AHDB

The GROWER

THE TECHNICAL JOURNAL FOR HORTICULTURE

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BECOMING RESILIENT TO WATER RISKS:

How to tackle drought issues this summer

BACK TO BASICS

Which everyday household items can you use on your crops?

INTO THE WILD

What effect does the surrounding landscape have on the pollination of your crop by bees and how can you improve it?


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ACKNOWLEDGEMENTS

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One point is awarded per annum for BASIS registered members for reading this magazine. From 1 June 2018 to 31 May 2019, please quote reference CP/67833/1819/j

In the previous issue of The Grower (issue 244 – Feb/Mar 19) we made an error in the 'Know Your Enemy' article on page 19. The text and bottom image should have been credited to Rob Jacobson, RJC Ltd., while the top image belongs to Bioplanet, Italy. We apologise for any issues caused.

This publication is brought to you by AHDB

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NECESSITY IS THE MOTHER OF ALL INVENTION

If we want to solve our labour issues in horticulture, we need to look beyond the farm and appeal to innovators and tech-savvy experts worldwide.

SmartHort, created by AHDB for growers, aims to boost labour productivity in horticulture through technology, automation and labour management techniques. It is a pioneering programme of events, training and an online hub that brings the latest science, information and intelligence on agri-automation and technology from around the world into one easily accessible place.

Whether it's genetics, production and harvesting systems, management systems or the products we grow, SmartHort's international community of growers, tech firms, innovators and researchers will fuel an exchange of ideas and knowledge to drive a transformation in food and plant production.

Of course, it's not as simple as the technology being available one day and growers adopting it the next. There are many reasons why people haven't been replaced with machines – the availability of technology for one. Professor Simon Pearson, Head of Agri-Robotics at the University of Lincoln and a speaker at AHDB's SmartHort 2019 Conference, says that, while the innovation is developing at pace, we're still ten years away from the industrial scale needed to replace people with robots.

The SmartHort community that AHDB is building will connect growers with the people and companies that can make things happen. We want to facilitate partnerships that growers never thought possible to help advance the uptake of technology in UK horticulture. From quick wins that can instantly transform the way you do things, to the game-changing investments that will revolutionise a business.

SmartHort will also offer live updates and insights on the research projects growers are currently investing in through their AHDB levy – from PhDs on grower reprogrammable robots to vision systems for fruit picking.

AHDB's SmartHort conference was live-streamed so that every grower can witness the turning point in UK Horticulture's technological revolution. You can rewatch the event by visiting **ahdb.org.uk/smarthort-conference-2019**

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CONTRIBUTORS

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

ANT SURRAGE

Ant grew up working on his family's ornamental nursery, starting with very basic jobs and working across a range of roles. He then attended the University of Worcester to study biology, specialising in plant genetics and cellular regulation in his final year. Now Ant works as a Technical Development Specialist for Fargro, working on the development of their range of national exclusive products, including an array of biopesticides, conventional chemistry and smart sensing technology.

Ant looks at the importance of your microclimate for biopesticides on page 22

ANGELA BERRIE

Angela joined ADAS in 1979 as plant pathologist, based at Wye and worked as an adviser and researcher mainly on fruit crops. In 1993 she moved to East Malling Research as a Research Leader in Plant Pathology, specialising in aerial diseases of fruit crops with special interest in epidemiology, and applied research on integrated control of diseases of all fruit crops. Current and recent research and development projects have concentrated on reducing fungicide inputs into a range of fruit crops by developing managed approaches to disease control and exploring the use of biofungicides and alternative products.

Angela looks to reduce spray numbers on page 24

NICOLA DUNN

Nicola is an Environmental Chemist working in AHDB's Resource Management Team with a specific focus on water. She is currently building a cross-sector programme of research and knowledge exchange on all things water-related, such as water quality and water resources. She also manages some carrot and brassica research projects for AHDB Horticulture. Nicola joined AHDB in 2017 after seven years with the National Farmers' Union working on environmental policy issues including water quality, NVZs, nutrient and soil management and waste. She is interested in the translation of research into on-farm change, and ensuring a balance between environment and agriculture.

Nicola helps you to prepare for drought on page 28

IN **BRIEF**

WATCH SMARTHORT 2019 ONLINE

The popularity of this year's SmartHort 2019 Conference (6-7 March), which examined the potential of new technologies in light of labour shortages in horticulture, saw tickets for the event sell out. However, growers who missed it can view videos from the live stream online at: **ahdb.org.uk/smarthort**

NEW EAMUS SECURED

AHDB's Crop Protection team have secured two new EAMUs. The EAMU for 'Amylo X WG' will be a boon to growers of ornamentals and Brassicas looking to tackle *Botrytis cinerea* and Sclerotinia in particular, while 'Decis Protech' can be used to combat, among other things, caterpillars and thrips on strawberry crops and aphids on runner bean and celeriac.
For more information, visit: **horticulture.ahdb.org.uk/latest-eamus**

EMERGING THREAT FROM NEW TOMATO VIRUS

Tomato brown rugose fruit virus has now been confirmed in Germany, posing a potential risk to UK production.

