

# The GROWER

THE TECHNICAL JOURNAL FOR HORTICULTURE

AHDB



Issue No. 247  
Sept/Nov 19

## CAN A COMPUTER MODEL IMPROVE BIOPESTICIDES?

Pest modelling system developed to speed up trials

## PLUM RESEARCH RIPE FOR PICKING

A new plum demonstration orchard shows best practice

## NEW ROBOTICS FUNDING TO TRANSFORM HORTICULTURE

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In the previous issue of The Grower (Apr/May 19) we made an error in the article on page 9, 'Making mushrooms a no-fly zone'. It was stated that "Diflubenzuron (Dimilin Flo) is still authorised for use on mushroom". This is incorrect: there is no longer authorisation for this product on mushrooms or other edible crops.

This publication is brought to you by AHDB

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# COMMENT



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Some incredible things have happened over the last 15 years.

World population has grown by 1.5 billion, British consumers spend over £12 billion a year buying groceries online – and I finally paid off my student loan.

For the horticulture sector, the advancements are equally huge. Production of crops such as strawberries and asparagus has soared. The value of horticulture has almost doubled in some sectors, and we grow crops and varieties that, a decade ago, most people had never even heard of.

It's food for thought as we begin to write AHDB's new strategy and was the focus of discussion at the last AHDB Horticulture board meeting (10 July). Our ambition for horticulture must look ahead to the next 10–15 years if we want to achieve the same level of success.

There are certain trends emerging.

Automation and robotics will transform the role of labour on British farms; doubling our efficiency at least.

Climate change will affect the varieties we produce, the pests and disease pressures on crops, the growing season and geographical spread of production.

As growers are all too aware, the availability of actives continues to decline.

The supply chain will not only consolidate, it will look and function in a fundamentally different way.

More British growers will have operations overseas.

There will be a rise in urban and vertical farming systems, and a change in the traditional business model – from attracting outside global investment to retailers setting up their own facilities.

Then there's the business of consuming. How will consumers buy their food? How will tastes evolve? And, crucially, what will they be prepared to pay for it?

These are some of the questions that AHDB needs to help answer. We operate in a rare, pre-competitive space in the industry. Yes, it's vital that we're responsive to the industry's needs today – our critical work on crop protection, emergency approvals and driving labour efficiency at a time of shortage – but we also need to be mindful of where the industry wants to be in the next 10–15 years.

I'll be talking to growers, crop associations and other stakeholders as we develop our strategy – your strategy – over the coming months. If you have an opinion, please get in touch. Better still, if you're a grower with a strategic mind and want to influence how things get done around here, then you might wish to consider applying to join the board. [ahdb.org.uk/horticulture](http://ahdb.org.uk/horticulture)

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# CONTRIBUTORS

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



## SPENCER COLLINS

After completing an MSc in Entomology from Imperial College London, Spencer worked in the Insecticide Team at Syngenta Jealotts Hill as part of the Early Discovery Team. Later, he started an AHDB-funded PhD at Warwick Crop Centre on cabbage whitefly (*Aleyrodes proletella*). After working as part of the horticultural service team at Warwick Crop Centre, he joined AHDB's crop protection team, focusing on securing minor use plant protection product authorisations for speciality horticultural crops.

**Spencer explains how a risk register is helping to predict new pest and disease threats on page 16.**



## JUDE BENNISON

Jude is a senior research entomologist with ADAS, based at ADAS Boxworth near Cambridge. Jude and her team specialise in research and consultancy on pests of ornamental, vegetable and soft fruit crops, with an emphasis on biological control and integrated pest management. Expertise of the team at Boxworth includes pest identification and biology, efficacy trials with biological controls, biopesticides and pesticides, resistance management, pest monitoring and forecasting systems and technology transfer.

**Jude has teamed up with research collaborators at Harper Adams, Keele, Warwick and Greenwich Universities in a project to look at vine weevil control. She explains their findings on page 20.**



## SACHA WHITE

Sacha is an entomologist with over ten years' experience of pest management in arable and horticultural crops, as well as management of tree pests and invasive organisms. Since joining ADAS in 2013, he has managed several AHDB- and industry- funded projects, including monitoring, surveying and developing integrated pest management for cabbage stem flea beetle, developing prediction and management programmes for insecticide resistance, and managing aphids, turnip yellow virus, mangold fly and slugs.

**Much of Sacha's work involves applying modelling approaches to improve pest prediction and control. You can read about how this is being used in our AMBER project to improve biopesticide control on page 18.**

# NEWS & UPDATES

## IN BRIEF

### BECOME A FELLOW

Applications for the LSA Charitable Trust Fellowship are now open. The scheme aims to cultivate future strategic leaders within horticulture. Six fellows are accepted annually for a two-year programme. If you'd like to increase your knowledge of the industry and network with new contacts, apply now: [lsactfellowship.org](http://lsactfellowship.org)

### TIME RUNNING OUT FOR ABSTRACTION LICENCES

Trickle irrigation is no longer exempt from water abstraction licences. Applications close in December, but Defra are urging growers to get theirs in sooner so they don't miss out. Find out more at [gov.uk/guidance/water-management-abstract-or-impound-water](http://gov.uk/guidance/water-management-abstract-or-impound-water)

### ROSE ROSETTE VIRUS (RRV) REGULATIONS

New legislation has been introduced to stop the arrival of RRV. All rose plants and cut flowers imported from Canada, India, Mexico or USA must now be accompanied by an official phytosanitary certificate confirming that they have been grown in an area free from RRV.

### LABEL RESTRICTIONS ON MALEIC HYDRAZIDE PRODUCTS LIFTED

The now-lifted restrictions followed an amendment to labels in November and meant that onions, potatoes and other crops treated with products containing Maleic Hydrazide could not be fed to livestock in the UK.

## REPRESENT YOUR INDUSTRY

**We are looking for new voices to help steer our work to make sure we're delivering value and impact for your horticulture sector.**

The election process for our crop sector panels is now open and we have 25 vacancies for progressing and inspiring growers.

Mark Eves, Director, PS & JE Ward Ltd and Protected Ornamentals and Bulbs and Outdoor Flowers Panel member, said: "People need to get involved with the panels. It's their money and they need to steer where that money is being used.

"I've been on the panels for a number of years and it's amazing what you can learn, not only from the work being done, but meeting with like-minded growers. It's us growers who bring the

ideas back down to earth and make it work for the industry."

Members serve a three-year term that starts in January and agree to attend two panel meetings per year, with the occasional teleconference meeting.

While on the panel, you will help shape the calls for research projects, ensuring they offer value for money. You will also act as an industry representative on projects to make sure the research team keep the needs of the industry in mind.

To join the panel, the candidate must be employed by a current horticultural levy payer. Deadline for applications is midnight 31 October 2019. A form is enclosed with this issue of The Grower, or visit [ahdb.org.uk/horticulture-panels](http://ahdb.org.uk/horticulture-panels) to find out more.

## UK OUTBREAK OF TOMATO BROWN RUGOSE FRUIT VIRUS

Symptoms of the tomato brown rugose fruit virus (ToBRFV) were reported for the first time in a UK tomato crop this summer.

Confirmed by laboratory testing, the outbreak was reported to the Plant Health and Seeds Inspectorate (PHSI). The affected glasshouse took the necessary steps to eradicate the virus and destroyed their crop.

ToBRFV has caused significant issues for growers of tomatoes across Europe and beyond, causing unmarketable fruit.

The likely routes of infection of the disease are through seed, propagation material or contact through contaminated tools, hands and clothing. Tomato is the major host of the virus, but trials have indicated it could also infect sweet peppers. Latest information and resources about the virus can be found at [ahdb.org.uk/knowledge-library/tomato-brown-rugose-fruit-virus](http://ahdb.org.uk/knowledge-library/tomato-brown-rugose-fruit-virus)





## EYESPOT - A VISION FOR THE FUTURE OF WEED CONTROL

A new herbicide applicator is seeking to make a step-change in weed control by both reducing herbicide use by up to 95% and by working autonomously, eliminating the need for a spray operator.

The technology, developed in an AHDB-funded project, uses a machine vision system to distinguish target weeds from the crop. EyeSpot assesses the growth stage of the target weed, evaluates the necessary dose and then uses a cutting-edge spot ejector to accurately apply herbicide droplets to individual leaves.

EyeSpot can also benefit the environment by reducing the need for mechanical weed control, thereby using less fuel and reducing irrigation needs through lower soil moisture losses. Furthermore, reducing cultivation also means that fewer weed seeds will be stimulated to germinate.

Growers were able to see the technology at an event at the University of Reading this summer. To find out more, visit [ahdb.org.uk](http://ahdb.org.uk)



## EVENTS PREVIEW TOMATO GROWERS' ASSOCIATION CONFERENCE

**DATE:** 26 September 2019

**LOCATION:** Chesford Grange, Kenilworth

The whole afternoon session at the annual conference will this year be dedicated to Tomato Brown Rugose Fruit Virus, which was reported for the first time in a UK crop earlier this summer. Experts from Fera, Defra and Royal Brinkman, will discuss prevention and control.

To book, visit: [britishtomatoes.co.uk/conference-bookings](http://britishtomatoes.co.uk/conference-bookings)



## CUCUMBER GROWERS' ASSOCIATION CONFERENCE

**DATE:** 9 October 2019

**LOCATION:** Marriot Hotel, Waltham Abbey

Innovation will be the focus of several presentations, with talks on New Generation Growing techniques, an autonomous growing challenge and the latest technology in horticulture. The NFU will discuss labour in horticulture and you'll also hear the latest crop protection research through AHDB projects AMBER and SCEPTREplus.

