXPORTING** POST-BREXIT?

Last chance to grab this exciting opportunity and start exporting across the globe at Fruit Logistica 2018

The AHDB British pavilion at Fruit Logistica is almost full, but a few remaining exhibitor slots are still available if growers wish to take advantage. The exhibition, which takes place from 7–9 February 2018 in Berlin, will showcase Great Britain's horticulture and potato industries.

Fruit Logistica is one of the largest and most important fresh produce shows in Europe, providing the number one route for UK enterprises to showcase their wares to thousands of international businesses. Buyers and decision-makers across the whole industry, from grocery, wholesale and speciality retail to foodservice and manufacturing,

will converge to uncover the hottest trends, latest product launches and the industry's vision for the future.

The AHDB stand provides growers and exporters with a focused hub to do business and champion the UK's reputation for outstanding food and farming. Exhibitors will have dedicated branded exhibition booths, meeting space and networking opportunities in a fully managed and catered stand.

Rob Burns, Head of Crops Export Market Development, said, "Fruit Logistica 2018 will be packed to the rafters with products from across the world that are guaranteed to give exhibitors food for thought in more ways

than one. The AHDB British pavilion is an opportunity many exporters have taken advantage of over the years through the new product launches, engaging new clients and fast-tracking onto the forthcoming trends and innovations.

"The industry's decision-makers should not be questioning whether they can afford the time to visit the event in 2018 – they should be questioning whether they can afford not to."

If you are interested in participating at the exhibition, we recommend you book your space now. Contact amanda.robins@ahdb.org.uk

INSIGHT INTO AHDB PROJECTS

WILL ROBOTS BE HARVESTING VEGETABLES SOONER THAN WE THINK? – NEW PROJECT

Jim Dimmock, AHDB, explains how cutting-edge developments in robotic engineering could lead to automated harvesting of field vegetable crops in the future

While robots perform exceptionally well at manual tasks in controlled factory environments, introducing robotics into a field situation to automate harvesting is significantly more challenging. Different working conditions and the fact that vegetables aren't uniform in shape or size means robots need to learn to make decisions and adjust and adapt in the field.

THE HOPE

Progress has been made to enable robots to pick up 'soft' objects to avoid damaging crops, with trials undertaken on lettuce crops at G's Growers. This new studentship project aims to further

develop the technology so that robots can learn to adjust to variations in the size and shape of different lettuce heads and adapt to different environmental conditions. The project will also scope whether other stages of harvesting are feasible by robotics.

WHY NOW?

The uncertainty of access to future labour and rising labour costs means exploring the opportunity for automation in harvesting crops has become a priority for many growers. Advances in technology also make it more feasible than ever before.



AHDB project code:

CP 172: Robotic touch, sense, and learning of delicate vegetables (AHDB Studentship)

Term: October 2017 to September 2020

Project lead: Fumiya Lida, University of Cambridge

AHDB contact: Jim Dimmock

THE IMPORTANCE OF BEING EARWIGS – FINAL REPORT

Knowledge about the role earwigs play as natural predators within crop protection programmes is growing, but there is still work to do to understand the impact of plant protection products on populations in fruit crops, comments Scott Raffle, Knowledge Exchange Manager at AHDB

Earwigs play an important role in regulating populations of aphids, scale insects, codling moth and pear sucker in apple and pear orchards. They also have the potential to be an important predator of aphids, sawfly and midge in blackcurrant crops.

However, research in orchards has shown that earwig populations can be affected by routine crop protection programmes.

These projects set out to understand the impact of insecticide applications in blackcurrant crops, and to examine how to integrate key crop protection products into pest management programmes without causing harm to earwig populations in apple and pear crops.

In blackcurrant crops, trends appeared to show that plantations with higher toxicity scores from spray programmes had fewer earwig numbers, although no significant correlation occurred.

Earwig numbers varied between plantations where spray programmes were similar, suggesting that other abiotic and biotic factors may have influenced earwig abundance in blackcurrant plantations in addition to spray programmes, and further research is needed.

Building up earwig populations in orchards by selectively using crop protection products will both increase the natural control of many major pests and allow occasional sprays of more harmful products when needed.

To protect earwig populations in apple and pear orchards, growers are recommended to avoid early-summer applications of Envidor and Agrimec where possible, as young earwigs appear to decline in trees treated at this time.

Results also suggest that an occasional application of Gazelle or Calypso

targeted to control pests which reach threshold is unlikely to have long-term effects on populations.

AHDB project codes:

TF 220: Further developments of earwig-safe spray programmes for apple and pear orchards

Term: April 2014 to March 2017 and

SF 168: Identification of the role of earwigs in blackcurrant plantations

Term: March 2016 to March 2017

Project lead: Dr Michelle Fountain, NIAB EMR

AHDB contact: Rachel McGauley



CHECKING FOR POTENTIAL PATHOGENS – PROJECT UPDATE

Dr Tim Pettitt, University of Worcester, updates on the efforts to develop diagnostic tools for early detection of plant pathogens

Developing diagnostic tools, which can be used on-site, to help growers check plants, water and growing media for potential pathogens provides nurseries with immediate decision support systems to help them manage disease problems early.

Dr Tim Pettitt and his team at the University of Worcester are aiming to improve on currently available test kits for *Phytophthora* and *Pythium* by producing antibodies of greater specificity, targeting species/groups of particular importance to various sectors of the industry, e.g. protected ornamentals and edibles, hardy nursery stock and soft fruit.

Test kits will use the lateral flow device format (LFD) which is capable of providing a test result in less than 10 minutes. They will confirm presence/absence of an Oomycete pathogen (*Pythium* & *Phytophthora spp* primarily), and also, if all goes to plan, be able to show whether the pathogen is alive or dead. This last goal would be a useful

tool for all growers who are using control techniques e.g. fungicides on crops, or water treatment options, to enable them to see whether their measures have been effective.

Target pathogens:

- *Pythium aphanidermatum*, a serious root pathogen of cucumbers, peppers and poinsettia
- A *Phytophthora spp.* specific test
- *Phytophthora rubi*, which is currently causing high crop losses in UK raspberry production
- *Phytophthora cactorum* and *P. fragariae* – the test will be able to detect both pathogens and distinguish between them
- *Phytophthora cryptogea*, a pathogen with a wide host range, e.g. herbaceous and woody ornamental crops, tomatoes etc.
- *Phytophthora cinnamomi* – an important cause of root rots in a wide range of woody species
- A *Pythium* test capable of picking out the infectious species from the

mass of common non-infectious species; realistically this is likely to consist of more than one LFD strip

Prototype LFDs for a number of the diseases caused by the targets named above are being tested by the team at nurseries around the UK.

You can read more about the progress of this project on the AHDB Horticulture website – horticulture.ahdb.org.uk/project/diagnostic-development-oomycete-lfds

AHDB project code:

CP 136: Diagnostics: Development of Oomycete LFDs

Term: June 2015 to June 2018

Project lead: Dr Tim Pettitt, University of Worcester

AHDB contact: Cathryn Lambourne

WHEN THERE'S A WALL, THERE'S A WAY

Abi Dalton, FAST, compares the performance of different nursery tree types when planted in an intensive orchard managed using the fruit wall system

To paraphrase Bruce Springsteen's 1986 classic cover of 'War': "Wall. Huh! What is it good for?"

Well apparently, not 'nothing' – it is good for managing tree fruit in an intensive orchard.

However, the real question that needs answering is, "What is the best type of tree to use for quickly establishing a fruit wall system while gaining optimum performance?"

AHDB project TF 206, led by FAST's Trials Manager Abi Dalton aims to reveal just that.

WHY THE WALL?

Growers need to reduce labour inputs, simplify management and increase the use of mechanical aids in fruit growing due to a general decline in skilled and available labour, but without the loss of yield or quality. While a reduction in yield from a fruit wall system of 5% in each of the first four cropping years compared to a conventional orchard can reduce net returns by up to £2,100 per hectare, overall, the fruit wall system could offer significant benefits to growers by reducing labour costs and allowing increased mechanisation.

That's mainly because new, intensive orchard systems are simpler and easier to prune than lower-density, traditional orchards. Depending on the planting distance, the time difference between hand and mechanical pruning can be up to 30 hours per hectare. Even considering the need for some hand pruning and cost of machinery, net labour savings could be high (approximately £6,300 per hectare) over the lifespan of an orchard, typically 12–15 years (not to mention machinery could be used for other operations on the farm). Indeed, anecdotal evidence from experimental plots in Northern Europe suggest that annual yields from fruit wall plantings can be around 20t/ha greater than orchards of a similar density managed conventionally.

Therefore, in this trial, orchard trees have been adapted to create a narrow, tall hedgerow to accommodate mechanised pruning. Simulated mechanical pruning has then been carried out at the nine-

leaf extension stage on new growth (the nine-leaf stage was determined to be the optimum for reducing regrowth but without reducing yield in AHDB project TF 207).

Mark Holden, Adrian Scripps Ltd, explained, "The cost of labour is inevitably increasing due to the rises in the minimum wage. Also, there is a potential shortage of a quality workforce in the future, therefore I am keen to explore how we can get the best from mechanisation. Another key target is improving the consistency and quality of the fruit from tree to tree in the orchards. Mechanical pruning was identified as potentially one way to achieve both these goals."