We have issued information to help you identify the symptoms and introduce hygiene measures in anticipation of its arrival in the UK. Visit **ahdb.org.uk/knowledge-library**

MICROBIALS WEBINAR

Growers interested in finding out more about microbials had the chance to hear from experts by joining our Microbials Webinars in March. The webinars; Managing contamination risks in fresh produce production, Disinfecting irrigation water for fresh produce and Challenges of chlorate testing are available to view online. Visit: **ahdb.org.uk** and search 'microbials'

ANOTHER GREAT LOSS **FOR CROP PROTECTION**

After clocking up an impressive 40 years in the industry, AHDB's Crop Protection Senior Scientist Vivian Powell has announced that she will be retiring at the end of April. She originally began work as an Assistant Scientific Officer, working on glasshouse crops at Stockbridge House Experimental Horticulture Station on 30 April 1979.

Vivian joined AHDB (when it was known as HDC) in 2001 and has overseen a number of difficult challenges that the farming and agricultural industries have faced, not least the recent loss of a number of key actives. "Recently, the change from risk-based assessments of actives to hazard-based has seen losses of numerous important actives and products over the years. Integrated pest management is increasingly important and the work of AHDB, through SCEPTREplus and other initiatives, will, I hope, provide growers with much-needed tools to continue sustainable production methods," explained Vivian.

Having made a number of good contacts and better friends over her four decades in the industry, Vivian says she will miss the people the most. "With MAFF, HRI, HDC and AHDB colleagues, external contacts with growers, consultants, panel members, grower associations, crop protection companies, researchers, contacts from overseas and CRD personnel, I have made many friends and I really hope that they will keep in touch when I am no longer working in the industry," she said.

Bollette Palle Neve, Crop Protection Scientist, who many growers

will already be familiar with in their interactions with AHDB's Crop Protection team, said, "Viv has been involved with the Minor Use programme from the start and always had the growers at the heart of what she did. She has an incredible knowledge of the industry and has shown unwavering determination and commitment when working on behalf of the growers."

Another long-time colleague and AHDB's Head of Crop Health & Protection, Jon Knight, said of Vivian's stellar career, "Viv has made an extraordinary contribution to the horticulture industry over many years and her almost encyclopaedic knowledge of products and process has been invaluable in keeping a supply of suitable crop protection products for the many crop sectors.

While Viv's work has always been as part of a team, her ability and willingness to work with both the producers and crop protection industry has been beneficial on all sides. Thankfully she has willingly passed on the accumulated knowledge and wisdom to Bolette, who we hope will continue the excellent work."

EVENT **INSIGHT**

MUSHROOM CONFERENCE 2019

DATE: 25 April 2019

LOCATION: Kenilworth, Warwickshire

The Mushroom Conference 2019 aims to bring together the mushroom industry during a time of major change, uncertainty and opportunity. Organised collaboratively with BGA, industry representatives and AHDB, we have gathered guest speakers to provide a combination of technical and commercial presentations.

Confirmed speakers so far include: Ralph Noble, who will be speaking about his work on bacterial blotch; Helen Grogan (Teagasc), who will speak about understanding Mushroom Virus X; Jason Day (G's), who will present on the current mushroom market and trends; and Lee Abby (NFU), who will have the latest from the NFU on labour and Brexit and what this means for the industry.

This event will also provide delegates with the chance to find out more about the re-establishment of the Mushroom Grower Group. With a networking dinner organised for the evening before (£6 supplement), a varied agenda on the day and the chance to view exhibitors, this event will provide a valuable opportunity for networking and gaining updates and insights from across the mushroom industry.

Visit **ahdb.org.uk/events** for more information and to book.

PLANT HEALTH IN A GLOBAL ECONOMY

Kim Parker, AHDB Crop Protection Scientist, reports on novel ideas for crop disease management emerging from the recent International Congress of Plant Pathology in Boston, USA

Every four years, researchers from around the world meet to share knowledge of the biology and management of plant diseases. A wealth of technology is emerging that could be harnessed to limit new disease threats and to minimise the economic impact of existing diseases on UK horticultural crops while also reducing reliance on routine fungicide usage.

LIGHT MATTERS

Mark Rea from the Lighting Research Center in New York described the growing interest in use of LEDs (light-emitting diodes) to manipulate plant production (flowering, plant size, nutritional properties and flavour) during the daytime as well as controlling plant pathogens at night. A key example was use of LEDs to control basil downy mildew through use of red light at night to prevent the fungus from producing spores while also enhancing yield.