To book your place, email [martin.ellis@plantraisers.co.uk](mailto:martin.ellis@plantraisers.co.uk)



# PLUM RESEARCH RIPE FOR PICKING

**A new plum orchard will demonstrate research to help growers extend their production season and improve profitability in the UK. Scott Raffle, Knowledge Exchange Manager, explains more.**

The new Plum Demonstration Centre is an exciting new initiative, funded by AHDB and set up by NIAB EMR, to show 'Best Practice' and new technology for the plum industry.

The Centre is one of the outcomes of an Innovate UK research project on 'Sustainable intensification of UK plum production'. It is one of four new orchards that is designed to help growers to take up the results from the research.

At the Centre, growers will be able to view two new exciting varieties bred at NIAB EMR (P7-38 and P6-19). An adjoining area will showcase Victoria grown on Wavit and five other promising rootstocks, while another section is being planted with 23 new varieties, demonstrating how the season can be extended from July to October. Two additional areas of the orchard will demonstrate a range of tree architecture for Victoria and there will be an area under protection to demonstrate the differences between outdoor and protected cropping.

Three further orchards have been planted by commercial plum growers in Kent, who were partners within the Innovate UK project. Tom Hulme (A. C. Hulme & Sons) has planted a number of early-fruited varieties at his site at Ash near Canterbury, while Charles Highwood (S W Highwood) has planted late varieties at his site at Pluckley. Oliver Doubleday (G H Dean) has established a new plantation of varieties with high-yield and quality potential but which have been found to have unreliable cropping. All of these orchards will be made available for

other plum growers to view over the coming seasons and AHDB will coordinate events to facilitate this.

AHDB has a long-term aspiration to develop more strategic and demonstration centres, where research can be put into practice and help to hasten industry adoption of new technology. Rob Saunders, chair of our Tree Fruit Panel, said: "A site like this offers a useful opportunity for us to instigate a centre of excellence where our recent and future research can be demonstrated in practice. We have decided to part-fund its maintenance so that grower demonstration events can be arranged to view new technology."

Having spoken to many progressive plum and tree fruit growers, there has been a huge enthusiasm to support this initiative. So we will not only be demonstrating the research undertaken in the Innovate UK project, but we'll also be demonstrating weed control, use of organic mulches and soil management. We also plan to seek support from machinery manufacturers to demonstrate a wide range of cultural techniques, such as mechanised weed control and flower/fruitlet thinning.

Soil management practices from our GREATsoils project will also be implemented and results from other recently completed tree fruit projects will be included, such as our 'Earwig-safe spray programme' work.

With further integrated pest management research projects currently being planned by the AHDB Tree Fruit Panel, the

orchard is well placed to demonstrate the results of these in future seasons.

Leading the work for NIAB EMR is senior research scientist Dr Julien Lecourt, who has a proven track record of managing demonstration sites, having set up a similar facility for the UK vineyard industry, which has already become a centre of excellence for growers both in the UK and overseas. The centre attracts visitors throughout the year and provides a focus for progressive growers, suppliers and manufacturers to share information and demonstrate the latest technology.

A further outcome from the Innovate UK project was a new Best Practice Guide for Plums, written by NIAB EMR and the Fruit Advisory Services Team (FAST). It includes useful information on the research designed to restore plum profitability and comprehensive details about varieties.

You can find the guide on NIAB EMR's website: [emr.ac.uk/projects/best-practice-guide-to-uk-plum-production/](http://emr.ac.uk/projects/best-practice-guide-to-uk-plum-production/)

The industry had the chance to view the Plum Demonstration Centre at this year's Fruit Focus event earlier in July. Further events are planned for later in the year. Visit [ahdb.org.uk](http://ahdb.org.uk) to find out more.



“AHDB has a long-term aspiration to develop more strategic and demonstration centres, where research can be put into practice and help to hasten industry adoption of new technology”



# STOP THE ROT

Georgina Key, AHDB Resource Management Scientist examines the relationship between effective calcium nutrition and integrated management in helping to reduce the risk of blossom end rot





Curcubit production in the UK is represented by two key crop types: courgette and pumpkin, with an estimated market value of £29m and £15m respectively (Defra, 2018). The edible pumpkin market represents an additional £4.5m.

Blossom end rot (BER) is one of the main causes of unmarketable fruit in courgette, and post-harvest wastage is particularly problematic in pumpkins, which are stored for an extended period of time. Both courgette and pumpkin lose an estimated 15–20% of fruit after harvest – growing conditions, location and cultivar can all have an effect. Post-harvest rots often develop from the blossom end scar due to pathogens such as *Fusarium*, *Botrytis* and bacterial rots. Our project FV 457 'Calcium nutrition in cucurbits' was carried out by ADAS to review and evaluate how nutrition can be used to reduce BER incidence in outdoor cucurbits.

BER is a wet rot that develops in fruit from the flower scar. It reduces fruit yield volume and quality after harvest.

BER affects a range of crops, including cucurbits such as courgette, pumpkin, melon and squash, as well as other crops, such as apples and tomatoes. Research suggests that the occurrence of BER is linked to calcium availability. Calcium has a number of functions in the plant, including the development of strong links within cell walls. Poor calcium availability during the fruit's development weakens its structure, increasing the risk from pathogens.

Calcium is transported within the plant via the xylem, which carries water and dissolved nutrients around the plant and is more readily distributed to leaves than it is to fruit. As calcium is used in cell walls, it

is not easily recycled and used elsewhere if needed by the plant. Dry conditions, lower root function or high humidity reduce water uptake and, therefore, the amount of calcium transported to critical locations within the plant, even if there appears to be sufficient available in the soil or growing medium. Calcium is also linked to the plant being able to take up other nutrients. However, it is worth noting that high levels of nitrogen in the soil can inhibit calcium uptake by plant roots. This can be caused by overusing fertiliser, despite there being adequate amounts of calcium available.

There is no 'silver bullet' to solve BER, but a combined range of methods is needed to manage the risk. More calcium ions dissolve into the soil solution as pH decreases. For cucurbits this means keeping the pH between 5.5 and 7.5 – a pH of 6.5 is the optimum. However, enough calcium should usually be available in the soil, especially if the soil has been limed. After long spells of wet weather, extensive use of irrigation or in sandy soils, additional granular or foliar calcium feeds can help increase calcium in the soil. The use of nitrate-based fertilisers (to increase the nitrate:ammonium ratio) may also help increase calcium uptake. Maintaining consistent soil water levels through trickle tape irrigation or the use of mulches, and promoting root growth through good soil structure (avoid excessive irrigation, provide good drainage where needed and adopt methods to avoid or alleviate soil compaction), are also important practices.

Applying calcium directly to the fruit and leaf surface may further reduce the risk of BER, particularly if applied in combination with boron and magnesium. Boron is a micronutrient needed for cell wall

development, among other functions. In crops with a boron deficiency, supplementary boron provision increases leaf calcium content and fruit yields. Foliar applications should be made in dull, overcast conditions, using nozzles set above 45° to create a fine mist and even coverage. Application of sprays should begin with the first flowering and continue throughout fruit development until maturation begins. In pumpkins, this should continue until two weeks before harvest on a weekly basis. The frequency of application will depend on costs, labour provision and the likelihood of BER developing in the crop. Soil sampling should be done periodically to assess boron availability, as well as other micronutrients.

Alternative growing systems can also reduce BER incidence. Tomato growers use grafted plants as standard, to combine desirable rootstock traits with target cultivars. This has also been used in melon and cucumber. Cucurbits can also be grown hydroponically, but this requires considerable investment unless there is existing infrastructure or a high-value cultivar being grown. Quality during storage can be prolonged by curing a fruit. Some growers do this in the field, while others lift, clean and store fruit in a well-ventilated barn or tunnel. Specific temperatures and relative humidity values can be found in the AHDB research report 'Calcium nutrition in cucurbits'. Handling produce with care prevents further damage to the rind, and trimming the stem will prevent puncturing other fruit in storage.

We are looking to fund trials to address gaps highlighted by this review and will consult with the Outdoor Cucurbit Grower Association to progress the work.

**Early symptoms of blossom end rot – look for water-soaked areas due to the rupture or collapse of cells.**

“ There is no 'silver bullet' to solve blossom end rot, but a combined range of methods is needed to manage the risk ”

# GROWTH IN GOOD ORDER

**Spence Gunn reports on this season's trials at the Bedding and Pot Plant Centre, exploring the timing of plant growth regulator applications and showing how some newer products can be used in programmes**

Cosmos may be in strong demand as a bedding plant, but its vigorous growth leads many growers to regard it as 'a bit of a thug' and liable to get quickly out of control. This makes it an obvious candidate for this season's trials of plant growth regulator (PGR) programmes at the Bedding and Pot Plant Centre. Marigold, another crop in need of careful, regular management to hold it back, has also been included, alongside dianthus and pelargonium.

Knowledge Exchange Manager Wayne Brough said: "There's a lot of uncertainty about the future of PGRs. We have a research programme looking at alternative cultural methods, such as water-deficit irrigation, as a long-term answer. However, we'll need PGRs for the foreseeable future, so it's important to have a range of options to avoid relying on any one product."