ESTABLISHING A TYPE

To determine which type of tree provides the best establishment performance, the project has been testing the effects on five different types of Gala trees (clone Royal Beaut) from nursery, planted at 3,571 trees/ha. These five types are:

- 1) One-year-old tree with five-plus branches
- 2) One-year-old unfeathered tree
- 3) Two-year-old tree
- 4) Standard knip tree
- 5) Twin-stem tree

The trial was planted and established in 2013. Eight trees of each type were replicated six times in separate row plots in a complete randomised design (48 trees per treatment, 240 trees in total). Every year, the effects of the five treatments have been recorded, including via measuring physiological stages, growth, yield, fruit maturity and quality, and tree physiology.

TWO IS BETTER THAN ONE

Early results suggest that two-year-old, Standard knip and one-year five-plus branch trees are offering the most suitable planting material for fruit walls, in terms of early yield build-up, class 1 fruit and optimum returns.

In 2016, two-year-old trees had significantly higher total yields than all other treatments except one-year with five-plus branches. One-year unfeathered had significantly lower total yields than all other treatments. However, overall, there was little or no increase in yields between 2015 and 2016 (See Figure 1).

The 80% class grade out in 2016 was higher than in 2015, partially due to lower disease pressure in 2016.

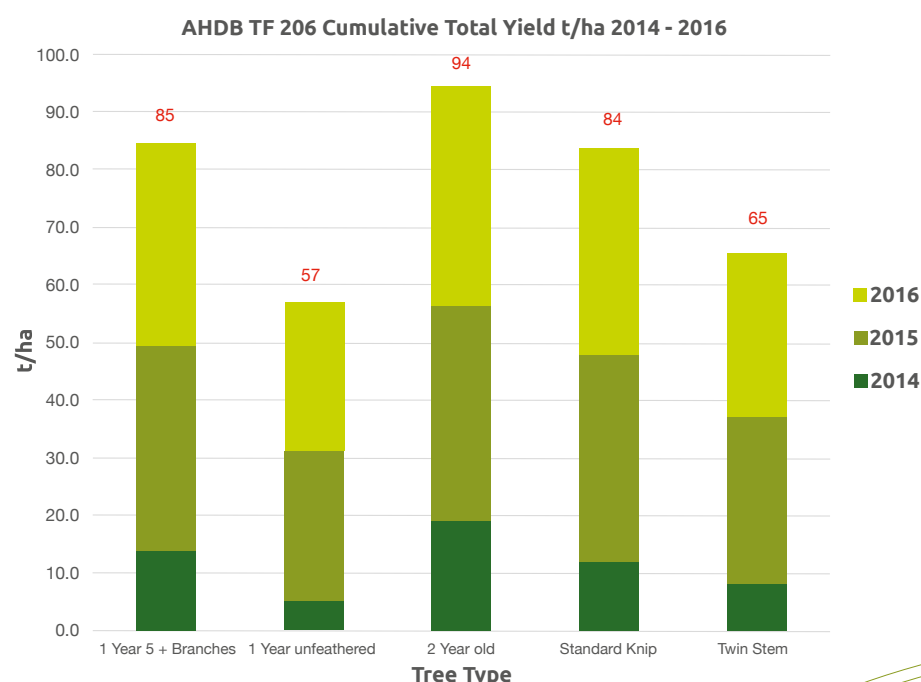


Figure 1 - Cumulative total yield t/ha 2014–2016

As demonstrated in AHDB project TF 207, fruit weight was consistently reduced by earlier pruning cuts, and conversely increased by later pruning cuts. However, average fruit weight in 2016 was around 100g, smaller than in both 2015 and 2014 (See Table 1). Below average rainfall from July to October, combined with the higher than average temperatures in August and September, were contributing factors for lower yields, smaller fruit and reduced volume in 2016. Fruit size in early years has gradually reduced as tree volume and yields increase.

Table 1 - Average fruit weight by type 2014–2016

Tree Type / Parameter & Year	Average fruit weight (g) 2016	Average fruit weight (g) 2015	Average fruit weight (g) 2014
1 year 5 + branches	96.5	107.0	132.8
1 year unfeathered	100.7	115.1	130.3
2 year old	94.5	108.7	135.1
Standard knip	103.7	111.9	128.5
Twin stem	100.0	119.8	147.7

A COMMERCIAL VIABLE OPTION?

It is not yet clear whether the responses are due to the establishment of different tree types or the pruning effects. Two-year-old and Standard knip are approaching commercially acceptable yields of over 40t/ha. Based on early yields, comparison with predicted returns and taking into account the costs for the different tree types, these types, along with one-year five-plus branches, may be more suitable for growing in a fruit wall system. Results so far also suggest that one-year unfeathered and Twin-stem trees are least suited to a fruit wall system because of their slow establishment and lower yields. This is despite lower trees costs for one-year unfeathered and predicted higher returns for Twin-stem trees. However, when yield efficiency of cumulative yield was examined (total yield divided by volume) Twin-stem trees were the best performing trees compared to all other types.

“Even considering the need for some hand pruning and cost of machinery, net labour savings could be high”

AHDB project code: TF 206

Lead researcher:
Abi Dalton, FAST

AHDB contact: Scott Raffle

Top tips for growers

- 1) Irrigation is critical at high planting densities, otherwise fruit size and quality may deteriorate
- 2) Extra fertigation and mulching should be considered for any weak areas
- 3) Fruit wall-managed trees have a narrow profile and may be suited to narrower alleyways – 3m rather than 3.5m as in this trial

EAMU LATEST



SUMMIT TO CONSIDER

My colleague, Crop Protection Senior Scientist Viv Powell, and I attended the third Global Minor Use Summit in early October, which saw 225 representatives from 35 different countries come together to discuss strategies for crop protection in speciality crops as well as minor use programmes and harmonisation. AHDB was represented at the Summit and also took part in the Global



Bolette Palle Neve,
Crop Protection Scientist, AHDB
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Priority Setting Workshop where crop protection priorities for outdoor temperate crops, glasshouse crops and tropical crops were discussed and agreed. Prior to the meeting each country had submitted around 35 high priorities and a global needs database had been created as a result.

It was interesting to listen to presentations from grower representatives from all over the world; it quickly became apparent that growers from all continents have very similar challenges related to limited access to plant protection products. We had useful discussions with grower representatives from several countries and especially Canadian colleagues representing glasshouse crops, who were very motivated to work together.

The last day of the conference was set aside for the Global Priority Setting Workshop, which was much like an X-Factor Final; the list of priorities had to be narrowed down to one or two for each category and all countries fought hard to get their priorities included in a global project to support new registrations. Priority pests such as *Drosophila suzukii* and *Tuta absoluta* were high on the list but with no suitable insecticides put forward they could not be taken forward for a global project. The selected priorities of interest to UK growers were:

- Temperate outdoor crops
 - Weeds in lettuce
 - Downy mildew in basil
- Glasshouse crops
 - Thrips in ornamentals
 - Powdery mildew in cucurbits

AHDB will take part in all of these projects as long as the plant protection products chosen are ones that will become available on the UK market.

EAMUS IN FOCUS

Sencorex Flow (metribuzin)

The new EAMU for Sencorex Flow (metribuzin) for ornamental plant production to enable use over dormant stock will be particularly useful for field HNS and rose growers.

"In current trials on field-grown roses (AHDB project HNS 198), mixtures including Sencorex Flow and Stomp Aqua have performed well. It is important to note, however, that Sencorex is a potent herbicide and that rates should

be tailored to the crop and soil type, normally in the range of 300–750ml/ha, which is less than the maximum authorised rate. Sencorex is not safe to use on container-grown crops even when dormant," cautioned John Atwood, Principal Consultant Horticulture, ADAS.

The authorisation for use under protection will be primarily beneficial for growers of cut flowers from bulbs grown in the soil.

To discover all of the latest EAMUs visit horticulture.ahdb.org.uk/eamu-news



THE INOCULATION EXPERIMENTATION

Finding effective controls for cavity spot has caused the carrot industry headaches for decades, but a new technique may now provide the breakthrough needed, explains John Clarkson

Cavity spot continues to be the most economically significant disease for UK carrot growers with losses of at least £3 million per season. It is principally caused by the soil-borne oomycete pathogen *Pythium violae*. Control relies on the fungicide metalaxyl, but its efficacy in controlling the disease and the potential withdrawal of approval in the future are major concerns.

The occurrence of cavity spot can be inconsistent and this has been a major barrier to identifying new control products or approaches, as field trials are often constrained by little or no disease developing. New research by Warwick Crop Centre aimed to develop an artificial inoculation technique to consistently induce cavity spot on carrots grown in pot experiments and field trials so that new control products can be reliably evaluated in the future.

Initially, methods were developed to establish large numbers of *P. violae* oospores in both liquid and solid substrate growth media and up to 47,000 oospores g⁻¹ were produced. As well as yielding the most spores, the solid sand-based medium, which had an organic substrate added, was also the most amenable to inoculation as it could easily be mixed with compost or soil before carrots were grown.

In two long-term glasshouse pot experiments, the *P. violae* solid substrate

was used to inoculate a sand/compost growing media at five different rates (5–75 oospores g⁻¹) and carrot seed sown. At higher rates, this initially resulted in some seedling death, reduced seedling size and a decrease in growth of the carrot plant foliage. However, at harvest, the principal effect of inoculation was the formation of small, stubby and stunted carrots with a much-reduced weight compared to the uninoculated control plants.

These infected carrots were also characterised by a long, hairy, brown tap root with increased lateral root formation, many of which were collapsed. Typical cavity spot lesions were also observed in a large proportion of these stubby carrot roots in one experiment (up to 26%). However, in both experiments, cavity spot severity was rather low, with a maximum of six lesions per carrot. *P. violae* could be consistently isolated from the infected tap roots and cavity spot lesions, confirming that these symptoms were due to the inoculation.