He also described the use of UVB light applied at night for suppression of strawberry powdery mildew, illustrating field-scale application being trialled in the USA.

SMART TRAPPING

The 'Jet Spore Sampler' is being tested in Australia for mobile surveillance of several significant fungal pathogens threatening the grains industry. This device collects spores directly into DNA extraction tubes and is mounted to a vehicle's roof-rack. Recent work at Rothamsted Research (UK) has taken air sampling for disease forecasting a step further by development of automated spore traps with wireless reporting. Amplified DNA of up to three different pathogens can be measured by fluorescence and the results sent out via mobile telemetry. It is already being used to forecast potato blight risk. These tools are shifting crop management to targeted approaches that can reduce numbers of spray applications while maintaining yield and quality.

SURVEILLANCE FOR ALIEN THREATS

Neil Boonham from Fera Science Ltd (UK), described the development of methods for the detection and surveillance of quarantine pathogens and pests that could be a threat to agriculture, forestry and natural ecosystems. LAMP assays can be used to detect a range of target diseases in horticultural crops, e.g. basil and lettuce, as well as new threats to hardy nursery stock, such as *Xylella fastidiosa*. The assays are versatile so have potential for use in a range of settings, such as seed-testing laboratories, in-field disease detection and plant import checks at ports of entry.

See more congress information at: apsnet.org/publications/Webinars/Pages/2018.aspx

INSIGHT INTO **AHDB PROJECTS**

MAKING MUSHROOMS A NO-FLY ZONE

Nathalie Key updates on the project aiming to control sciarid flies on mushrooms

SCEPTREPLUS

Sciarid flies are well-recognised pests of mushrooms, with the most common species in the UK being *Lycoriella solani* and *L. auripila*. As part of the SCEPTREplus second-year trials, the current control measures in place for sciarid flies were reviewed.

Biological control methods of sciarid flies include entomopathogenic nematodes. *Steinernema feltiae* is a more effective control than other species and research on mushrooms has shown that two reduced-rate applications of *S. feltiae* at 1 million per m^2 one week apart gave equal control of *L. auripila* as opposed to a single full-rate application at 3 million per m^2. These two reduced-rate applications are now recommended on the Nemasys M® label for mushroom sciarid fly control.

Chemical plant protection product Diflubenzuron (Dimilin Flo) is still approved and can give 90–95% control of sciarid fly in mushrooms.

Promising insect growth regulators have been shown to give effective control of Lycoriella ingenua on mushrooms when used as a drench in work conducted outside of the UK.

Joe Martin, AHDB Crop Protection Senior Scientist, commented, "Future experiments in 2019 should have benefit to many crops where control of these pests is seen as a priority and hopefully identify additional methods for control."

STOP THE ROT

Dawn Teverson reveals the latest on research into Allium white rot

FV 449a: Integrated control of Allium white rot

Allium white rot (AWR) is a disease of onion caused by the soilborne fungus *Sclerotium cepivorum*. In the UK, salad onions are the main affected crop, with estimates of 2–15% infection each year, equating to £7 million per annum in lost revenue. Heavy infestation of high-yield-potential soils has caused growers to relocate to less productive but AWR-free land, particularly onto lighter sandy soils. Rotation is not an option, as resting structures called sclerotia are produced, allowing the pathogen to persist in soil for up to 20 years. Chemical control is limited to a few off-label approvals (EAMUs).

The three-year project started on 1 March 2018. It aims to examine fungicides and biocontrol agents for the management of AWR and examine Allium products for their effect on sclerotial germination.

Furthermore, biofumigants will be tested for the ability to reduce AWR and basal rot (*Fusarium oxysporum* f. sp. *cepae*). Treatments that work will be combined as part of an integrated management plan.

Salad onions are being used as the test crop. Work is also being conducted to test Allium-derived compounds (e.g. garlic oils) as a means to stimulate sclerotia in soil to germinate.

INTO THE **WILD**

Dr Jessica Knapp, University of Exeter, examines the relationship between bumble bees, courgettes and the effect of the surrounding landscape on pollination

Pollination is crucial for the UK's crop production, but, alarmingly, declines in pollinators are becoming more frequent and many native species have experienced mass population declines over the past century. However, simple and sustainable initiatives can allow native pollinating species to rebuild and thrive while significantly enhancing crop yields.

One simple, yet highly effective strategy is to encourage wildflower growth in uncultivated areas of croplands. Rich wildflower areas are associated with high pollinator diversity and abundance, which can spill over into the cropland areas. Additionally, they provide resources and habitat for pollinators in close proximity to the focal crop, which reduces their forage distance. This sustainable practice increases the abundance and diversity of native pollinators, which in turn improves pollination rates and productivity. Allocating land to nature will also increase the likelihood of being accepted onto environmental stewardship schemes.