Application timings and the use of the novel PGRs within a programme of treatments were both evaluated in trials this year.

The first programme tested a single treatment on seedlings before the true leaves expanded (hypocotyl stage) for persistence beyond transplanting that could be particularly valuable for vigorous subjects such as cosmos. Seedlings were sown in week 18 and the treatments applied at week 19 to cosmos and marigold (before transplanting week 22), and week 21 to dianthus (transplanted week 23).

The second programme, which didn't include marigold, applied a treatment to the seedlings two days pre-transplant in week 21, followed by the same or a different PGR seven days post-transplant. Some of the post-transplant treatments included a novel adjuvant for PGRs, which is expected to become available later this year.

## COSMOS

The hypocotyl-stage treatment looks promising. The most effective treatment was Pirouette, which was regarded as the current industry standard for this trial – its active, paclobutrazol, is the same as Bonzi.

The result from Terpal, which is related to chlormequat in action, appears just as good – though the crop needs to be taken further to check for any effects on flowering.

“Without the results from the Bedding and Pot Plant Centre, where would you start?”

Results in the pre-/post-transplant programme highlighted the need to start very early with this crop. None of the treatments appeared effective enough, even after a second post-transplant application had been deemed necessary.

In addition, because this trial was sown a week earlier than the hypocotyl-stage trial was started, there were already signs of petal scorch or flowering delays from some of the treatments by the time

of the trials open day – including those involving Primo Maxx II, Regalis Plus, Dazide Enhance and Terpal.

## DIANTHUS

Terpal was ineffective when applied at the hypocotyl stage. Pirouette and Primo Maxx II were both effective at this timing, but a novel and as yet unapproved PGR was better – though it caused some petal scorch in trials last year.

A Terpal drench pre-transplant and spray post-transplant looked promising, comparable to Pirouette.

## MARIGOLD

There was even less to choose between PGR treatments at the hypocotyl stage on marigold. Pirouette gave the best control, but Dazide Enhance (which has full approval), Moddus and Terpal all looked effective when assessed in mid-June.

## PELARGONIUM

A Pirouette drench pre-transplant followed by a Terpal spray post-transplant is looking best so far for pelargonium. Terpal on the seedlings, followed, post-transplant, by application of Terpal with an adjuvant was almost as good.

Some of the programmes on dianthus and pelargonium that included Terpal applied pre- or post-transplant appeared comparable to Pirouette, when assessed





**AHDB project code:** PO 019a

**Lead researcher:**  
Jill England, ADAS

**AHDB contact:** Wayne Brough

at the open day, though neither crop was fully in flower at the time.

David Talbot, ADAS, who spoke at the centre's open day in June, said: "Effects from any PGR are highly specific to species or variety – for example, we're finding Terpal can cause a slight delay to flowering in pelargonium but may slightly advance it in dianthus, so you need to run trials under your own conditions and

for the affects you want on your crops and for your market."

Plug grower Gary Woodruffe of Bordon Hill Nurseries has already started trials based on what he's already seen at the centre. Mr Woodruffe said, "We've tried Terpal on a range of crops and found it good to hold silver-leaf cineraria and geranium, for example, but less so on lobelia," he said. "It was a question of

tweaking rates compared with those the Centre had tested."

Gary's colleague, Russ Woodcock, added: "We always have to trial PGRs under our own growing conditions – we do a lot with moisture control but still rely heavily on PGRs to react to changes in the weather, for example. But without the results from the Bedding and Pot Plant Centre, where would you start?"



## SITUATION CRITICAL



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### Bolette Palle Neve explains why the demand for 120-day emergency authorisations is on the rise

The number of EAMU applications we have submitted to Chemical Regulation Directorate (CRD) has increased year on year, from 75 applications in 2016 to 138 applications in 2018.

The decreasing number of available products has led to a critical situation in some crops, where growers find that they have no products available for the control of a certain pest, disease or weed. Sometimes this is due to the development of resistance to products, as we are seeing with pyrethroids for diamondback moth control. Sometimes it is simply because there are no suitable products approved for the crop, such as for groundsel control post-planting in celery or the control of spotted wing drosophila in cherry.

To help plug these gaps, we submit a number of applications for 120-day emergency authorisations every year and unfortunately this number has also been increasing. In 2015, we submitted just four of these applications. This increased to 25 in 2018. Each application is very time-consuming and costs nearly £5,000 in fees.

We would rather avoid 120-day emergency authorisations, as they only provide a short-term fix for growers. Each application is submitted to CRD for full assessments, then presented to the Expert Committee on Pesticides (ECP), which provide its opinion on the proposed use. The advice of the ECP is then provided to Defra, where further consideration is given before the Minister then makes a final decision.

From this year's applications, we are still waiting for the several outcomes. This includes the use of Custo-Fume as a soil sterilant in ornamentals, soft fruit and tree fruit, and the use of Cuprolyt in stone fruit and pome fruit for canker control. All successful outcomes are communicated to growers via email. If you are not receiving these, please email [comms@ahdb.org.uk](mailto:comms@ahdb.org.uk)



## EAMUS IN FOCUS

### Flexidor and Dow Shield 400

Following successful trials in SCEPTREplus, two new EAMUs have been secured for weed control in rhubarb crops. Lindsay Hulme, E Oldroyd & Sons, said: "Dow shield is our only protection against thistle, which is particularly hard to control and even harder to pull out

when hand weeding. Flexidor is a valuable extension to the control of Himalayan balsam.

"Labour for hand weeding is particularly scarce as often the weeding of rhubarb takes a back seat in terms of priorities and the cost makes the crop unviable."

To discover all of the latest EAMUs visit  
[horticulture.ahdb.org.uk/latest-eamus](http://horticulture.ahdb.org.uk/latest-eamus)



# PLUGGING THE GAPS SCEPTREPLUS IN CROP PROTECTION

**Joe Martin, Crop Protection Senior Scientist, explains what's in store for another busy year in trials to secure new plant protection authorisations**

Our flagship crop protection programme, SCEPTREplus, is now in its third year. The programme identifies and tests new plant protection products (PPPs) to find solutions to control pests, weeds and diseases.

A strength of SCEPTREplus is its close link to the AHDB Extension of Authorisation for Minor Use (EAMU) programme. Before trial work even starts, the work on EAMU approval begins.

AHDB's regulatory experts and SCEPTREplus team are in regular contact with product manufacturers and the Chemical Regulation Division (CRD), developing a potential market route for each new product.

For inclusion in a SCEPTREplus trial, a product must have the potential for approval for use as a PPP and, ideally, be available for growers to use in the short to medium term.

As soon as products show good efficacy and the crop safety is at acceptable levels, the EAMU team start seeking the

necessary approvals from CRD. This process may start even while the trials are still running.

AHDB crop protection scientists Bolette Palte Neve and Spencer Collins identify and aim to fill any data gaps on all promising products. This can include generating residue data for a crop if data is not already available. Currently, residue data generation is ongoing for 12 different crops. This is for weed control products as these are of the highest priority for different horticulture crop sectors.

Their work also focuses on extending basic substance approvals and liaising with manufacturers to determine if on-label approval is being sought.

Once the data has been generated, an application is made to CRD. The SCEPTREplus programme has gained new 19 EAMUs, with more applications underway.

**To find out more about SCEPTREplus, visit [ahdb.org.uk](http://ahdb.org.uk)**

**New targets for 2019**

Diseases	Pests	Weeds
Smoulder and white mould in narcissus	Blueberry gall midge	Legumes
Fusarium basal rot in narcissus	Glasshouse mealybug	Asparagus
Rust on leeks and ornamentals		Young trees
Pythium and Rhizoctonia root rots on baby leaf crops		
Powdery mildew on ornamentals and cucumbers		



# CRYSTAL BALL FOR CROP PROTECTION

Spencer Collins, Crop Protection Scientific Officer, explains how our risk register is helping to predict when plant protection products may be withdrawn from use, giving us an early warning sign to seek alternatives



The introduction of cut-off hazard criteria for plant protection product regulation means that any active substance classified as a critical risk, 1A or 1B carcinogen, mutagen or toxic for reproduction, is not liable for approval, regardless of use.

An 18-month use-up period is the maximum time given for the use-up of any product containing actives that are voted for non-renewal in Europe. However, if the decision to not renew the approval is due to a critical risk, a shorter use-up period may be given. This potentially gives the industry a short window to find a replacement product or develop new integrated control methods.

To help growers pre-empt which actives may be lost in future, our EAMU team

has introduced a new process to track the renewal process of active ingredients. This is done as part of the AHDB risk register using a traffic light system, making it clear which actives are likely to be lost through the European renewal process and which ones are likely to be safe.

The risk register is used in all panel and grower association meetings. Only publically available information, such as the renewal assessment reports (RaR) published by the European Commission and review reports published by the European Food Standards Agency (EFSA), will be used to inform the risk register. Issues about the renewal of actives are flagged in these documents, which allows us to assess the risk of loss.

The risk register of actives in Europe doesn't always indicate bad news. It can also be used to identify low-risk actives that will likely have a long life in plant protection products. This gives us the confidence to allow research to focus on these products, maximising the use of the active throughout all sectors of horticulture.

When we flag that an active ingredient has a high risk of loss, all targets that are controlled by the active can be filtered out, allowing the impact to the industry as a whole to be understood. This information, combined with known available control methods, allows foresight in future gaps in crop protection methods.