Generally, there was no clear effect of oospore concentration on the severity of any of these symptoms associated with *P. violae* inoculation.

A preliminary field experiment was also carried out as part of a PhD studentship, whereby macrocosms (concrete pipes sunk in the ground) were filled with a

soil/sand mix, artificially inoculated with *P. violae* solid substrate inoculum and carrots sown. In this situation, there was no effect on seedling survival or subsequent carrot growth but at harvest, a large proportion of the carrots (up to 40%) were affected by typical cavity spot symptoms.

Overall, inoculation with *P. violae* was very successful compared to previous attempts but further work is still required in follow-on project FV 391b to reduce variation between experiments and increase the number of cavity spot lesions before the approach is used in extensive testing of control products in pot-based glasshouse tests or in the field.

AHDB project SCEPTREplus hopes to use this inoculation technique in trials to screen control products and generate new Extensions of Minor Use approvals to reduce the reliance on metalaxyl.

AHDB project code:
FV 391a

Researcher:
John Clarkson,
Warwick Crop Centre

AHDB contact: Dawn Teverson



A CHANGING LANDSCAPE

In the second instalment of our four-part series about biopesticides, AMBER project lead Dave Chandler, Warwick Crop Centre, examines the benefits and drawbacks

Having covered what biopesticides are from a technical standpoint in the previous instalment, it is time to look at why growers are using them more frequently.

As explained previously, biopesticides are used in the management of pests, diseases and weeds. The biopesticides industry is expanding rapidly, driven largely by changes in legislation such as the Sustainable Use Directive on pesticides, which requires growers to use Integrated Pest Management and gives precedence to the use of biopesticides and other alternatives to conventional chemical pesticides where those alternatives provide satisfactory control. As the number of registrations of new synthetic chemical pesticides has declined, registrations of biopesticides is increasing, and we are now reaching a tipping point where more biopesticides will come onto the market than conventional chemical pesticides. There are already over 40 different biopesticide products on sale in the UK, but with more products already available in mainland Europe and elsewhere, we fully expect this number to rise considerably in the next few years.

The increase in biopesticide products provides growers with an opportunity to use them in their crop protection programmes and potentially offset some of the problems caused by the reduced availability of chemical pesticides. However, biopesticides are not a simple like-for-like replacement for conventional chemical pesticides. It is important not only to understand the pros and cons of using biopesticides, but also to have a good understanding of how each biopesticide works in order to decide whether they are suitable for your own circumstances and – when you decide to use them – how to get the best performance out of them. This is something that the AHDB-funded AMBER project aims to do. In this article we'll look at some of these issues in more depth.

A NEW DIRECTION

The first thing to realise is that the regulations on crop protection shifted fundamentally – and irreversibly – with the implementation of the Sustainable Use Directive on pesticides in the EU. This makes Integrated Pest Management (IPM) the default method of tackling crops pests, diseases and weeds for all farmers and growers. IPM is a 'systems' approach in which different crop protection tools (chemical, biological, physical and cultural controls, alongside plant breeding) are combined with careful monitoring of pests and their natural enemies. The term 'pest' is used here to mean not only invertebrates such as insects, mites and slugs, but also the full range of plant pathogens

as well as weeds; the principles of IPM apply to all crop protection issues. Given the increasing harmonisation of plant production standards around the world, we fully expect the tenets of the Directive to apply in the UK in the future, irrespective of what happens with Brexit. Fortunately, many growers in the UK are already using IPM and this provides an excellent starting point for adopting biopesticides.

Pros

SAFETY

Biopesticides are usually considered to be minimal-risk products for people and the environment. The European Commission has just formally classified semiochemicals and micro-organisms used in plant protection products as 'low-risk' active substances, and – given the obvious benefits from using low-risk products – we expect to see retailers and others having a real drive to see more and more of these used by their suppliers.

“Regulations on crop protection shifted fundamentally – and irreversibly – with the implementation of the Sustainable Use Directive on pesticides in the EU”

RESIDUES

Many biopesticides are residue-exempt and are not required to be routinely monitored by regulatory authorities or retailers.

Re-entry and handling intervals are becoming more important considerations when selecting a plant protection product for use, especially in protected crops, and many biopesticides have a zero or low re-entry and handling interval.

BIOLOGICAL ACTIVITY

Some microbial biopesticides can reproduce on or near to the target pest/disease, giving a degree of self-perpetuating control. We also know that some of these microbial agents are able to boost plant growth and can help improve water uptake under conditions of drought stress.

PESTICIDE RESISTANCE MANAGEMENT

As alternatives to conventional chemical pesticides, biopesticides can help reduce the selection pressure for the evolution of pesticide resistance in pest populations, and there is even evidence that some microbial biopesticides can stop the expression of resistance once it has evolved. The risk of pests and disease developing resistance to biopesticides is often considered to be low, certainly for those agents that have multiple modes of action. However, in principle, there is always a potential for a target pest/disease to develop resistance or tolerance, depending on the size of the selection pressure, and hence we suggest it is good practice to adopt an anti-resistance strategy when using biopesticides.

IPM COMPATIBILITY

Biopesticides fit in well to the basic ideas behind IPM. Biopesticides often have good compatibility, both with biological pest control agents (natural enemies) and with conventional chemical pesticides, so they can be readily incorporated into IPM programmes. Biopesticide and biocontrol suppliers will often have some compatibility information to help guide use.

DEVELOPMENT COSTS

The costs of developing a biopesticide are significantly lower than those of a conventional chemical pesticide, which should encourage companies to develop a wide range of products, particularly for use on minor crops.

Other considerations

There is clear evidence that, when used under the right circumstances, biopesticides can make a valuable contribution to crop protection as part of an IPM programme. However, there are disadvantages of biopesticides and a balanced approach to evaluating them is required. The downsides to using biopesticides have generally been made in comparison with conventional chemical pesticides, and include the following:

RATE OF CONTROL

Many biopesticides have a slower rate of control and often a lower efficacy and shorter persistence than conventional pesticides.

ENVIRONMENTAL WEAKNESS

Microbial biopesticides have a greater susceptibility to adverse environmental conditions.

GROWER KNOWLEDGE

Because biopesticides are not as 'robust' as conventional pesticides, they require a greater level of knowledge on behalf of the grower to use them effectively. The Application and Management of Biopesticides for Efficacy and Reliability (AMBER) project, funded by AHDB, is attempting to

“Biopesticides are not a simple like-for-like replacement for conventional chemical pesticides”

provide this knowledge to complement the information available from manufacturers and suppliers.

LEAF SCORCH POSSIBILITY

Some of the botanicals are reported to cause leaf scorching when exposed to high levels of sunlight.

As stated above, comparison with conventional pesticides isn't necessarily appropriate, since biopesticides often work in a different way and are not a straight 'swap' for pesticides. It is worth emphasising that we see them being used alongside chemical pesticides and other control options as part of IPM.

AHDB project code:
CP 158

Project leader:
Dave Chandler,
University of Warwick

AHDB contact: Joe Martin

In the next part of the series we'll look at how to use biopesticides properly to get results and best practice guidelines.

AMBER is a five-year project designed to help growers improve the performance of biopesticides. Find out more by visiting <http://bit.ly/AMBERproject>

A NEW HERO FOR A PEST-FILLED WORLD

Big data is being used across the world in many ways to help discover trends and analyse vast swathes of data. Discover how information collaboration across borders is helping to combat the threat posed by migrating pests in the UK

Citizen science.

It may sound like the name of the latest superhero from a Marvel comic book series with a penchant for glass beakers and white lab coats, but it is actually a hero of a different kind that is helping growers in the UK to stay one step ahead of trouble caused by horticultural pests.

Since the rise in popularity of social media and platforms that allow you to study 'trends' – such as Twitter – the concept of following what is trending to keep track of events across vast areas has taken a keen hold. And horticulture hasn't been waiting around to take advantage either.

AHDB, in collaboration with Syngenta, created the 'Pest Bulletin' at the start of the decade. Its aim is to provide UK growers with up-to-date information on pest activity and other important related news to help them stay one step ahead of any potential damaging pest invasions. One of the latest components that is helping to further the success of the Pest Bulletin is the use of citizen science. This involves using everyday people – from scientists and growers to moth enthusiasts – in order to collect vast swathes of data that can then be analysed for trends. For example, in the case of pest tracking, a grower in the Netherlands could record that they have identified a certain pest in their crop in early May. If a number of other farms in the area also report the sightings, and then a few weeks later the sightings begin to move across into Belgium, this then can help provide UK growers with a suspected timeline of when the pest might arrive on their shores. This allows UK-based growers to be proactive rather than reactive (when it may be too late to prevent an infestation) and to prepare for the pest's arrival, perhaps pre-treating crops or setting up pheromone traps, depending on the best response to the particular threat.

"Although citizen science may lack a degree of 'scientific rigour', it is an excellent way of sampling over a wide geographical area and also of involving

the wider population in science," explained Rosemary Collier, who is the Director of Warwick Crop Centre and is instrumental in the implementation and production of the Pest Bulletin. "Furthermore, citizen scientists are often far from being 'amateurs' and may possess large amounts of knowledge and expertise in their particular area of interest."