Healthy natural pollinator populations in the landscape will reduce the need for commercial pollinator supplementation. A system in which there is a mutualistic relationship between croplands productivity and native pollinator populations' long-term survival could be a win-win scenario for growers.

However, initiatives such as this have often been met with scepticism – one such argument being that the wildflowers may 'distract' pollinators from the focal crop, providing a competitive disadvantage. Additionally, some pollinators are long-distance foragers by nature, so closer proximity to the focal crop is not considered to be an issue, and the effectiveness of natural pollinators has also been questioned, highlighting the need for more research aimed at the effectiveness of pollinator-supportive management practices.

EFFECTIVELY WILD?

Recent research by Dr Jessica Knapp at the University of Exeter explored these issues. She investigated the value of pollination to courgettes and whether the presence of wildflowers in the landscape enhanced pollination services to fields. Furthermore, she modelled whether the floral resources courgettes provide improved pollinator population health, long-term survival and conservation by using field data to develop a simulation model using BEE-STEWARD software. Jessica also investigated the effectiveness of commercial colonies for pollination. Her research took place over nine courgette fields located in Cornwall, Worcestershire and Cambridge.

Jessica's results showed that pollination is highly beneficial for courgettes and that yields were 39% higher compared with when pollinators were excluded.

Native pollinator species were shown to be highly effective pollinators – honeybees (*Apis mellifera*) and buff-tailed bumblebees (*Bombus terrestris*) being the most prominent. Jessica found that introduced commercial colonies had no significant impact on pollination levels in areas that are rich in native pollinators, showing management practices should aim to conserve these natural native species, in turn reducing the need for commercial supplementation (and the associated costs).

It was shown that having diverse wildflowers in the landscape significantly increases the abundance and diversity of native pollinators, resulting in higher courgette pollination rates. For both honeybees and bumblebees, their abundance in wildflower field margins did not reduce their visiting rates to courgette flowers, suggesting that wildflowers are not competing with courgette flowers for pollination services. Bees showed a preference for courgette flowers in the morning, when flowers are open, before 'switching' to flowers on the field margin in the afternoon, when courgette flowers are closed.

Courgettes were shown to provide significant nutritional benefits to bumblebee population health. Courgette nectar was shown to be a valuable food resource for bumblebees and crop flowering was shown to coincide with when bumblebee foragers are most active, meaning increased pollination rates and more nectar being returned to the bees' colonies, which will aid in bumblebee population long-term survival.

> “Diverse wildflower presence hugely increased the amount of important pollinators”

Despite courgettes providing vast quantities of nectar and pollen to bumblebees, they are a mass-flowering crop and therefore only provide a temporary pulse of nectar and pollen. This temporal pulse positively impacts the colonies, and early-season-grown courgettes were shown to increase the number of hibernating queens, colonies and adult workers. However, bees’ long-term survival depends on alternative floral resources being available to fulfil their nutritional requirements in the long term, once courgette flowering ceases. This further highlights the benefit of the presence of wildflowers as they will aid in fulfilling bees’ long-term nutritional requirements beyond that of the focal crop alone.

As bumblebee foragers are generally most active mid-summer, early courgette planting was the best scenario for achieving more forager visits (pollination potential) and more food (nectar) to be brought back to the colony. Matching the crop life cycles with key periods of pollinator activity can be an effective way of improving pollinator population dynamics and pollination efficiency.

For growers, this may mean planting mass-flowering crops with complementary pollinator life cycles (such as early and late courgette) in fields adjacent to each other.

A WILD FIND

Interestingly, Jessica discovered that 56% of courgettes were able to reach marketable size and shape without any pollination, due to a process known as parthenocarpy, which is fruit set in the absence of pollination. Methods to induce parthenocarpy, such as selective breeding and hormone application, were able to increase fruit quantity without adversely affecting the quality in 18 crop species that traditionally require insect pollination for fruit set. Despite the natural parthenocarpic tendency of courgettes, no parthenocarpic varieties are currently grown on a commercial scale in the UK.

Growers should consider growing parthenocarpic varieties if pollinators are exceedingly scarce as it will help improve fruit uniformity caused by lack of pollination. In return, these parthenocarpic crops will progressively increase pollinator abundance over time by providing nectar and pollen which help build populations levels, increasing pollination rates.

“Given that pollination increases courgette yield by 39%, growers should conserve pollinator populations for stable pollination services across their land,” explained Jessica.

“Simple management, such as encouraging wildflowers within courgette fields, could help to attract pollinators to courgette flowers and support bees’ nutritional requirements beyond the extensive, yet transient resource provided by courgettes.”

> “For growers, this may mean planting mass-flowering crops with complementary pollinator life cycles”

This research highlights the value of native pollinators, in addition to the value of diverse wildflower presence into uncultivated parts of the fields to increase the abundance and diversity of important native pollinators.