This means the AHDB research and our EAMU programmes can focus on



“ The risk register of actives in Europe doesn't always indicate bad news. It can also be used to identify low-risk actives that will likely have a long life in plant protection products ”

identifying alternatives before the loss of an active, allowing the industry to be a step ahead rather than behind the legislation that governs the use of plant protection products.

EAMU applications have a 12-month target date for completion, so any early information for a loss of a product can give us valuable time to put alternative control options in place before the final use-up date, especially if replacement actives require residue trials.

The non-renewal of pymetrozine, for example, was tracked through renewal assessment reports and review reports from EFSA. The potential loss of the important aphicide was identified before the non-renewal decision and allowed projects such as SCEPTREplus to focus on finding new potential replacements

that could help fill the crop protection gap. It also allowed the EAMU team to seek new minor use authorisations of currently available aphicides for a number of crops.

This intelligence in understanding the renewal system of active ingredients for plant protection products is invaluable, allowing AHDB to foresee potential losses to the industry and prevent gaps in crop control methods forming.

#### PLANT PROTECTION PRODUCT RENEWAL PROCESS

Care should be taken regarding the renewal system in Europe. Actives are only suggested for renewal or non-renewal. Member states need to vote on the decision and it can be politics that leads to the final decision.

Since the introduction of the European plant protection product legislation 1107/2009, all active substance for plant protection products have been subjected to new requirements for approval at a European level. All active substances are subject to this legislation and must have fulfilled the risk assessment requirements to remain as active ingredients in plant protection products in Europe. A number of active ingredients have already gone through the renewal process, with some given the full 15 years of approval. However, some of them have been subject to a non-renewal. Recently, actives that have received non-renewals at a European level have been important crop protection ingredients – examples of these include linuron, pymetrozine and thiram.



# AMBER: MODELS TO GIVE BIOPESTICIDES A GREEN LIGHT

**Wider use of biopesticides could add significant strength to integrated pest management (IPM) strategies. Physical trials are prohibitively expensive, so science has turned to sophisticated computer models**

The control provided by synthetic chemistry is relatively predictable. Products are manufactured to exacting specifications and, provided label guidance is followed and pesticide resistance is not present, consistent results can normally be achieved.

However, consistency is not so easily attained with biopesticides. Knowledge of the biology and requirements of those that are living organisms, such as entomopathogenic fungi, is needed to help bring pest organisms under control and far more needs to be known and understood for products and the necessary application guidance to be developed.

In 2016, AHDB commissioned a five-year programme of work called AMBER – Application and Management of Biopesticides for Efficacy and Reliability. Set to conclude at the end of next year, the collaborative research will help the industry make the most out of biopesticides.

Across horticulture, there is a vast array of growing environments. To test biopesticides in just a few of these environments is both expensive and time-consuming. Even small-scale laboratory and greenhouse experiments are costly and can only ever indicate how products might perform in commercial situations. In response, the AMBER research team has looked at the potential to use computer models to make sense of the complex biopesticide world. The team hopes that such approaches will deliver low-cost insights to guide the development and deployment of biopesticides in horticultural systems.

In addition to being relatively low-cost, computer models allow many interacting

variables across the whole system to be investigated in a controlled way. The flexibility provided allows the various interacting factors to be pulled apart and put back together again. Multiple biopesticide control programmes can also be investigated quickly and cost-effectively.

All models need to be based on quality data to perform. Information on the main factors that affect biopesticide performance, such as pest population size, humidity and spray coverage, have been hunted down from the scientific literature and will be supplemented with data gathered from bespoke experiments conducted by the research team.

A key difference, for example, between a ‘conventional’ approach and one based on biopesticides is the timescales involved. The team knew, for example, that fungal biopesticides can act more slowly than synthetic pesticides. In fact, it can take about a week for a fungus to infect and kill the target pest. During this time, the pest can grow and reproduce, and this needs to be taken into account by any model. The speed of kill is influenced by many factors, such as the fungal species, target pest species and its life stage (e.g. larval or adult stage), the pest population size, the crop and environmental conditions.

The initial AMBER model predicts how pest populations change over time and how biopesticides influence these changes. The development of each individual pest within a population can be tracked, as it moves from one stage of development to the next, until it reaches adulthood and reproduces.

Because the pests are modelled at the individual level, the effect on the whole population can be estimated far more accurately. The rate of population growth depends on the number of individuals in each life stage, the number of life stages, the development time of each life stage, the natural mortality occurring in each life stage, the adult pre-reproductive period (the time between becoming an adult and producing offspring), reproductive rate (number of offspring produced per adult) and the adult sex ratio.

To test the virtual approach, the team has focused on the control of glasshouse whitefly with entomopathogenic fungi (*Lecanicillium* and *Beauveria*). Once the whitefly model is complete, the team will look to model other key pest species. These will then be validated.

The characteristics of the biopesticide (infection efficacy, time until kill and persistence) and the biopesticide spray programme (programme start date, number of sprays and spray interval) have all been modelled. The model is already sophisticated enough to predict the impact of different initial pest population sizes, biopesticide attributes and spray frequency and timing on pest control.

The model is an incredibly useful tool for researchers and biopesticide manufacturers. Ultimately, it will allow for methods and guidance to be improved. This will help increase grower confidence and the uptake of biopesticides within IPM programmes.

**This article is based on information provided by Dave Skirvin and Sacha White, ADAS.**



“The model is already sophisticated enough to predict the impact of different initial pest population sizes, biopesticide attributes and spray frequency and timing on pest control”

## MODEL SUCCESS

A deterministic ‘boxcar train’ model has been used to:

- Simulate the number of individual pests at each developmental stage (train carriage)
- Track the maturation of individual pests to next developmental stage (movement between carriages)
- Calculate the number of eggs laid per day
- Estimate the pests lost to natural mortality
- Simulate the applications of biopesticides (frequency and timing) and control efficacy (persistence, mortality and speed of kill)

**AHDB project code:** CP 158

**Lead researcher:**

Dave Chandler, University of Warwick

**AHDB contact:** Joe Martin



# VINE WEEVIL UPHEAVAL

ADAS entomologist Jude Bennison summarises on new cutting-edge IPM strategies

Vine weevil is one of the most detrimental insect pests of hardy nursery stock. With the shrinking arsenal of plant protection products, the development of new integrated pest management (IPM) programmes is paramount to control this challenging pest.

## SCENT SEDUCTION FOR PEST REDUCTION?

Pest monitoring by trapping is an essential part of any IPM programme. Experiments at Harper Adams University on monitoring adult vine weevils have tested a range of traps and have found the most effective is the 'Chemtica vine weevil trap' (not currently available in the UK). Leading on from this, later experiments investigated whether Chemtica traps baited with plant material were even more effective, due to the odour released from the leaves.

Baited traps contained cut leaves of the desirable vine weevil host plants *Euonymus fortunei* or yew inside a mesh bag. Vine weevils were released into tents containing both unbaited and baited traps. The weevils could smell the cut leaves but not eat them if they entered the traps. It was revealed that weevils were more attracted to the traps containing cut foliage, in comparison with those containing no foliage at all, suggesting they find the cut leaves odour very alluring.

Interestingly, before release, the weevils were fed on either *Euonymus* or yew leaves, to condition them to the two food sources. Weevils showed a preference towards the leaves they had been fed prior to release. This revelation indicates that future traps containing lures should take the previous feeding history of the pest into account.

In an earlier project (SF HNS 127), Alison Karley from the James Hutton Institute and David Hall from the University of Greenwich investigated how vine weevils respond to the odour caused by the chemicals (volatiles) released into the air from cutting the leaves of *Euonymus*. Gas chromatography (GC) coupled to electroantennographic recording (EAG) was used to see how the antenna of a vine weevil responded to these volatiles.

Up to 20 plant volatiles invoked a response. A volatile called cis-jasmone generated a particularly strong response. This is a well-known signalling compound which has been shown to both attract and repel various other insect species. Weevils are also attracted by the scent of other weevils' frass, so identifying these attracting volatiles could improve weevil catches. Ylang-ylang essential oil contains many volatiles found within weevil droppings, and in EAG experiments weevils respond to 16 volatiles found within this oil, including linalool, caryophyllene and germacrene D. The volatiles identified in this work are candidate attractants that may help to develop an artificial lure for vine weevil.

## SUB-LETHAL EFFECTS TO DETER INSECTS?

Many growers use nematodes for the control of vine weevil larvae, but control of adult weevils still relies heavily on foliar insecticide sprays. AHDB project SF HNS 112 showed that the IPM-compatible pesticides pymetrozine (Chess WG) and indoxacarb (Steward) gave useful control of adults. However, the approval for pymetrozine will expire in January 2020, and when this work was undertaken,

Steward only had an EAMU for use on outdoor ornamentals, so there was a need for alternative IPM-compatible treatments.

Besides killing weevil adults, some insecticides and biopesticides could provide 'sub-lethal effects'. Such products don't completely kill the insect but can result in abnormal behaviours, such as stopping the adults feeding, or inhibiting egg hatching. Experiments at ADAS Boxworth explored the lethal and sub-lethal effects of foliar sprays on adult vine weevils feeding on *Euonymus fortunei* leaves. Treatments were either applied directly onto vine weevil adults or onto detached leaves on which adults could feed.