MOTH MONITORING

AHDB is currently running a number of research projects that utilise the concept of citizen science to help inform growers. One such project is 'FV 440 Lettuce and baby leaf salads: Investigation into control measures for Silver Y moth and caterpillars'. This focused particularly on silver Y moth, diamondback moth and – to a lesser extent – on turnip moth (cutworms). The project evaluated a novel system for monitoring pest moths using pheromone traps and also investigated other ways that growers might be provided with an early warning of caterpillar infestations. Both the silver Y moth and diamondback moth do not overwinter successfully in most parts of the UK and new infestations are generally the result of 'invasions' of moths that migrate into the UK, mostly from continental Europe. A meteorologist based at Rothamsted Research, Charlotte Wainwright, was part of the project team and, using weather records (wind direction in particular) and information from citizen science websites in northern Europe (which include observations by the general public on both species of moth), she was able to show that the diamondback moths arriving in large numbers in 2016 probably originated from Norway.

PUTTING IT INTO PRACTICE

UK growers have the opportunity to contribute to the citizen science data that AHDB holds through the recently launched crop walker guides app. The app (available on iPhone and Android) allows growers to identify pests that they find in their crops and then record where and when this happened, producing a

bespoke report. The data is geotagged by the app and collated by AHDB, which can then help to form a larger picture of when and where pests are active.

Once the data from the app is recorded, it doesn't just sit around doing nothing. It is analysed and patterns or trends are identified that could aid further research.

For example, the data obtained on pest activity and location can be used as evidence by AHDB in cases for need which support applications to the Chemicals Regulation Division (CRD) for EAMUs (Extension of Authorisation for Minor Use). This was the case earlier in 2017 when AHDB secured an emergency article 53 authorisation for the insecticide Benevia 100D (100g/l cyantraniliprole) to aid control of thrips on allium crops (you can discover more on our website horticulture.ahdb.org.uk/latest-eamus-and-updates). The application to the CRD was backed up by big data from growers and agronomists showing the need for control measures.

So, with the latest crop walker guides just a download away, are you ready to be a hero?

WANT TO STAY AHEAD OF PESTS TOO?

You can find out more about the Pest Bulletin here:

www.syngenta.co.uk/ahdb-pest-bulletin

Further information is also available through the AHDB Pest Bulletin blog, here:

<http://blogs.warwick.ac.uk/rosemarycollier>

AHDB project code:
FV 048c

Lead researcher:
Rosemary Collier,
Warwick Crop Centre

AHDB contact: Dawn Teverson



“ Although citizen science may lack a degree of ‘scientific rigour’, it’s an excellent way of sampling over a wide geographical area ”

CITIZEN SCIENCE AND YOU

Citizen science projects have been used on a large scale in the UK for years. You may recognise, or have even taken part in, some of these well-known projects that utilise citizen science:

RSPB BIG GARDEN BIRDWATCH

The RSPB coordinates a national count of garden birds over a weekend in January each year to see how well various species are doing. In January 2017 about half a million people took part

BIG BUTTERFLY COUNT

Similar to the RSPB Garden Birdwatch, this took place over a week in August 2017

UK SURVEY ON ASH DIEBACK

The purpose of this survey was to identify ash trees that might be tolerant to ash dieback and could be used in future breeding programmes – visit <https://livingashproject.org.uk/survey> for more info



DO YOU UNDERSTAND HUMIDITY?

Edward Hardy, FEC Energy, explores the difficulties of maintaining the perfect humidity in a glasshouse

Humidity control is an important aspect of managing a glasshouse climate. Many growers have a target level of relative humidity (RH) or humidity deficit (HD) in mind, but achieving it can be a tricky and potentially costly process.

Ornamental growers tend to consider humidity in terms of RH where high RH gives risk of disease, whereas salad crop growers use HD primarily as a measure to define how active the crop is. Transpiration of the crop increases the water level in the air and can take conditions away from target set points; if nothing is done about it, the air can become saturated (100% RH) – i.e. it has reached its dew point. This can lead to the formation of condensation and increase the risk of disease. To manage humidity, growers employ different techniques dependent on crop type and glasshouse conditions:

- Temperature increase
- Forced air exchange
- Dehumidification
- Air movement

The accurate measurement of humidity relies on good sensors and well-positioned measuring boxes. Sensors require regular maintenance, checking and calibration. Dry and wet bulb measurements, for example, need the

constant availability of distilled water and clean wicks, whereas electronic sensors should be independently calibrated monthly. Incorrect measurements will result in reduced crop performance or increased energy consumption, or both.

“The air you just paid to heat has now gone and been replaced by colder air than before”

Maintaining an even climate will ensure humidity levels measured at one point are the same or very similar to those in other parts of the glasshouse. This is important for getting even crop growth, good energy efficiency and also to ensure controls respond to actual conditions – not singular events or the worst areas. Vertical air movement is currently being popularised; however, using existing air movement fans may well maintain satisfactory conditions.

By increasing the temperature of the air, its moisture-carrying capacity is also increased, meaning a decrease in relative humidity. Growers have traditionally taken this approach, increasing pipe temperature to reduce RH, then opening vents in reaction to high glasshouse

temperatures. Although this may drive out moisture, the air you just paid to heat has now gone and been replaced by colder air than before.

The use of dehumidifiers could be an alternative option, mechanically taking moisture out of the air. These require an electrical connection and will have an operating cost associated with their use, although recent research has shown that the energy cost of these is less than the energy saved through reduced ventilation. The water extracted from the air should be removed from the glasshouse and the dehumidifiers will require a degree of maintenance to ensure ongoing efficient operation.

grow **save**
helping horticulture save energy

GrowSave is hosting a workshop on basic humidity control in Stratford-upon-Avon on 17 January 2018. This event is designed to give block supervisors and others who have the occasional need to change glasshouse settings some background into why humidity control is important and how it is influenced.

GETTING TO THE ROOT OF THE PROBLEM

Dr Rob Simmons, Cranfield University, explains why soil management is key to increasing your asparagus yields

It is estimated that asparagus growers could be losing up to 60% of their crop yields over a period of a decade, due to the effects of asparagus decline. Soil compaction in wheelings of asparagus plantations may be a contributing factor. Considering that in 2014 the ex-farm value of British asparagus was approximately £27.6 million, this could mean losing up to as much as £16 million across the industry each year. So, just reducing that figure by as little as 10% would see a boost of up to £1.6 million for growers in general.

That's why in project 'FV 450 Asparagus: Sustainable soil management for stand longevity and yield optimization', Dr Rob Simmons and his team at Cranfield University – Dr Sarah De Baets and Dr Joanna Niziolowski – are aiming to find the best practices for soil management that will help to improve growers' returns. This involves preventing or remediating wheeling compaction, improving soil structural status,

and reducing run-off and erosion in asparagus production systems.

EARLY PROMISE

Good progress was made in year one, with two replicated field experiments established at Cobrey Farms at Gatsford, Ross-on-Wye. After one year of growth no significant differences in Root Mass Density (RMD) and root profile distribution between Gijnlim and Guelph Millennium were observed. For both varieties, about 65% of the total measured plant root mass was found at the crown zero line (CZL), near the surface at 0.0–0.15m depth. Very few roots had explored the soil at 0.3m, 0.6m and 0.9m away from the CZL.

Further away from the CZL, roots tended to be mostly in the 0.15–0.3m and 0.3–0.45m soil layers and avoided the top soil (0.0–0.15m). For both varieties there were no roots detected in any of the root cores (0.0–0.45m depth) taken 0.9m away from the CZL.

When the dimensions of the re-ridged bed-form (Figure 1) are superimposed on the baseline varietal root distribution, the results indicate that:

- For both Guelph Millennium and Gijnlim there is a risk of damaging 7–9% of total root biomass if the rotating tines of the bed-former were used to till soil to 0.15–0.3m depth, within 0.3m of the CZL
- In addition, for Guelph Millennium, there is a risk of damaging 2% of total plant root biomass if rotating tines of the bed-former till soil to 0.0–0.15m depth within 0.3m of the CZL

“Although the year-one field trial results indicate that for both Gijnlim and Guelph Millennium varieties, sub-soiling operations can be undertaken at operating depths of 0.175–0.3m, when crowns are planted on 1.83m centres. It is strongly advised that growers undertake exploratory root profile distribution surveys prior to commencing sub-soiling operations,” explained Simmons.

Going forward there are hopes to upscale the current research to encompass a wider variety of soil types, tillage intensity, age of crop and ridge spacings so that a comprehensive picture of factors affecting UK asparagus root architecture and root profile distribution can be established.

AHDB project code:
FV 450

Project leaders:
Dr Rob Simmons, Dr. Sarah De Baets and Dr Joanna Niziolowski, Cranfield University
AHDB contact: Jim Dimmock

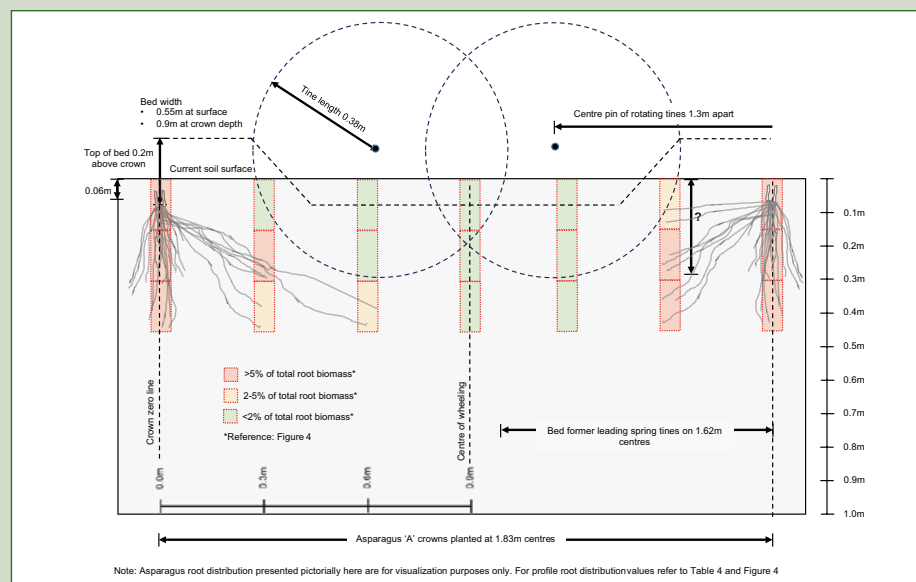


Figure 1. - Asparagus root distribution profile

HUNGER GAMES

John Adlam, Dovebugs, and Neil Bragg, Bulrush Horticulture, look for a way to tell when a plant is ready for a good meal



“If only the plant could tell me when it is hungry, before going yellow.”