Managing land for pollinators will ensure that there are stable pollination services over time. Growers should aim to preserve or plant wildflowers to facilitate pollination services to courgettes and support pollinator nutrition and long-term survival. Providing additional habitat for pollinators will not only improve overall population health but also enhance pollination services. Wildflower presence in field margins also provides an array of other environmental benefits, such as reduced soil erosion and improved soil health and structure, illustrating their potential as an environmentally friendly, sustainable agronomic practice to improve yields.

FUTURE WORK

While pollination clearly affects cucurbit yield, other environmental factors such as water, nutrients, pests and disease will also affect the quantity and quality of yield. It would be useful to gain a greater understanding of how a plant’s physiological health interacts with the level of pollination it receives to influence yield. A more complete understanding is needed to ensure that ecologists don’t promote the conservation of one ecosystem service at the expense of another and that growers are able to prioritise key services in their management for optimal crop yields.

A factsheet, ‘Cucurbit pollination: Mechanisms and management to improve field quality and quantity’, is now available for download on the AHDB website. Visit ahdb.org.uk/knowledge-library

AHDB project code: CP 118

Lead researcher: Jessica Knapp, University of Exeter

AHDB contact: Grace Choto

SOCK IT TO THE SUCKER

Can we ever move away from a reliance on spray applications to tackle pear sucker? Michelle Fountain, East Malling Research, reveals the efforts of research into the problem pest

In the early 2000s, scientists at East Malling Research established that the predominant species of pear sucker in UK pear orchards was no longer *Cacopsylla pyricola*; *C. pyri* had become more prevalent. Before this, pear sucker had become resistant to the majority of approved control products and the strategy is currently to attempt to knock back immature stages of the pest with repeated applications of adjuvants and salts, with a well-timed application of Envidor at egg hatch. This timing of application of Envidor, at egg hatch, is critical as it is most effective against the very early emerging pear sucker nymphs. Despite this, there are still breakdowns in control of pear sucker in many orchards most years. It is clear that a more sustainable strategy, which does not rely on multiple applications of sprays, is needed. The benefit would be a reduction in the reliance on spray applications, which would have wider positive impacts on the environment.

Jerry Cross and PhD student Csaba Nagy began to investigate why some orchards were more prone to pear sucker attack. Csaba found that orchards which had high populations of pear sucker and most frequently suffered from high honeydew levels often exhibited a dearth of predatory insects in the pear trees. It was also noted that the most intensive pear sucker damage was often seen in the centres of orchards furthest from a source of natural vegetation.

> “The most intensive pear sucker damage was often seen furthest from natural vegetation”

It was known that anthocorids, in particular the species *Anthocoris nemoralis*, were very important predators of pear sucker, so studies began to investigate where these natural enemies came from and how far into the orchard they dispersed. Hawthorn, willow, hazel and nettle were found to be good host plants, supporting anthocorids. These plants enabled populations to build up because they supplied a source of food – either other species of sucker or aphids – to sustain the anthocorids. It was clear that certain hedgerow species could be exploited to build up local numbers of anthocorids.

However, anthocorids are not the only natural enemy that will feed on

pear sucker and it was also noted that where anthocorid numbers were protected from harmful crop management practices, including plant protection products, earwig numbers also increased. Earwigs were previously overlooked as potential predators of pear sucker because they are active at night – when most growers are not in the orchards – and because they have historically been associated with fruit damage. The latter is very rare in pear and only occurs in apples where there is already an entry hole in the skin of the fruit.

Since these earlier insights, an objective of AHDB project TF 223 has been collating data on 18 pear orchards. Importantly, not only on the numbers of eggs, nymphs and adult pear sucker but also on the numbers of natural enemies, including earwigs, anthocorids and ladybirds.

LESSONS LEARNED

Many lessons have been learned over the previous three years which have enabled growers to avoid unnecessary sprays. Because they also track the building numbers of natural enemies, a spray is sometimes delayed or mitigated because control becomes unnecessary. Of course, because the monitoring is providing very detailed records, the timing of spray application has been much more efficient and the first-generation egg hatch has been controlled more effectively where an Envidor has been necessary. It has been noted that too many applications of products to remove honeydew can be detrimental to natural enemies and that monitoring should continue beyond harvest when an 'Indian summer' can sometimes result in a resurgence of pear sucker egg laying, leading to damage of overwintering buds.

The result of all this work has been a reduction in the number of applications of plant protection products applied to pear orchards and much better control of pear sucker in the majority of UK orchards.