Unfortunately, none of the treatments killed the adult vine weevils or reduced the leaf area consumed, relative to the water control. However, a direct contact spray of pymetrozine (Tafari) slightly reduced egg hatch compared with the water control. Furthermore, a direct-contact spray of a high application rate of the parasitic nematode *Steinernema carpocapsae* (Nemasys C) led to the weevils trying to avoid contact with the nematodes, but only on the day of application. The coded insecticide AHDB 9933 resulted in weevils lying on their backs or hiding under leaves for 2–3 days, after which they recovered and behaved normally. The biopesticide azadirachtin (Azatin), which suppresses feeding in the case of some insects, led to no reduced weevil feeding during these experiments. Research will continue to investigate the sub-lethal effects of biopesticides and whether the behavioural changes they cause could result in less crop damage.



“ This is the first time that plant volatiles have been used successfully to increase trap catches of vine weevils ”





## CAN WE RELY ON COLD-TOLERANT FUNGI?

The commercially available product, Met52 bioinsecticide, contains the parasitic fungus *Metarhizium brunneum* (*anisopliae*). This fungus requires warm temperatures to be effective. Gill Prince and Dave Chandler at Warwick Crop Centre demonstrated that this fungus has an optimum temperature of ~27°C and isn't effective below 15°C, making it more effective when used during spring potting.

As a result, an investigation commenced to try and identify 'cold-tolerant' fungal strains for use against vine weevil larvae. The two most promising fungal strains germinated and grew at low temperatures but showed lower virulence than that of Met52, offsetting any benefits of activity at lower temperatures.

This research has highlighted the need to use several different IPM practices for effective vine weevil control. This includes the use of traps and potential lures for monitoring adults, and the use of parasitic nematodes for control of larvae. Biopesticides that result in abnormal behaviour and cold-tolerant fungi are showing strong potential, and research will continue to explore these practices. With the shrinking availability of plant protection products, research that strives towards the development of robust IPM programmes is crucial for control of this highly detrimental pest.

**AHDB project code:** HNS 195

**Lead researcher:**  
Jude Bennison

**AHDB contact:** Wayne Brough

- **Chemtica traps are the most effective for trapping**
- **Baited traps containing cut leaves of *Euonymus fortunei* or yew leaves increased trapping rates**
- **Future traps should take the previous feeding history of the pest into account**
- **Biopesticides could provide 'sub-lethal effects' that result in abnormal behaviours of vine weevil**
- **Insect-pathogenic nematodes are effective for the control of vine weevil larvae**
- **The use of several different methods within an IPM programme is the most effective for control**



# FASTIDIOUS FACT-FINDING FOR *XYLELLA FASTIDIOSA*

*Xylella fastidiosa* is one of the world's most damaging plant bacterial species. The magnitude of its threat to native plants and cultivated crops has fostered a culture of global collaborative research, recently fortified by a multi-million-pound injection of UK public funds

The bacterium, which affects at least 500 plant species, can cause leaf scorching, wilting, stunting, dieback and death. It has wreaked the most havoc in warmer climates (especially, in the Mediterranean and South America), but isolated cases have been seen in northern Europe – although, its presence has not been detected in the UK.

As prevention is always better than cure, a new project, 'BRIGIT', focuses on early detection and management of the bacterium in the UK. The work is centred on four areas of activity:

## 1. Awareness raising

The project team will raise awareness of *Xylella* to help make sure that any UK outbreak is identified quickly, so it can be contained and eradicated.

## 2. Enhanced diagnostics

Rapid and accurate diagnosis of *Xylella* is central to its effective management. Sampling techniques will be improved and more reliable, sensitive and specific tests will be developed. How plants become infected, and how quickly infection takes hold and spreads, will also be investigated.

## 3. Insect vectors

The bacterium is transmitted (vectored) by insects that feed on the contents of the xylem (water-transporting plant tissue). Records of the geographical distribution, abundance and movement of UK vectors will be made. The meadow froghopper will be monitored most closely, due to its relative abundance and its association with transmission on the continent.

## 4. Movement modelling

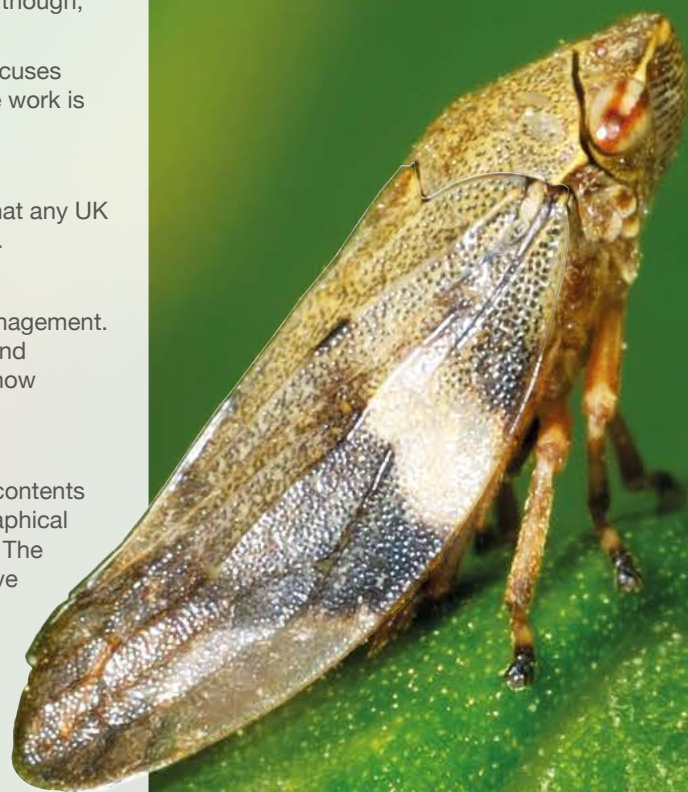
Knowledge of the bacterium, its vectors and the plant trade will be used to model potential disease movement. The points in the trade network where *Xylella* is most likely to enter, establish and spread will be identified. This information will allow biosecurity measures, and surveillance and control strategies, to be improved.

BRIGIT will establish how *Xylella* might be introduced and spread in the UK. Through working with the public, industry and policymakers, the work will develop the management solutions to put the UK in the best position to deal with the bacterial threat.

## ABOUT BRIGIT

BRIGIT is funded (c. \$0.5 million) by the Biotechnology and Biological Sciences Research Council, with support from the Department for Environment, Food and Rural Affairs and the Scottish Government.

The AHDB-funded research project, CP 178, looking at genetics for novel control measures for *Xylella*, complements the work in the project.





# MAJOR SHAKE-UP OF WEED INVESTMENT REQUIRED

## What will the future of weed control look like for UK horticulture and agriculture?

The way the UK invests in weed management needs a radical rethink, if weeds are to be kept below economically damaging levels. This was one of the key findings from a major cross-sector review, which also concluded that the industry is in danger of forgetting lessons from the past.

Commissioned by AHDB and BBRO, the review explored weed management in horticulture, cereals, oilseeds, potatoes, sugar beet, legumes and grassland systems. Despite decades of research investment, the authors warned that a great deal of knowledge, especially on basic weed biology, is at risk of being lost to the industry, simply because essential reference sources are not being archived effectively.

Joe Martin, AHDB senior crop protection scientist for weeds, said: “The UK has been at the forefront of weed research in the post-war era, laying the foundation for management. However, the legacy of this research is being eroded. Key reference sources, such as those published by Defra and its predecessor, MAFF, are gradually being lost.”

In addition to identifying, protecting and translating weed management information, the ADAS-led review team highlighted that information can become trapped within high-science, peer-reviewed journals. As a result, it recommended that a mechanism be identified to get essential information out to farmers and growers faster.

The horticultural sector was praised for being at the cutting edge of weed management. Innovation was more likely to arise from this sector because of the high-value nature of its produce and the extreme

pressures it faced to reduce dependence on plant protection products. However, it was felt that a more coordinated cross-sector investment would help fast-track innovation, with proof of concept established in horticulture first, prior to wider industry testing.

A review of global weed management tactics culminated in one of the most comprehensive assessments of non-chemical control methods to date. Mechanical, electrical and thermal weeding techniques were found to have great potential. Genomic approaches, to disrupt weeds and to develop herbicide-tolerant crops, were also earmarked as avenues of exploration.

### ‘KNOWLEDGE-INTENSIVE’ APPROACH

The future of weed control is likely to require a far more ‘knowledge-intensive’ approach, according to the review’s authors. This is because weeds need to be tackled across the whole system, rather than within individual crops. Such system approaches will see a greater dependence on the use of cover crops, minimum cultivation systems, inter-row management, inter-cropping, drone technology and weed maps. This provides the framework for an integrated strategy that has to be the future of weed control in all crops.

Lynn Tatnell, one of the review’s authors at ADAS, said: “An in-depth knowledge of the life cycle of weeds is needed to make the most out of non-chemical control methods. Planning and patience are required too – the solutions need time, with results being seen across the wider rotation and not just within one season.”

Investment in weed monitoring also needs to be sustained to allow growers to react to population changes. This includes the funding of basic research to investigate, for example, how weeds spread (e.g. via organic materials) and how herbicide-resistant populations can be tracked and managed.

Currently, herbicides are the main method of control across cropping sectors. As chemistry will continue to play an essential role, it was recommended that substances to support it be developed, such as adjuvants and soil stabilisers. Improved targeting of herbicides was also cited as key, including the development of weed thresholds for patch spraying. Alternative chemistry, including biopesticides, was also considered to have strong potential, especially in horticultural crops.