It is probably a consideration many growers have thought about but dismissed. Fortunately, AHDB's project HNS 193 has the primary aim of trying to answer that question. Most growers have little to benchmark their own crops against and often rely on visits from their consultants or trade, who might suggest that the growth or leaf colour could be improved – or even worse, face rejection from a customer. Samples have been traditionally sent away for leaf tissue analysis, substrate testing or both. While the results may indicate issues, they are at best ‘spot values’ on a curve with little idea of whether the values are really going down, up or are fixed. If the crop has actually been depleted of available substrate nutrients, then it may be too late for remedial actions such as top-dressing with fertiliser or liquid feeding in an attempt to significantly improve the crop before dispatch.

FOUR MILLION REASONS

Annual UK sales of controlled release fertiliser (CRF) are currently £4 million relative to a nursery gate crop sales value of £1 billion for nursery stock. The cost of fertiliser is quite a small percentage of crop sales, but the impact on the income from a crop when it has a visible nutritional problem can be extensive. Economically, potential losses to growers can often amount to 10% of crops, through weak growth, missed market dates and deficient crops. Additionally, there are direct costs of a tissue analysis that may well vary between £50–100 per sample, and then there might well be the cost of top dressing to consider and the labour needed to undertake the remedial work. With margins being continually eroded, any project that can reduce losses and/or save on laboratory sampling must be attractive.

THERE'S AN APP FOR THAT

AHDB project ‘HNS 193 – Nutrient management in Hardy Nursery Stock’ set out with the aim of providing nurserymen with practical methods of nutrient monitoring to enable them to measure the health of the plant and adjust nutrient applications accordingly.

Starting two seasons ago at Greenmount College, Co. Antrim, NI, and PCS, Destelbergen, Belgium, the team began by selecting a range of subjects for the monitoring work. These were Chamaecyparis, Buddleja, Viburnum and Skimmia (in year two the Skimmia was substituted for a herbaceous plant, Tradescantia). All were selected because of either their response to nitrogen levels in substrates or their known growth habits, which would make their assessment easier.

The first year focused on investigating a number of pieces of handheld equipment and comparing results against regular, independently analysed samples of leaf tissue and substrate.

The handheld equipment included a phone app for measuring the green colour index of the leaf tissue, a meter for measuring chlorophyll fluorescence, a dipstick or ion-specific electrode for measuring the nitrate N level in leaf sap, and a substrate EC meter. The Green Index iPhone app and chlorophyll fluorescence measurement proved relatively easy to use, as did the ‘Pro-Check’ EC meter for determining the substrate EC and moisture content. The main drawback with the equipment requiring leaf sap was that with subjects such as Chamaecyparis, it proved almost impossible to express the sap, and even back in the lab after freezing the samples, the extraction was difficult at best. It was also highly coloured, which interfered with the technique being used, such as the dipsticks.

Early on the data from the sites demonstrated that the allocation of nitrogen that was being used by the crop and the amounts being leached out were quite different between species. For example, the nitrogen uptake by Viburnum was slow to start, while even at 8kg/m³ Tradescantia was

assimilating most of that released throughout the growing season. Also of interest was that leaching rose considerably in Buddleja after trimming, until growth resumed when it was reduced. While this effect can be understood it was not known to be quite as dramatic as we discovered.

REFINING THE TESTS

In year two the work was repeated with a fully replicated site trial that gave growers experience of full monitoring.

Equipment-wise, the dipsticks for nitrate levels were dropped as they had not responded well to coloured sap. All other equipment remained the same as in the first year.

The Skimmia replacement, Tradescantia, was much more responsive to nitrogen levels. Moreover, its leaf shape and form yielded sap more easily (See Figure 1).

However, the second year very much confirmed the team's view that getting sap from leaf tissue samples was not practical out on the nursery.

Results for the use of the iPhone app, Green index, the use of chlorophyll fluorescence meters and the Pro-check did show a relationship to the trend indicated by leaf analysis. In the case of the AtLeaf and Apogee chlorophyll fluorescence meters, we were able to detect the lowering of leaf N levels two weeks in advance of any leaf symptoms showing up.

Year three is now well underway and our aim is to use the data collected to draw up a table that enables nitrogen tissue levels to be assessed from the equipment readings to make nutrient applications tailored more accurately to the plants we have been looking at.

One size does not fit all when it comes to CRF rates and we've seen just how wasteful in nutrient leaching that approach can be. It may well be time to look again at dibbling rather than pre-incorporation so that individual crop types can be easily adjusted and have a bespoke CRF rate.

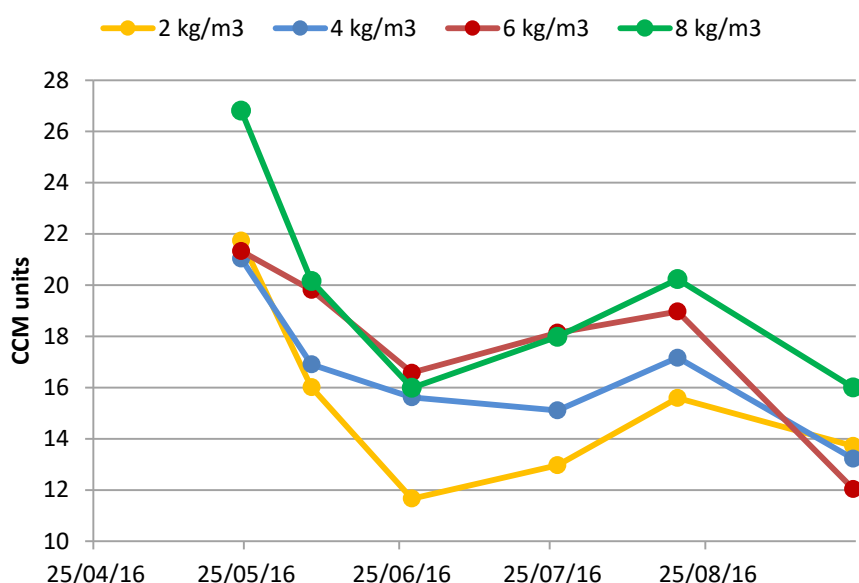


Figure 1. Chlorophyll measurement for Tradescantia grown with different rates of nitrogen delivered as increasing CRF rates.

AHDB project code:
HNS 193

Lead researcher:
John Adlam, Dovebugs

AHDB contact: Wayne Brough

IS IT WORTH IT?

Investment in monitoring equipment will be needed, possibly costing up to £3,000. However, taking into account the value of crops being monitored, the capital expenditure is quite low, especially considering the effect on a grower's sales when they have a nutrition problem.

To make the handheld equipment work on a nursery, growers will need to do the following:

- 1 Select a subject which is considered a main representative crop on the nursery, with a large leaf, and which is known to respond well to fertiliser inputs
- 2 Make one person on the nursery responsible on a weekly basis for the collection and storage of data and to manage follow-up samples where needed (see AHDB Horticulture Factsheet 10/16)



BIG DATA, BIG KNOWLEDGE

Jane Rickson, Rob Simmons and Lynda Deeks, Cranfield University, take a holistic cross-disciplinary approach to mining and using soil management data

Many growers already collect data on aspects of crop agronomy, field operations and aspects of soil health as part of their routine farm management. While some of it is used for business planning or to support assurance and certification schemes, there is underutilised potential that could be used to optimise benefits on farm.

Some of this data could enhance the productivity and competitiveness of growers' businesses, including data that could drive innovation in cropping systems. However, these potential benefits can't be realised from data from one business on its own, or even a few businesses working together.

To get the best out of this data means combining it with as many other coherent data sets as possible, generating what is known as 'big data'. Storing, cleaning, transforming and analysing such large and complex collections of different kinds of data is beyond the normal computing capacity of most individual businesses. Meaningful interpretation of such data sets requires new and emerging methods of data management and processing known as 'agri-informatics' to unearth valuable insights that would otherwise have remained hidden.

One area where big data has real potential is in helping to improve soil management in horticulture, where intensive production practices can lead to soil health issues.

Many of the problems caused by these issues were identified by growers in an AHDB survey carried out in 2013 as part of a project analysing soil management research and knowledge transfer in horticulture (CP 107). The project confirmed how important soil management is to crop productivity, not least because of soil-borne pests and diseases, and degradation resulting from compaction, erosion, loss of organic matter and loss of biodiversity.

The review revealed that more work was needed in areas such as:

- Understanding which soil parameters need to be measured by growers and developing 'smart technology' to measure these properties
- Making the best use of soils data
- Fine-tuning nutrient management
- Better systems to manage intractable, soil-borne diseases
- Using 'precision agriculture' to improve soil management

- Using and getting the best from soil amendments and other inputs
- Managing soils for cropping consistency

THE EMERGENCE OF AN INFORMATION SYSTEM

The need for a system to enable the horticulture industry to make better use of existing whole-farm, cross-rotational data is being addressed in the project CP 107d (part of the AHDB GREATsoils programme), the development of a horticultural soil management information system or 'SMIS'. It's exploring how better use of data and information on, and knowledge of, soil management practices can help growers make informed decisions that achieve the best possible yield and quality from the crop without compromising what is their key farm asset – the soil.