However, this reduction in application and the removal of broad-spectrum products from use in pear orchards has led to some interesting effects and observations of new pests in more recent years. *Anthonomus spilotus* was positively identified for the first time in the UK by NIAB EMR and the Natural History Museum. The weevil, which has a very similar life cycle to apple blossom weevil but occurs mainly on pear, causes damage to individual flowers and, more worryingly, to young leaf shoots. A threshold for this pest has not yet been established, but a pre-blossom application of Calypso, in mild weather, appears to give good control of the weevil for more than one year. In addition, there have been sightings of other minor insect pests, including the Magdalis weevil. This weevil only causes cosmetic damage to pear leaves and is differentiated from Anthonomus by its much shorter rostrum (nose).

Indeed, one grower expressed how the diversity of insects had dramatically increased since the cessation of insecticide applications. This was revealed in 2017 when we tap-sampled his orchards on midsummer's eve in 2017 during an earwig assessment (it's what entomologists do) and were surrounded by a plethora of insects, including dragonflies, large hoverflies, lacewings, ladybirds and bees, which were roosting in the trees and were disturbed when the branches were tapped. Not so enjoyable was the numbers of biting midges and other flies attracted to the light of our head torches.

FUTURE WORK

The next steps for pear sucker management should include the determination of not only thresholds for pear sucker management, based on egg and nymph counts, but, crucially, thresholds for natural enemies in the crop.

A ratio of pear sucker and key natural enemies in relation to life stage and temperature would help growers make informed decisions on whether a treatment is necessary.

More work is needed to predict how much natural habitat is necessary to control pear sucker and what the ratio of edge to orchard should be to maintain this balance. More work is also needed on the role of the invasive harlequin ladybird and its role in pear sucker predation. In addition, we need to be mindful of an increased frequency of sporadic pests, e.g. capsids, invasive species, and stink bugs, that may compromise and disrupt the improving integrated pest management in apple and pear orchards.

> “More work is needed to predict how much natural habitat is needed”

AHDB project code: TF 223

Lead researcher: Michelle Fountain, EMR

AHDB contact: Scott Raffle

ONION TRIALS REVEAL **NEW OPPORTUNITIES**

Bruce Napier, NIAB, reports on the latest exciting developments from AHDB's onion variety trials project

For many years, AHDB and seed companies have funded the independent assessment of onion varieties' growing habits, yield, quality and storage potential. Over recent years, the 10-year yield average has been creeping up by approximately 1 t/ha, as better varieties become available and agronomic practices improve. Plant-breeder programmes continue to produce improved varieties to meet grower requirements (e.g. high yield, disease resistance, good quality and storability). These trials are direct comparisons of new and established varieties and growers have the opportunity to inspect the trials at key growth stages.

Trials hosted on commercial farms are delivered by NIAB and overseen by a BOPA-appointed (British Onion Producers' Association) steering group. Over 320 drilled varieties have been tested by NIAB since 2000. This period has seen increased numbers of high-quality red varieties.

It would be an understatement to say that the 2018 growing season was a challenge. A cold, wet/snowy start followed by a dry hot spring and summer stretched the limits of the varieties and of irrigation capacity and reserves. A wet August delayed harvest for many.

A range of maturities can still play an important part in spreading risk, but there is a trend towards growing early-maturing varieties. Early-maturing varieties such as Hybing, Hybound, Centro, Vision, Hypark, Fasto and Numbito (browns), Red Light and TEON502 (reds) are at the early end of the spectrum.

The cold start meant that material with good early vigour was more likely to perform well and it suffered less from the dry conditions in May. Fasto and Hybound had good early vigour and primed seed fared well.

Downy mildew was not an issue, but growers should select mildew-resistant varieties, which require fewer and cheaper fungicide programmes. For organic growers and high-disease-pressure years, the mildew-resistant varieties offer potential (e.g. Santero, Hylander and the newly launched Redlander).

High incidences of bacterial infections and Fusarium rots contributed to harvest and pre-storage losses in some crops, with UK yields down by more than 25% and similarly across Europe. Efforts continue to identify varieties with resistance or tolerance to Fusarium.

However, 2018 was low-yielding, with rots and a low percentage of bulbs >60 mm being the main factors – 25 t/ha between the highest and lowest yields was not uncommon. Hypark, Fasto, Hybound, Hyway and Bossito (browns) and Red Light were the highest yielding.

Numbito, Hytech, Santero, Hybound, Hyway, Packito and Chico (browns), 37-111 and 37-222 (reds) were the best varieties for having high percentages of single centres.

Storage potential from ambient store or cold storage is a key factor, with over 50% more bulbs lost between the worst - and best - performing varieties.

2017 harvest storage results showed that Drytan, Hyway, SVND7772, Medaillon and Vision (browns), Red Tide, Redspark and 37-111 (reds) have consistently had above-average percentages of sound bulbs in ambient store.

In cold storage, the varieties Drytan, Vision, Hyway and Hyfive (browns), Red Tide and Retano (reds) were the best performing.

Material from the 2018 harvest is expected to have greater losses early on through rots rather than sprouting, but this should push up prices.