### FUTURE DIRECTION

The review has provided its funders and the wider industry with the comprehensive information needed to coordinate investment through a targeted programme of research and knowledge exchange. AHDB has recently committed to support a coordinated programme of activity on the integrated management of weeds over the next five years.

Joe Martin said: “AHDB has to balance many priorities. Due to the strategic importance of weeds, the green light has been given to develop the next phase of investment. This will involve working in partnership with industry to develop cross-sector programmes of work.”

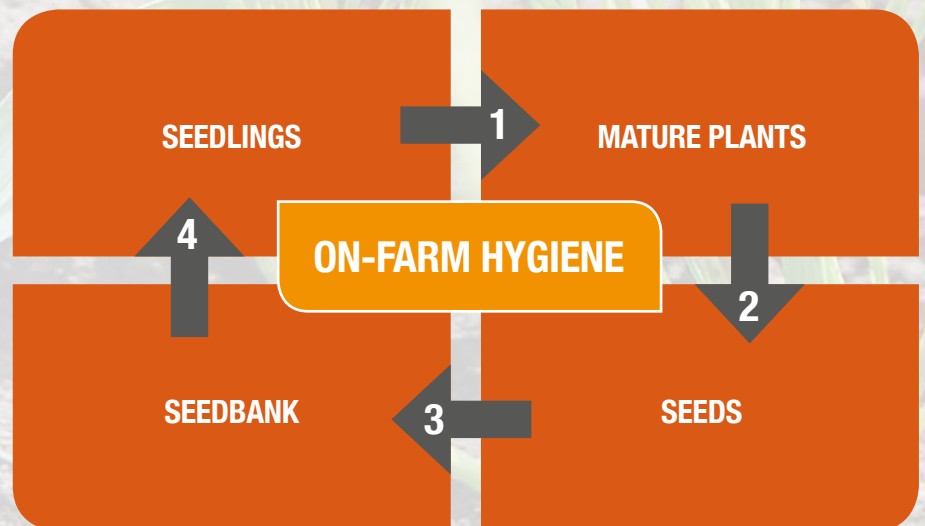
**The full review can be accessed via [ahdb.org.uk/weedreview](http://ahdb.org.uk/weedreview)**

The ‘Weed control options and future opportunities for UK crops’ (project number CP 182/1807258) was led by ADAS. The work was funded by a contract from AHDB, BBRO and cash and in-kind contributions from other partners. The project had wide industry support and involved five manufacturers, three distributors, technology providers, key crop experts and CRD.



The use of non-chemical weed-control approaches requires a good understanding of basic weed biology. To target management, the life cycle of weeds can be split into four main components.

1. Kill weed seedlings
2. Stop seed set
3. Prevent seed return
4. Deplete seed bank





# CAN WE MEET THE ENERGY DEMANDS OF AUTOMATION?

With the rise in robotic solutions in horticulture, our GrowSave project considers how this might impact your energy use and costs



As more and more technology is introduced to the horticultural world, energy demand is also very likely to rocket up.

Of course, automatic solutions are already being used across many processes in horticulture, alongside their human operators – salad packing lines and ornamental pot spacing, for example. Harvesting is the next challenge for the industry: it's one of the most labour-intensive areas.

Robotic solutions to picking field vegetables like lettuce are in their early stages. At the moment, robots harvest considerably slower than their human counterparts. A study by University of Cambridge achieved a robotic harvest rate of just one head of lettuce every 30 seconds, which is much slower than human labour.

Other industries do manage, however. Retail giant Amazon used to pack all of its deliveries by hand, but now has machines that can pack boxes up to five times faster than humans.

If the industry manages to improve the speed and operating efficiency of harvesting robots, they're likely to be able to operate for considerably more hours than humans.

But an increased robotic solution to the labour shortage would have high energy demands. How might we meet this demand?

### ON-SITE GENERATION

It is likely that energy generation, and potentially storage, will have to become a factor on many sites – especially where the local electricity network is constrained.

The type of generation will have to be carefully considered, depending on when electricity is required and whether the source matters. For example, solar photovoltaics (PV) might be located on site. However, if your automated processes take place consistently throughout 24 hours, then this wouldn't be an ideal match. Conversely, an anaerobic digester (AD) or natural

gas engine could be generating at a consistent level all day long, satisfying the on-site requirement for electricity. A site with continuous generation, like an AD plant, would be able to make the most of cheap, on-site generated electricity all day long.

The fluctuation in energy production from some renewable generators has limited its uptake so far: a site needs to be able to utilise as much of the energy generated as possible rather than export it to the grid to make it worthwhile, even if that production is dependent on the weather.

“Regardless of the capital cost, if the operation can't be achieved economically, then the benefits of automation will not be realised”

### LOCAL NETWORK

Local electricity networks are creaking at the moment and getting connected to the grid is difficult and costly. This might make the case for on-site generation all the more attractive. Many areas that are constrained are being controlled through active network management (ANM).

In some cases, demand side response (DSR) is used to control loads on the local network. For example, a site might be asked to switch off supplementary lighting if demand is too high.

Energy networks can also be managed actively to control the flow of energy into the network from local generators. If the network is strained and generation is too high, then those generators can be curtailed. Those that were given their grid connection capacity most recently would be forced to turn their generation off first, then the next most recent grid connection and so on until levels of export reach sensible levels again.

### ENERGY STORAGE

Energy storage could well feature in the industry's solution to increased demand. We're seeing similar developments in the electric vehicle world, where many electric vehicle charging stations around the UK are coupled with battery banks. The battery banks are charged steadily from the energy grid but can also deliver enough power to charge cars quickly. This puts less pressure on the grid connection and still supplies the demand required.

The same kind of system could also work for charging horticultural robots and meeting other on-site loads around the clock.

### ECONOMICS

At the end of the day, operating a smarter growing facility will all be about cost – both capital and operational. Regardless of the capital cost, if the operation can't be achieved economically, then the benefits of automation will not be realised.

As the technology develops, it may well be more economic to time robotic operations to happen when there's either cheap import electricity (like the overnight economy tariffs available from many domestic suppliers) or when on-site electricity is generated.

### SHOULD YOU AUTOMATE?

Before embarking on an automation project, businesses need to consider how much energy the operation would need, both at peak and standard running. Is there electricity capacity on site to run it? Where would the cheapest electricity come from? Is on-site generation an option? How often does the automation need to operate? And what is the cheapest time to run the robots?

The key point is: don't neglect the cost of operating your automation. Energy is expensive, and annual running costs can be much more than the capital expense of installing the robots.

You can find out more about energy technology and costs – visit our website: [growsave.co.uk](http://growsave.co.uk)



# MOVING FROM GOOD TO GREAT

**How can playing with Lego boost labour productivity in horticulture?  
Delegates at the first Strategic SmartHort Centre,  
held this summer, found out**

## SMARTHORT

When was the last time you played with Lego? Growers attending the first Strategic SmartHort Centre workshop were willing to embrace their inner child to play a game with Lego bricks to simulate a horticulture business, with impressive results.

The exercise introduced the group to some of the key principals of LEAN: pull systems to make the supply chain more efficient, visual management aids to trigger when to order new stock and testing a reorganised workspace to potentially reduce the amount of time wasted walking and waiting. The simulated production lead time improved by almost 70%.

And while this was just a game, it helped to re-enforce the message that small changes in a production system to reduce waste can have a significant impact.

Neil Fedden of Fedden USP, who are leading the SmartHort Strategic Centres, said: "LEAN isn't just about seismic shifts or completely overhauling your operation, it's about lots of small incremental improvements across the whole operation. It's about understanding where the true value is – that is what your customer is willing to pay for. Everything else in your process could be considered waste and LEAN helps you to reduce that through small changes."

Volmary, Wisbech, is acting as a 'live case study' as part of its role as a SmartHort Strategic Centre host. Volmary is an independent, growing family business which propagates many millions of bedding plants, perennials, shrubs, vegetables and herbs. At peak production at the Wisbech site, sticking alone is over 2 m cuttings a week. Seventy per cent of its business takes place in just three months of the year. Dealing with these seasonal peaks, with a challenging labour market (30% of seasonal staff offered employment last

year didn't turn up to work), was one of the reasons Volmary signed up to the SmartHort programme.

Throughout the year, we will be working with Volmary to introduce LEAN techniques to two production areas: potting and sticking. The processes were analysed using techniques from the LEAN toolbox by growers attending the workshop. They counted, timed and paced out the operations to create a process map and used a 10-second interval observation technique, called Activity Sampling, to capture what actually happens real-time in the process over a 20-minute period.

One of the eye-opening moments was following the 'journey' of a cutting. The only element of the process that adds value – the part the customer is willing to pay for – is sticking the cutting in the compost-filled tray, which takes just one second to complete. Within their current process, the lead time for the cutting from refrigeration to plug is 7,016 seconds.



### Typical LEAN projects for horticulture

- Reducing set-up times with production that involves lots of different varieties
- Reducing the lead time to dispatch
- Coping with seasonal spikes
- Improving communication with back-office and production staff in complex changing businesses
- Organising workplaces with expanding volumes with spaces that aren't able to also grow



Neil said: “The percentage of value added within a process is always extremely low, but it’s an incredibly useful tool to make people think about their production in a new way. We can now ask where in those other 7,015 seconds is there potential to reduce the wasted time.