SMIS has already begun to collate relevant data and expertise on sustainable soil management from many diverse sources: scientific and technical literature, expert knowledge, anonymised data collected by growers, outputs from AHDB research projects, and anecdotal information from growers and crop sector groups.

This integration of wide-ranging data forms and sources makes SMIS unique – such a holistic approach has never been attempted before. The pool of knowledge and information that's being gathered will form a 'rule-base' on the causes of soil management issues and how soil management practices can solve them. This rule base will encompass the management of compaction, erosion, organic matter content and key soil-borne diseases. The database will identify particular soil and crop management factors affecting yield and yield quality in a rotational context. Obtaining coherent datasets that encompass full rotations is critical to identify positive or negative effects of particular operations/practices on yield, yield quality and to promote sustainable soil management.

Growers' data is an essential element of SMIS because it brings an understanding of the timing, type and frequency of farm operations in a rotational context, including those that can lead to soil degradation, and provide an evidence base for those practices that promote sustainable soil management. Most importantly, anyone who agrees to share their data through SMIS can be confident

that it will be fully anonymised and used solely to generate the SMIS 'rule-base'.

The value of this whole-farm data is enhanced further by linking it to soil data already held in Cranfield University's LandIS database (landis.org.uk) and to meteorological data sets. This will make it possible, for example, to define the environmental conditions when land can be worked without causing soil compaction – known as 'workability' days – or how quickly soil that has suffered compaction can recover naturally.

Once the database has been compiled, computer-based 'agri-informatics' analytical tools known as 'data-mining' techniques will be used to interpret the data to tease out any common patterns.

BENEFITS FOR GROWERS

SMIS will collate, harmonise and integrate information and data on soil management that is currently spread across a number of organisations, and provide a wealth of relevant information on sustainable soil management specifically related to horticulture from one central source.

For individual growers, patterns in their own farm data are often obscured by the variations in soil management practices and their effects from season to season, year to year and from field to field. This 'noise' starts to fade as the pooled dataset gets bigger. Patterns that aren't visible in an individual data set are more likely to be revealed and can be used, for example, as the basis for best practice guidance on soil management.

SMIS is very much a live and dynamic project: new data, knowledge and information are continually being added. As the database expands, SMIS's explanatory and predictive capability increases. Our ability to interpret the database will be strengthened over time, as new and more sophisticated statistical and data mining techniques emerge.

For further information on SMIS and details of how to contribute your own farm data, please contact Lynda Deeks at l.k.deeks@cranfield.ac.uk.

AHDB project code: CP 107d

Project leader: Jane Rickson

Research consortium: Cranfield University, James Hutton Institute and PGRO

AHDB contact: James Holmes



“ For individual growers, patterns in their own farm data can be obscured by a variety of soil management practices ”

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Why not join us at one of the following upcoming workshops to find out more?

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AHDB.ORG.UK/GREATSOILS

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GET LEAN TO GROW FATTER

Neil Fedden, Managing Director and Principal Consultant of Fedden USP, discusses how growers can improve their workforce in a post-Brexit world



The uncertainties of the impact of Brexit on the UK economy have certainly intensified now that negotiations with the EU have commenced, and questions are being raised in many sectors, most recently in the agriculture and horticulture industries.

The BBC reported at the beginning of September that Brexit could have a 'catastrophic' impact on any industries that rely heavily on EU workers, following the production of a draft plan whereby firms would have to recruit locally, unless they could prove an 'economic need' to employ EU citizens. They could face a skills tax to boost training of UK workers if they still choose to employ unskilled EU staff.

The agriculture and horticulture industries have, of course, relied heavily in recent years on labour resources from Eastern Europe and the horticulture industry alone requires around 80,000 seasonal and 10,000 permanent workers each year.

My view is that many UK growers would be very wise to make comprehensive plans to train up their current workers in-house now, if they are not already doing so. By using techniques such as 'Lean' and 'continuous improvement' it will mitigate the risk of heavy reliance

on the flow of overseas workers and staff engagement and job satisfaction can be significantly improved as a result. Workers can also be trained to develop specialist skills using these techniques and so, over time, the overall quality of employees is improved.

“Using techniques such as 'Lean' will mitigate the risk of heavy reliance on overseas workers”

Some of the most productive companies in the UK reward staff for increased skill levels related to continuous improvement and leadership activities and this could easily be adopted by those in horticulture. Such incentives will help to attract the best candidates from the EU as well, who will see the opportunity to learn additional skills from the respected UK industry as enhancement to their career development.

With improved quality comes improved efficiency, productivity and the elimination of wasteful activities, certainly once 'Lean' and 'continuous improvement' techniques are fully implemented. As a result,

in time, less resource will be required and the bottom line performance of the business improved.

It will be crucial for businesses to improve their bottom line with so many uncertainties arising over Brexit, including the potential increase in prices as a result of the weak pound relative to the euro. The focus on closer working relationships with suppliers to reduce quality issues or improve yield will help to mitigate these increases.

There are short-term benefits from the weak pound and there is evidence of increases in demand from UK suppliers as a result of this. The ability to improve capacity without significant capital investment becomes crucial and, again, productivity improvements through 'Lean' and 'continuous improvement' seems to be a popular request that we have received over the last six months.

There is no doubt that Brexit poses many challenges to the UK economy, but equally it presents opportunities and the companies that capitalise on this will be the ones that thrive in the future.

**Want to have your say?
Get in touch with us on
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PREPARING FOR A LEANER FUTURE

With rising labour costs and uncertainty about future worker availability following Brexit, Gracie Emeny examines whether adopting Lean principles can help horticultural businesses survive the rocky road ahead

Access to affordable labour is one of the key concerns for most growers. David Swales, Head of Strategic Insight at AHDB, estimates that labour costs could increase by up to 50% after Brexit as a result of having to incentivise and attract workers. While automation and robotics may offer hope to offset these costs in the long-term future, a new knowledge exchange programme launched by AHDB Horticulture is trying to encourage the uptake of Lean principles and maximise labour efficiencies to help in the short term.

Earlier this year, Management Performance Ltd (MPL) visited six horticultural businesses to observe and assess their use of labour and review their performance management. While each of the businesses was diverse in its size and crop sector, there were clear commonalities for areas of improvement across all businesses.

The report identified clear areas of development that are likely to be applicable to many horticultural businesses. We are now building resources to help address these three key areas: management training support, developing standardising operations procedures and creating performance management systems.

“Other than the weather, labour costs and availability are our biggest challenge but also our biggest opportunity”

TRAIN THE TRAINER

There was very limited investment in management training for supervisors. In order to enable front-line managers to get the best performance from workers, they need to be provided with the skills required to manage people effectively and challenge poor performance.

STANDARDISING OPERATING PROCEDURES

Discrepancies were identified between the performance ratings of the ‘best’ and ‘worst’ workers.

The approaches to carrying out tasks adopted by the ‘best’ workers, for example how they were picking crops, weren’t standardised in best practice guidelines and were just accepted as a difference due to individual capability.

PERFORMANCE MANAGEMENT SYSTEMS

Few businesses were target-setting and reporting on performance regularly, nor were they establishing systems to address why targets were not being met. Getting to know your business is crucial for improving efficiencies.

Stan Willey, Operations Director at MPL, said, “At the start of the process all the businesses visited believed that they

EYE ON INDUSTRY...

“Lean concept is centred on the management of the best use of resources, by eliminating waste and improving productivity”

were unique in terms of labour issues and therefore could not be likened to other growers. The reality is that they are all volume-driven, labour-intensive operations and the management skills of the front-line manager in these types of businesses are paramount to success.”

Tom Hulme, A C Hulme Ltd, who participated in the programme, said, “Other than the weather, labour costs and availability are our biggest challenge but also our biggest opportunity.

“We signed up as we want to understand different ways to look at productivity and also benchmark ourselves against others in the industry. The visit confirmed that we are on the right track but need to stay focused on efficiencies.”

As part of this programme of work, AHDB Horticulture is holding a series of events focusing on improving labour efficiencies. Two workshops took place in November, while the next will be in March 2018 in Lincolnshire and Lancashire.

To find out more and to book a place, visit horticulture.ahdb.org.uk/events



Stan Willey,
Operations Director, MPL

There is a general misconception that ‘Lean’ is more to do with the automotive industry than agriculture.

This cannot be further from the truth, as the Lean concept spans the whole range of industries and has, in part, been evident in the farming industry for centuries.

The Lean concept is centred on the management of the best use of resources, by eliminating waste and improving productivity.

The five key managed resources for all industries are: space, labour, equipment, materials and product or service.

SPACE

The effective management of space has its roots in farming and growing. Farmers and growers select the best fields to maximise the income generated. This management of space was evident in all the members’ sites visited.

LABOUR

The effective management of labour has its roots in both growing and factory operations, such as textile manufacturing. Growers, to a great extent, manage labour by only recruiting people at seasonal times when the workload is heavy – thus eliminating some of the waste that is prevalent in factory operations. Once again, a good practice was employed by all the businesses visited.

The textile industry developed standardised operating procedures for jobs to ensure best practice is followed by workers to maximise their potential earnings. This practice was missing in the businesses visited for this study, where variance in performance levels was generally accepted as simply due to individual capability.