Varieties need to match the grower's requirements and ideally have two or more above-average characteristics, e.g. for early maturity and high green plot yields, Hybound and Hypark are suitable choices; for green plot yield and post-storage yields, Hyway, Medaillon and Vision performed well. Fasto and Numbito are newer varieties with potential.

Full updates of trial data are available to levy payers from BOPA monthly grower newsletters, sponsoring seed companies and horticulture.ahdb.org.uk

AHDB project code: FV 348d

Project lead: Bruce Napier, NIAB

AHDB contact: Dawn Teverson

> “Efforts continue to identify varieties with resistance or tolerance to Fusarium”

CHOOSING THE RIGHT VARIETY FOR YOU

There are many points to consider when choosing which varieties of onion to plant that will differ from grower to grower, but the following should be taken into consideration:

- **Select a range of varieties according to soil type, desired harvest period, habit vigour and disease tolerance**
- **Select varieties best suited to your storage facilities**
- **Varieties should match the market and available storage facilities – longer-storing varieties give more options**
- **In high-disease-pressure years, choose varieties with good disease resistance**
- **In high-disease-pressure years, use local knowledge of fields to avoid disease hot spots**
- **Consider seed cost**

EAMU LATEST

STAYING POSITIVE

AHDB Crop Protection Scientist Bolette Palle Neve looks at some of the successes of the past year

Bolette Palle Neve,
Crop Protection Scientist, AHDB
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Looking ahead to the rest of the 2019 growing season, I thought it would be good to focus on some good news for once. I have therefore had a look at the EU pesticides database to remind myself of the active ingredients which have been renewed in the past year. A recent renewal means that these actives have another 7–15 years until they have to be renewed in Europe again. Following renewal of actives in Europe, products containing these actives will have to be renewed in each member state, and for the actives listed below, this process is already underway.

Actives of relevance for the UK that were voted for renewal in Europe in the past year comprise of:

- Acetamiprid
- Ampelomyces quisqualis strain AQ10
- Bentazone
- Carfentrazone-ethyl
- Copper compounds
- Laminarin
- Pethoxamid
- Propyzamide
- Trifloxystrobin
- Zoxamide

Unfortunately, as we know, a large number of actives have also been voted for non-renewal. As a result of this and other approval changes, our winter has been very busy, working with growers on urgent EAMU applications but also on 11 applications for emergency 120-day authorisations. We do what we can to avoid these applications, as they require a very strong case for need, are expensive and only provide a short-term solution to a serious problem for growers.

> “They only provide a short-term solution to a serious problem for growers”

EAMUS IN FOCUS

Hurricane SC

“The Hurricane SC EAMU for pre-emergence use was obtained after trials in AHDB’s SCEPTREplus herbicide screens on carrots showed that it could be a useful partial replacement for linuron,” explained Angela Huckle, Horticulture Research Consultant at ADAS. “It gives control of brassica weeds such as shepherd’s purse, charlock and runch, as well as chickweed and speedwell which would have been previously controlled by linuron, and therefore is a useful and important addition to currently approved herbicides to fill this gap.”

To discover all of the latest EAMUs visit **horticulture.ahdb.org.uk/latest-eamus**

SCEPTREPLUS HAS NEW ACTIVES IN ITS SIGHTS

AHDB's Joe Martin, Crop Protection Senior Scientist, reveals the future plans of the SCEPTREplus programme

Last year was busy for the SCEPTREplus team, with 21 new trials conducted on weeds (six targets), pests (nine targets) and disease (six trials), as well as continuation of many projects from year one.

> By the end of 2018, AHDB had secured 9 EAMUs, with over 135 products tested with in kind and/or financial support from 29 product manufacturers

Planning for work in Year Three of the SCEPTREplus project is now well underway.

Ongoing work will continue for 29 projects across all sectors. Continuation of existing projects has been important to gain more knowledge of the products being tested and to expand on targets. For example, with aphid control there is a need to expand onto other aphid species and conduct fieldwork on key actives that have been identified. Where reviews were conducted last year, the plan in 2019 is to conduct field experiments looking at a range of different products. Weed control in celery is also being revisited, where work was started in Year One, but, due to the very limited control options available, further work was requested by the growers. While some progression has been made in weed control for carrot growers, there is a need to explore post-emergence applications further.

In addition to continuing work, the SCEPTREplus team are starting work on new target areas where there are currently limited control measures, as identified by growers, grower associations and panels.

There are four targets for weed control, including legumes, asparagus, ornamentals and young trees in tree fruit production. Of particular interest to hardy nursery stock is investigating different media blends and weed control performance related to leachability and persistence.