“The tools give you an objective data set that you can analyse. It’s only when you stand back and watch that you identify the problems; you often can’t see issues when you work with them every day.”

The next step for Volmary is to put an action plan together based on some of the areas the group identified. Suggested changes ranged from introducing height-adjustable individual working stations, having different colour trays for different cutting types and bringing in a portable fridge to reduce the walking time from the glasshouse bay to where the cuttings are stored.

“It’s only when you stand back and watch that you can notice problems; you often can’t see issues when you work with them every day”

Another key area identified was how to free up key personnel to invest more time training and optimising new agency staff. There can be a 25% variance in the number of trays of cuttings the best and worst workers can achieve, so helping to close that gap could make a big difference.

Shirley Barber, who supervises sticking production at Volmary, said: “As a business, we are continuing to grow. We have previously identified some improvements that could be made, even before this workshop, but the tools

we have been given today help us to evidence the cost benefit of investing to make those changes.”

The cost/benefit analysis of the potential improvements identified in a process is a critical part of LEAN. While introducing an automated conveyor belt could help to reduce the amount of time staff are walking back and forth, will the investment offset that labour cost? Using a prioritisation matrix – another LEAN tool – businesses can identify where the quick wins and biggest impact can come from.

If you’re interested in finding out how to implement LEAN into your business, contact [grace.emeny@ahdb.org.uk](mailto:grace.emeny@ahdb.org.uk) or visit [ahdb.org.uk/smarthort](http://ahdb.org.uk/smarthort) where resources from the workshops will be available.



# CATAPULTING THE WAY TO AUTOMATION

Three businesses are collaborating to develop an autonomous guided vehicle that can cope with the challenges of glasshouse production. Debbie Wilson, head of knowledge exchange at AHDB, explains more

The ultimate solution to the shrinking pool of available labour in horticulture is to automate. Our survey in 2017 showed over 84% of businesses were planning to invest in automation or robotics to offset labour challenges. However, end-to-end automated processes are a distant vision for many reasons. Two of the main barriers include the poor fit of 'off-the-shelf' solutions to the diverse production systems growers' work with and an unfavourable cost/benefit ratio in the current trading climate.

Growers will be familiar with several universities and commercial companies working to develop more automation and robotics for use in horticulture. But, as we heard at the SmartHort 2019 Conference back in March, the size of the challenge exceeds the current capacity of robotics expertise working in this area.

Our pioneering SmartHort Automation Challenge fits this landscape perfectly. The project invited growers to submit proposals for the chance to work collaboratively with leading automation experts from the WMG department of the University of Warwick. The outcome would be the delivery of a prototype automated solution to an area of their production system.

We were not disappointed by the response to our invitation. We received 22 great project submissions, with ideas from across the different horticulture crop sectors. These ranged from correcting the position of pots on potting lines for smoother operation, to developing a 'smart' irrigation boom for the precision application of water and pesticides. Solving all of these problems would improve labour productivity for each business.

## THE WINNING PROJECT

Although the original plan was to work with just one of the businesses to deliver a prototype solution in this pilot initiative, we are pleased to have been able to widen the benefits.

WMG is currently working with three businesses: Crystal Heart Salad (lettuce propagators, Yorkshire), Valefresco (salads, Worcestershire), and WD Smith & Son (bedding plants, Essex). The project will develop an autonomous guided vehicle (AGV). This will address a common issue of transforming on-site labour-intensive manual logistics to an automated system. We hope the solution could eventually be applied widely across horticulture.

Following fact-finding visits to each site, a feasibility study is underway to review the viability of existing commercially available AGVs to provide a solution. It will also identify commonalities and differences amongst the needs of the three sites and agree a base-level solution which will then be developed.

Data from each site is being fed into discrete-event simulation (DES) models to assess the likely return on investment. So far, none of the 13 off-the-shelf AGVs that the team think had the best potential to the challenge could be used without significant modification. The jury is currently out about whether it will be more effective to adapt existing AGVs or for the WMG team to build a completely new system. We currently expect the baseline price of a suitable AGV to be £30,000—£45,000; teasing out the value of the potential benefits will take more time.

## WMG AND CATAPULT

With a focus on the life cycle of automation in manufacturing, process control and embedded systems, the 30-strong group of engineers comprising the automation systems group is headed by Prof. Robert Harrison, who is leading this initiative, along with his colleague Dr Bilal Ahmed. The automation group sits in the WMG department of the University of Warwick, whose focus is on collaboration between academia, the private and public sectors to drive innovation in applied science, technology and engineering. The group is also a member of the Innovate-UK-backed High Value Manufacturing Catapult, also designed to bridge the gap between business and academia and, in this case, providing funding for our SmartHort Automation Challenge project.

The 2,500-strong cohort of postgraduate students at WMG will also be given the opportunity to work on the project ideas submitted by growers over the next 1–2 years. Many of these projects will also provide solutions that a wider range of businesses will benefit from, so please look out for future updates on this exciting project.

This is helping us to build the capacity of expertise that has the potential to help with the labour challenge that horticulture currently faces.

**To find out more about our SmartHort campaign and to follow the progress of the winning project, visit [ahdb.org.uk/smarthort](http://ahdb.org.uk/smarthort)**

SMARTHORT

WMG  
THE UNIVERSITY OF WARWICK

CATAPULT  
High Value Manufacturing





## PROFILE: CRYSTAL HEART

Crystal Heart is a greenhouse-based propagation business producing lettuce seedlings in trays.

Trays are currently moved by forklift trucks that can pick up, transport and set down 30 trays at a time. The picking up and putting down of the trays requires considerable experience and skill. However, the average travel distance can be several hundred metres, so a significant amount of time is taken travelling between locations in their 3.7 ha site, which involves little skill.

## THE VISION

To use autonomous guided vehicles to move trays between locations, maintaining a constant supply to a skilled forklift truck driver but eliminating the travel time.

Some of the challenges to implementing existing industrial AGV systems in a glasshouse system include:

- Humid or dusty environment
- Ability to work indoors and outdoors
- Travel routes constrained by greenhouse posts and doors
- Tray placement locations need to be dynamic, as laying down areas are progressively filled



# NEW ROBOTICS FUNDING TO TRANSFORM UK HORTICULTURE

**Agri-robotics in the UK has received a huge boost, thanks to a £6.4m investment in a new centre of excellence at the University of Lincoln. AHDB will be the main knowledge exchange partner. We spoke to Simon Pearson, Professor of Agri-food Technology Research, University of Lincoln, to find out more.**

## **Can you tell us about the new 'Lincoln Agri-Robotics' Centre?**

We have funding for a completely new group of 30 full-time robotics experts to deliver a step change in the development of technology for crop production. At the University of Lincoln, we are already working on projects in this area and this new centre will double the scale of our research.

Lincoln Agri-Robotics will be working on three grand challenges: crop harvesting, speeding up crop breeding programmes and forecasting and monitoring crops.

Although this funding is for three years, the centre is about a longer-term commitment by the University of Lincoln to deliver a comprehensive programme of agri-robotics research. We want to boost the number of agri-roboticists in the UK, while making sure we deliver work that directly impacts the industry.

## **How has the centre been funded?**

As part of the Expanding Excellence in England programme, Research England want to accelerate the development of key niche areas that would have an impact on UK industry in the future.

The agri-industry needs support to drive productivity, specifically labour productivity. One of the solutions for that is going to be the development of robotics and artificial intelligence (AI) and we have received £6,344,000 to drive this.

The investment is a share of the £76m modern Industrial Strategy fund, designed to keep the UK a world leader in science, research and innovation.

## **How will horticulture growers benefit from Lincoln Agri-Robotics?**

This is about driving industrial productivity, so, clearly, crop-picking robots are going to be a big focus. We'll also be looking at robotics for crop forecasting, autonomous vehicles around farm, sensing crop health and measuring soils. We see a large array of applications and the major beneficiary of this project will be horticulture.

The pain point for the horticulture industry is access to seasonal labour, so one research route will be looking at fruit pickers. The other area is about increasing intelligence in horticultural production, through things like monitoring crops, carrying produce around the farm and data gathering. You'll find robots for this area coming in first because they're easier to do.

For agriculture, we won't see lots of robots running around fields, but we will see robots helping to improve the selection of key crop traits to create more resilient varieties.

AHDB supported us in our bid for the funding and we want AHDB to be our main knowledge exchange partner to ensure the industry is benefiting from our work.

## **Will the research projects be near-market commercial technology or blue-sky concepts?**

We have a lot of near-to-market research happening here at the University of Lincoln. What we're missing in the UK is a pipeline of basic research that can

create the robotics of tomorrow. This new centre is about priming up the next generation of near-market research.

However, we want to see the impact through to growers' businesses and we'll be working closely with the industry to make sure our research is sustainable.

## **When is the work at the centre expected to start?**

We are busy recruiting for the new team at the moment, which is challenging. Worldwide, there are very few professors in agri-robotics, so we are looking to recruit people with general robotics skills to move into agri-robotics.

This centre is about developing new careers and establishing capacity for the future in a transformative area of research. We're up against big industrial companies, and robotics is a skill that is in demand from other industries, but we're creating something very new and exciting.

We're aiming to have the three professors in place by November and the work will progress from there.