EQUIPMENT

The effective use of equipment does have its roots in the automotive industry. However, the automation of a manual repetitive process is a lot easier if the expensive equipment is used 24/7, 365 days of the year as it is in factories.

Success stories in horticulture come from areas such as packaging, where check-weighers can reduce product giveaway.

MATERIALS

The effective use of materials (normally chemicals) has its roots in the health and mining industries. These industries use massive amounts of data to analyse cause and effect (e.g. if you blast a quarry, what quantity of stone do you get for a kilogram of explosive?). This is, for the horticultural industry, a prime example of sharing data to eliminate waste.

PRODUCT

The elimination of waste product is driven by good control of the aforementioned inputs. The horticulture industry has, for many years, led the way in the Lean technique of visual management, using images to convey messages – for example, pictures of corn cobs to illustrate whether a particular batch is class 1 or class 2, to avoid conflict between supplier and customer. It could benefit from using the same sort of measurement system and knowledge base as the health service, whose processes are very similar – for example, patients fed nutrients in a controlled environment and nursed to health. All this needs to be achieved within the main limitation that food producers have – time.

PROTECTED PRODUCTION IN THE PROVINCES

AHDB Knowledge Exchange Manager, Wayne Brough, gives his insight from the recent AHDB/BPOA/Bedding and Pot Plant Centre Study Tour to Ontario, Canada

The ornamentals industry is a strong driver of the Canadian economy, with close to \$2 billion (£1.2 billion) in farmgate revenues and over \$360 million (£212 million) in exports, primarily to the USA. Horticulture is important in the province of Ontario and, along with top fruit and grape production, there is a high density of ornamental growers situated between Toronto and Niagara, along the southern edge of Lake Ontario. A wide range of ornamental crops are grown including bedding plants, cut flowers, hardy nursery stock and pot plants; the AHDB/British Protected Ornamentals Association/BPPC study tour to the area primarily focused on growers of the latter crops.

A number of the nurseries visited during the tour specialise in the production of a single pot plant crop, such as phalaenopsis orchids, but the vast majority produce a range of crops throughout the year, including African violets, chrysanthemums, ferns, hellebores, poinsettias, roses, etc. Many are family-run businesses (over several generations) and vary in size from a modest 0.5ha to over 6ha, with production in a range of glass- and plastic-protected structures of various levels of sophistication.

AUTOMATION AND ROBOTICS

The minimum wage for labour in the province is about to increase to \$15 CAD (about £9) per hour and is set to rise further in the near future, and attracting staff at all levels into horticultural businesses is proving difficult in the area. Automation solutions are therefore being sought by nurseries and are being developed by the local research centre. On a number of the nurseries visited, various pieces of machinery or robotics are in use carrying out routine and repetitive tasks to keep production costs in check. At Aldershot Greenhouses, East Waterdown, an Aris Rombomatic machine prepares and inserts rose cuttings into 10.5cm

and 15cm pots to enable the business to produce a weekly output of 40,000 10.5cm and 15,000 15cm pot rose plants and accommodate much higher production peaks for the key marketing periods of Mother's Day and Valentine's Day.

Jeffery's Greenhouses in Jordan have invested in four harvest automation machines (*refer to Image 1*) for spacing a range of pot-grown crops throughout the year. These were put in use for the first time this year to space poinsettias grown on concrete floors, and the staff are still learning how to work with and get the best from them. As all the floors in the glasshouse facility were laser-levelled concrete flood and drain floors, the terrain is perfect for the use of these robots.

Robots and integrated systems are being developed at the local Vineland Research and Innovation Centre. Using cutting-edge technology such as hyperspectral imaging, neural networks and artificial intelligence, a smart irrigation system is being developed for nurseries that can monitor crops for stress levels, from equipment fixed to gantries, and apply corresponding levels of irrigation automatically. David Gholami, a Vineland-based researcher at the Canadian Greenhouse Conference, believes that "trials with campanula grown on a commercial nursery in 2017 produced a crop (using this automated irrigation gantry system) as good as, if not better than, that produced by a seasoned grower."

Other systems being developed at the Centre include a planting robot for tulip bulbs and harvesting robots for crops such as cucumbers and mushrooms. Gideon Avigad, Research and Programme Leader, pointed out that many of the systems are still two to three years away from full commercialisation.

Advanced technologies are not the solution for all. At the Canadian

Greenhouse Conference, Charles Grinnell, CEO of Harvest Automation, informed the audience that where large volumes of a specific crop are grown on nurseries, in a monoculture type system, the adoption and integration of technology – especially robotics – has good potential and can be very cost-effective; however, where a variety of crops are grown, each with their own requirement, the development and adoption of such systems can be much more difficult to justify.

CROP CULTURE

With the range of pesticides becoming more limited in Canada and with pesticide resistance issues, integrated pest management (IPM) has been widely adopted on most of the nurseries visited. Most commonly this involved using macro-biological agents introduced to control thrips, whitefly and aphids; aphid banker plants were in use for kalanchoe production at Westbrook Greenhouses, Beamsville. Biopesticide use is still very much in its infancy on most of the nurseries. Surprisingly, although yellow sticky traps were often in use they appeared to be changed too infrequently and blue traps were not used for thrips monitoring as is the case in UK protected horticulture (*refer to Image 2*).

Most of the growing media used by the nurseries is based on peat harvested from Canadian bogs. With the exception of the addition of perlite in the culture of certain crops, few other amendments were employed in the media (in the case of orchid production, bark was the main growing media ingredient).

Interestingly, at Aldershot Greenhouses a mobile fan was in operation to move hot, humid air around over outdoor crops of hellebores, and previously fans on outdoor production have been seen in Europe to prevent frost damage in field-grown hardy nursery stock. (*refer to Image 3*)

MARKETING AND PRODUCT DEVELOPMENT

Being so close to the Canadian/United States border, a high percentage of plant material produced on some of the nurseries visited is shipped into the USA and as far south as Texas and Florida, generally via third-party transport companies. At nurseries such as Jeffery's Greenhouses, the business operates vendor-managed inventories in Home Depot (chain DIY) stores; 55 stores in Ontario, Canada, and a further 29 in New York State, USA. Albert Grimm, Head Grower at the nursery, confirmed that 90 staff are employed just to manage and look after plant material in the stores to maximise sales, as payment is via 'pay by scan'. Other businesses such as Schenck Farms and Greenhouses supply produce into other businesses running such vendor-managed inventories, avoiding the need for teams of staff to manage in-store

displays. Moreover, produce is also sold via local distributors and brokers and is also supplied to local chain stores, grocery outlets and garden centres in Ontario.

Much of the plant material is sent to market with non-branded packaging. Some businesses, such as CosMic Plants, Beamsville, have however developed their own brands with bespoke labels and sales material for their range of phalaenopsis orchids. A number of nurseries, especially those with their own retail outlets like Bradford Greenhouses, Bradford, add value to plant lines using a range of ceramic or coloured pot outers, ornamental inserts purchased from China or by combining plants in novel ways; for example, the addition of an upright, tall grass in the middle of a garden mum is common practice throughout the area. (refer to Image 4)



Image 1



Image 2



Image 3



Image 4

“Interestingly, a mobile fan was in operation to move hot, humid air around over outdoor crops of hellebores”

Thanks go to the following nurseries for hosting the study tour group:

Aldershot Greenhouses, East Waterdown
Bradford Greenhouses, Bradford
CosMic Plants, Beamsville
European Planters, Niagara-on-the-Lake
Homestead Growers, Vineland Station
Jeffery's Greenhouses, Jordan
Meyers Flowers, Fruit Farm and Greenhouses, Niagara-on-the-Lake
P. Ravensbergen and Sons, Smithsville
Schenck Farms and Greenhouses, St Catharines
Spring Valley Gardens, St Catharines
Westbrook Greenhouses, Beamsville
Vineland Research and Innovation Centre

A PREMIUM FUTURE?

From Brexit to market trends, Claire Shaddick provides the latest news from the British Tomato Conference 2017

Growers are being warned to prepare their businesses for the consequences of Brexit even though it's still unclear what form the new trading conditions will take.

AHDB's Head of Strategic Insight, David Swales, told the British Tomato Conference in Kenilworth in September that waiting to see what happens was a high-risk strategy for the industry. "It will be a good 18 months before any deal becomes clear, but we do know what the issues around Brexit are. I encourage you to think about those now and come up with some plans," he said.

For instance, new work by AHDB on modelling how changes in labour availability will affect growers when freedom of movement ends suggests costs could increase by around 50%.

Swales believes that, if the UK failed to agree a trade deal – which would likely result in tariffs being imposed on both imports from and exports to the EU, it could put tomato growers at an advantage.

"Tariff-free access is critical for most sectors, but for tomatoes barriers might present opportunities for import substitution. Pretty much in all the scenarios where we leave the Single Market, (wholesale) prices of tomatoes could rise by as much as 20%," explained Swales.

STRONG MARKETS

Whether or not Brexit can offer the industry a chance to displace imports in future may still be speculation, but what is clear is that households are spending more on fruit and vegetables, and that tomatoes are outperforming the market in terms of growth.

Kantar Worldpanel's Consumer Insight Director, Emma Fencott, stated that annual tomato sales were now worth £759 million; an increase of 6% on last year compared to the 4.6% rise for fresh produce as a whole.

With 93% of households buying tomatoes during the course of the year – a figure second only to potatoes – and

on average at least twice over a four-week period, she said there was little opportunity to increase sales by finding new shoppers or encouraging existing shoppers to buy more often. Instead, prospects for driving growth lay in premium products such as the cherry variety Piccolo and vine packs.