## **How can growers get ready for robotics?**

It is paramount that there is close communication between us and growers. The type of robotics coming through might impact the way you invest, the type of varieties you grow and the systems you are going to use. The investment is going to be very high when you're in the implementation phase of robotics, so having a good understanding of the technology is going to be crucial for effective adoption.



## SMARTHORT

That's why we'll be working closely with AHDB to help that journey; adoption of technology is most effective when all partners understand the risks and opportunities.

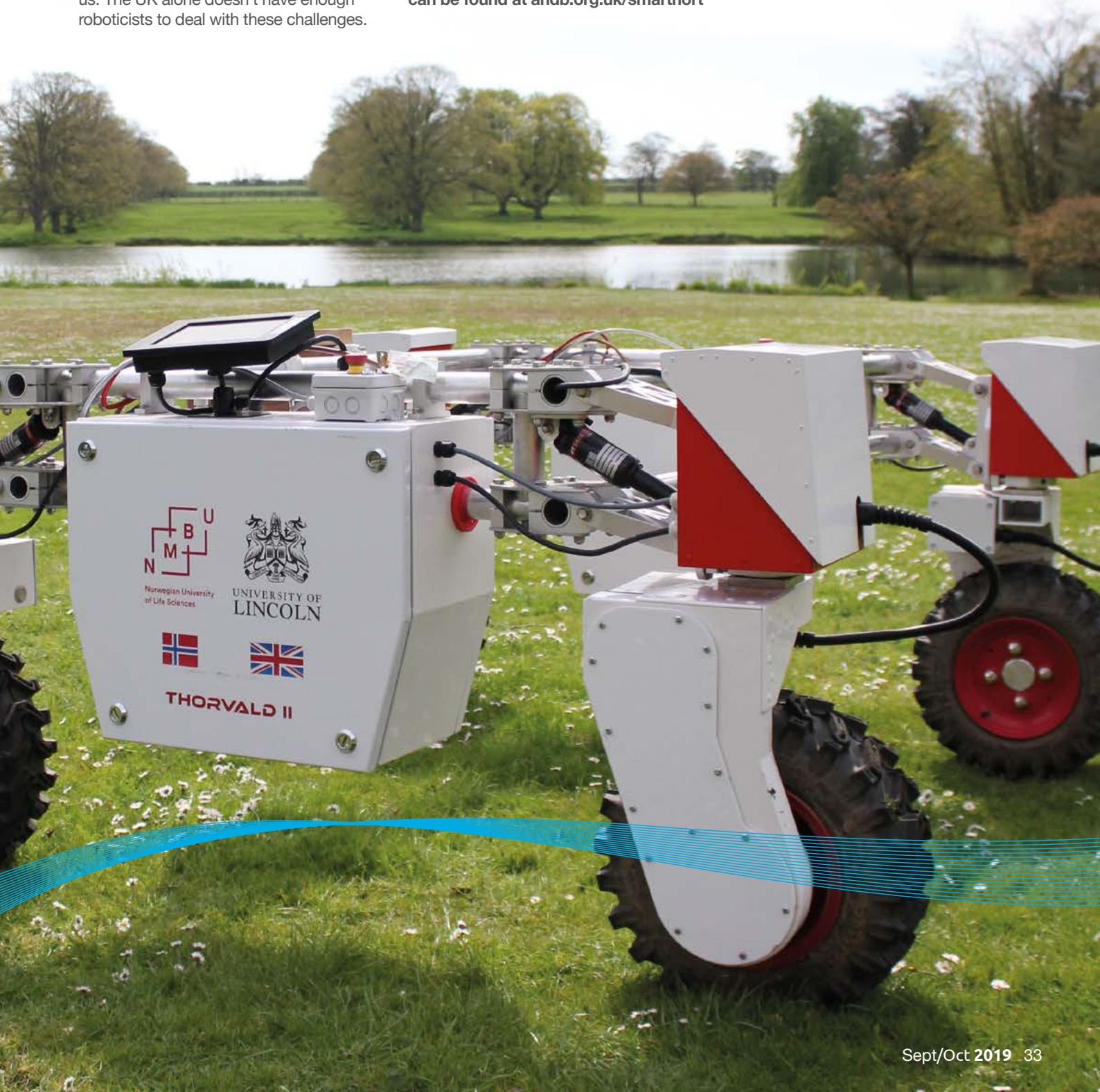
#### How will the centre work with experts internationally?

A significant part of the funding is for sabbaticals and to enable people to travel and come to the UK to work with us. The UK alone doesn't have enough roboticists to deal with these challenges.

The global picture is pretty grim too, so the only way we're going to move the dial is to get people to join up and create an international community.

**Anyone interested in finding out more about Lincoln Agri-Robotics can contact Prof. Simon Pearson on [SPearson@lincoln.ac.uk](mailto:SPearson@lincoln.ac.uk)**

**More information about robotics and automation development in horticulture can be found at [ahdb.org.uk/smarthort](http://ahdb.org.uk/smarthort)**



## THE WORKER'S PERSPECTIVE

**We asked two EU seasonal workers at G's Growers about their experiences in the UK.  
Here's what they said**

**NAME: SVETOSLAV TERZIEV**

**JOB TITLE: TRACTOR DRIVER**

**COUNTRY OF ORIGIN: BULGARIA**

I've been coming to the UK since 2010, primarily to earn money and I like the regular and transparent payments that we get from working in the UK.

When I'm looking for a job, it's important that the company has a good reputation, is reliable, gives me opportunities to develop and to have friends. Since I'm coming to earn money, the salary is very important. But my decision to work for a specific company also depends on the accommodation, where it is in the UK and access to towns and airports.

For me, a good workplace is about the working environment, the people working for the company and the management. There are things that companies can do to make it easier for foreign nationals to integrate and work in UK horticulture, like easy transport from an airport, proper planning for contracts with start and finish dates, longer contracts so we don't just come for a few months, good accommodation and help with transport to the UK.

I think the UK needs people like me. Brexit will affect the UK more negatively than people like me who are hard workers coming here to earn money, doing the difficult and low-paid jobs. Because of Brexit, though, we take home less money, plus the prices here are higher and so we have to spend more while we're living in the UK.

When the market is open in Europe, if we're not wanted or welcomed here because of Brexit, then people like me will look for other places to work.

**NAME: IRINEL PRUTIANU**

**JOB TITLE: RIG DRIVER**

**COUNTRY OF ORIGIN: ROMANIA**

The UK is a good place to work in horticulture and the money is good. I've been coming to work here since 2015.

When I'm choosing a company to work for, it has to be trustworthy and have a good reputation. I'm coming for seasonal work to earn money, so the salary is very important for me. It's also important to have good accommodation, good management, good working conditions and have easy access to the place of work. I keep coming back to the same company because, although it was the first company I came to, I like it, have learned a lot of things and want to help.

For me, a good workplace has regular and clear payments, good management, health and safety standards and good and reliable colleagues. To help foreign nationals like me working in the UK, companies could organise language training, help with transport to, and in, the UK and provide or help with accommodation.

Despite the UK's EU referendum vote in 2016, I'm not afraid I'll be without a job, because I can see that companies like the one I work for need workers like me. Brexit won't change how I feel about the UK and I'd like to come back here even if the UK does leave the EU because I like the pay, the working environment and the experience.

However, the vote has meant that I take less money home now than I used to. I need to save more, because everything is more expensive in the shops now after the value of the pound dropped.

“For me, a good workplace has regular and clear payments, good management, health and safety standards, and good and reliable colleagues”





### STAFF MANAGEMENT CHECKLIST

- ☐ Can staff easily reach your location when they first arrive in the country?
- ☐ Can you provide living conditions that will support them after a day of physical labour?
- ☐ What are the language barriers? Are there any local providers of English language training?
- ☐ Are your key health and safety messages in the right language? Can they be easily understood?
- ☐ Is your induction plan understandable? Do you use standard operating procedures? If so, are they in the right language?
- ☐ Does your supervisor speak their language?

Tess Howe, from AHDB's industry skills development team, said: "Seasonal labour is hard to find, especially of good quality, so any employer now should be looking at how they stand out. That will be by offering reasonable accommodation, good terms and conditions and working to minimise language barriers. Teaching English can have a massive impact on communication within the team, helping morale and productivity, and for many it will be a transferable skill, so they will be keen to learn."

Find out more at [ahdb.org.uk/skills](http://ahdb.org.uk/skills)



# Your panel needs you!

**We are seeking new voices to represent horticulture.**

**Become a panel member and help guide our work to address the issues affecting your industry.**

We are currently seeking specialists in the following areas or locations:

Protected edibles and mushrooms	Herbs – 2 vacancies
	Mushrooms
	Propagator (edible and non-edible)
	Organics
Protected ornamentals and bulbs and outdoor flowers	Bedding plants (pack and pot grown) – 3 vacancies
	Pot plants
	Protected and outdoor cut flowers
	Protected cut flowers
	Daffodils – Scotland
Hardy nursery stock	Heathers and alpine
	Shrubs and climbers – 2 vacancies
	Herbaceous perennials, alpine and grasses – 2 vacancies
Soft fruit	General production - 4 vacancies
	Rhubarb
Tree fruit	Culinary apples
	East Anglia
Field vegetables	Vegetable propagation

**Apply on the form enclosed with this issue of the Grower or online at [ahdb.org.uk/horticulture-panels](http://ahdb.org.uk/horticulture-panels)**