Fencott also noted that premium types accounted for much of the extra spend on tomatoes this year. Three-quarters of the growth in premium ranges is new to the category, with some spend being additional and some coming from consumers trading up. "But only 36% of households are buying premium tomatoes, so there is massive scope in terms of headroom for growth," said Fencott.

SOLVING LABOUR ISSUES THROUGH AUTOMATION

Automation could help address the problem of a more restricted labour supply and robotic harvesting is an increasing focus for research.

Fumiya Iida, Director of the Biologically Inspired Robotics Laboratory at the University of Cambridge, outlined his collaboration with vegetable growers G's on harvesting field lettuces – one of the few tasks in the crop's production that is still done by hand. "A standard robotic arm can't work in that environment," he commented, "so we have started doing experiments on different ways to 'pick and place', with suction cups or grasping fingers, to see if it can be applied to lettuce harvesting."

Iida, who is leading a new AHDB studentship project which will further this work, said that while robots were becoming commonplace in factories, applying them to horticultural tasks in commercial cropping environments was more challenging. However, the wider availability and falling costs of the technology, and the fact you can now build a prototype in months rather than years, is making it more feasible, he added.

“Prospects for driving growth lay in premium products such as the cherry variety Piccolos”



Swales: Prepare now for Brexit



Fencott: Premium tomatoes offer most headroom for growth



Iida: Experiments on robotic harvesting



SOLVING INCONSISTENT TREATMENT RESULTS

Horticulture writer Spence Gunn provides an insight to the goings-on from the recent Cucumber and Pepper Conference held in Essex

AHDB research is beginning to pin down the reasons why growers achieve only inconsistent results when using certain types of biopesticides. For treatments based on fungi, the application timing, water volumes and even the intensity of sunlight when plants are being sprayed could all make a difference to their effectiveness, growers heard at a cucumber and pepper day in Essex in October.

RSK ADAS entomologist Mark Ramsden, who is on the research team in the AMBER biopesticides project (CP 158), said such products would play an increasing role. "But they are less tolerant than chemicals of variability in the environment and require more precision in their application," he said.

Initial trials on commercial nurseries looked at the issues affecting the performance of fungal-based biopesticides against aphids in an organic sweet pepper crop and powdery mildew in cucumbers.

In the pepper trial, Botanigard WP (*Beauveria bassiana*) was applied using vertical booms against a severe infestation of peach-potato aphid. While tests confirmed that the spores had reached the crop, the infestation was not controlled.

"Botanigard killed aphids in the laboratory but not in the crop," explained Ramsden.

"Temperature and humidity were within recommended limits but there is some evidence that UVA and B, not filtered by standard glass, may damage the spores. And where aphids are infected, the speed of kill may not be fast enough to keep pace with an established infestation, so such products are best used as soon as pests are seen."

He said that guidance on spray volume and product dilution was lacking for many biopesticides. For instance, there was no consensus on the meaning of 'spray to run-off', while too high a dilution will result in droplets that don't contain any spores. The position of the boom and angle of the jets may also have meant that some outer leaves had stopped the spray from penetrating the pepper canopy.

In the cucumber trial, the biofungicide AQ 10 (*Ampelomyces quisqualis*) gave some control of powdery mildew. Used on the variety Bonbon, which has some resistance to the disease, it resulted in only traces of mildew compared with a 4.5% infection of leaves on untreated plants.

In project 'PE 022a – Pepper: Improved control of Fusarium internal fruit rot', the biofungicides Serenade ASO (*Bacillus subtilis*) and T34 Biocontrol (*Trichoderma asperellum*) were effective at reducing levels of Fusarium internal fruit rot in peppers, said RSK ADAS plant pathologist Dave Kaye.

The disease enters through the open flowers before fruits form – used preventively, both treatments reduced rots in fruits that had developed from flowers open at the time of spraying.

High humidity is one of the risk factors for Fusarium rot. Jon Swain, Senior Engineer at FEC Energy, who manages AHDB's GrowSave energy-saving advice programme, told the meeting that moisture can pass through modern thermal screens, making it possible to vent above a closed screen without risking too much loss of heat if humidity needs to be controlled.

He said keeping screens closed for longer is a key element in the Dutch 'next-generation growing' approach to energy-saving environmental control. Its strategy to control humidity is first to vent above a closed screen, then gap the screen if necessary, and use pipe heat as a last resort. Decisions on gapping can be based on a measuring box positioned above the screen.

GrowSave has set up two study groups to explore next-generation techniques and find out which can best be adapted to local conditions. "It's important for us to learn together about what is the right approach here; you don't need to adopt all of the elements to benefit," said Swain.

INSIDER INSIGHT



XYLELLA: A COLLECTIVE RESPONSIBILITY

Jonathan Whittemore, Senior Procurement Manager at Johnsons of Whixley, explains why going it alone could lead to Xylella pain



As an industry, one of the biggest challenges that we have at the moment is ensuring that the message about the dangers of Xylella gets out to everybody who needs to know.

There are many stakeholders involved, and many different agendas; there are the nurseries, the plant health authorities, the HTA and other industry bodies, the landscapers, the garden centres, architects and planners. All have a different perspective on the situation, ultimately fuelled by commercial necessity. But this is too big an issue for the different sectors of the industry to think it is someone else's problem. Let it be clearly understood: the impact on the industry will be equally devastating for us all.

There are many strains of Xylella – and new ones still being discovered – which will have different effects on different species. There are hundreds of varieties of plants affected, ranging from herbaceous perennials through to hardwood trees, and new varieties are being added to the list of susceptible species as I write. Worse, we know there are plants that can carry the disease while showing no symptoms or effects.

It is not known whether those areas presently affected have been afflicted for decades (and it's only recently that diseased populations have been diagnosed) or whether Xylella is a recent phenomenon – I suspect it is not.

Nor is it known if there are any species within susceptible genera that are resistant to the disease.

“This is too big an issue for different sectors to think it is someone else's problem”

There's certainly more that we don't know than we do know, and just because the plants we grow are not currently on the 'at-risk' list doesn't mean they won't be in the future.

However, large areas of ignorance do not excuse our waiting for 'further and better information'. Enough is known already to demand immediate action.

Xylella is a disease that affects a vast range of plant species and, for a nursery like Johnsons of Whixley, if there is an outbreak of Xylella in our area, under the current sanctions, it is game over. As it will be for the landscapers and garden centres, and there will be a devastating impact on the countryside, landscapes, parks and private gardens.

There is a danger at this point that, while awareness of the issues of the disease is increasing, the unknowns end up with us getting mixed messages about what is the right thing to do. A joined-up approach is needed now from the different agencies and stakeholders in the industry. Strong leadership is required and action is urgent.

We have a collective responsibility to inform and to warn. The whole of our industry is at risk if this disease enters the UK.

Disclaimer: Please note that any opinions expressed in this article are solely those of the author and do not necessarily reflect the thoughts and opinions of AHDB or its employees.



HORT THOUGHT

Each issue we ask you to weigh in on a topic that the industry is talking about. This time we take a look at whether robots are the future

Q: “Do you think that a significant portion of your workforce will be replaced by robots or automation within 10 years?”



**IAN NELSON, PRODUCTION MANAGER,
JOHNSONS OF WHIXLEY**

YES

“Will robots replace people in production nurseries? Eventually? Yes. When? Not so sure.

What we do is not complicated. Most of the tasks are repetitive and you always seek greater product uniformity. A crop being 100% ‘average’ being one that is a mix of brilliant and ok. The human aspect does not lend itself to consistency.

Almost all of our jobs currently require physical input and people are limited to how much they can do and how many hours they can do it for. The robot may not be quite so bothered about clocking-off time or taking a tea break.

Right now, ‘touchy-feely’ skills are still needed to make the best crops but with advances in ‘imaging’ and subsequent understanding by robots of those messages, then 90% of those are probably replaceable. The mechanical and information technologist will become more essential than the nursery worker in making plants.”



**THOMAS DAVID GILCHRIST, HORTICULTURIST,
DAVE GILCHRIST LTD**

YES

I don’t think labour will be available – it’s as simple as that!

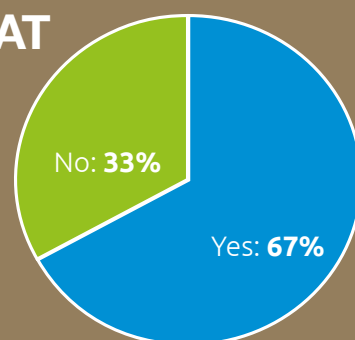


**BRUCE HARNETT, MANAGING DIRECTOR,
KERNOK PARK PLANTS**

NO

“I think that automation and robotics will inevitably have an increasing influence on how we work, but will not necessarily ‘replace’ labour, potentially re-deploy it, requiring upskilling to other work areas or choosing alternative labour that will perform other essential tasks – concentrating on improving the service, for example, is becoming increasingly important in our offer. Automation is also about improving efficiency with an aim to increase capacity and output, while maintaining or improving quality, precision, reactivity and speed rather than a simple notion of reducing labour. As it stands, robotics is clearly more viable for larger-scale, higher-volume situations. We hope that robotics of the future will be able to widen their application to cater for more flexible, smaller-scale, more challenging situations in the future.”

**HERE’S WHAT
THE REST
OF YOU
THOUGHT:**



**WHAT DO
YOU THINK?**

Have your say and get involved by tweeting us @AHDB_Hort with your thoughts, using the hashtag #Hortthought

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