Six new targets have been identified for disease control, including rust control in leeks and ornamentals such as fuchsias, Fusarium basal rot in narcissus, Pythium and root rot control in soil-grown baby leaf crops, powdery mildew in cucumber and ornamental, and smoulder and white mould control in narcissus. Rust is an important disease of leeks, and crop losses can occur even with current fungicide options. Loss of products would have a major economic impact for leek producers.

Four additional pest targets have been identified, including blueberry gall midge for soft fruit, stem nematodes in protected ornamentals, silverleaf whitefly in tomato production, and glasshouse mealybug control in protected production where there is potential to consider organic production.

For updates: **horticulture.ahdb.org.uk/sceptreplus**

SCEPTREPLUS

BACK TO **BASICS**

From salt on mushrooms to sunflower oil on tomatoes, where do you stand legally on using basic substances?

All growers will know that the number of plant protection products available to them is dwindling. Even with the huge effort we put into finding effective plant protection products and securing approvals for them, there are still crop sectors that struggle to manage pests, diseases and weeds effectively. As a result of this, we have in recent years seen growers becoming more interested in alternative substances and we get many queries from growers wanting to check the approvals status of some of these.

From a legal perspective, the situation is fairly clear – any formulated product used for plant protection purposes must be authorised as a plant protection product and therefore have a MAPP (Ministerially Approved Pesticide Product) number. Growers wishing to control pests, diseases or weeds should make sure that only products with the appropriate registration number are used.

There are, however, other substances which could still be considered for plant protection purposes. These substances are called 'basic substances'. These are defined as substances which are not predominantly used as a plant protection product but may be of value for plant protection and for which the economic interest of applying for a full approval is limited. Basic substances are approved at a European level and applications for their approval are handled by the European Commission (EC). Twenty basic substances are currently approved by the EC for plant protection (see Table opposite).

> "It's not just us humans that are partial to a pint, slugs and snails are also attracted to beer"

Substance	Approved use
Beer	For use in traps for control of slugs and snails in all crops
Calcium hydroxide	Neonectria and other fungal diseases on pome and stone fruit
Chitosan hydrochloride	Elicitor of plant defences against bacterial and fungal pathogens on vegetables, berries and small fruits
Clayed charcoal	Soil-applied against complex of soil-inhabiting fungi causing black measles on vines
Diammonium phosphate	Attractant to aid management of Mediterranean fruit fly, cherry fly and olive fly in orchards
Equisetum arvense (extract)	Scab, mildew and peach leaf curl on fruit trees, cucumber and tomato
Fructose	Elicitor of plant defences against codling moth on apple
Hydrogen peroxide	Liquid disinfectant for mechanical cutting tools to help prevent spread of soilborne plant pathogenic bacteria in protected edibles (e.g. tomato and pepper)
Lecithins	Powdery mildew in various salad and fruit crops and ornamentals, and tomato late blight
Mustard seeds powder	Seed treatment for disease control in cereals
Onion oil	To mask the smell of umbelliferous crops to help with carrot fly control
Salix spp. (cortex)	Fungal leaf diseases on fruit trees, including apple, and vines
Sodium chloride	Fungal diseases in mushrooms and powdery mildew and European grapevine moth in vines
Sodium hydrogen carbonate	Apple scab, mildews on soft fruit, vegetables and ornamentals, liverwort in pot grown ornamentals
Sucrose	Elicitor of plant defences against codling moth and sweetcorn borer
Sunflower oil	Powdery mildew on tomato
Talc E553b	As a physical barrier in fruit trees and vines to repel pests such as spotted wing drosophila and diseases such as powdery mildew
Urtica (extract)	Aphids, caterpillars, spider mites and foliar diseases
Vinegar	Fungal and bacterial leaf diseases on tomato, ornamentals and various vegetables
Whey	Powdery mildew in cucurbits

We are continually working with scientists, industry bodies and growers to keep abreast of substances which offer potential in crop protection. Several basic substances have been screened in efficacy trials as part of SCEPTREplus and some of these are being taken forward for further work.

We have also been involved in gaining approval for a few of the substances. One example is the authorisation of sodium hydrogen carbonate for use as a herbicide. Its potential as a liverwort treatment was recognised by Mike Norris, then General Manager at New Place Nurseries, who heard about its use from New Zealand growers. This led to its inclusion in a herbicide screening project (HNS/PO 192a) in container-grown ornamentals, where it worked extremely well. It has a physical mode of action, drawing water out of the liverwort by osmosis and drying it out. Based on its performance in the trials, we sought an approval for liverwort control in collaboration with Patrice Marchand from the French Research Institute For Organic Farming, who has built up considerable experience in putting together the required basic substance dossiers. We have also worked with Mr Marchand to obtain an approval for use of sodium chloride in mushrooms where it is used for spot treatment of various diseases and we are currently progressing an extension of the use of chitosan chloride in ornamentals.

Further information about basic substances, and those that are currently approved, can be found at horticulture.ahdb.org.uk/basicsubstances

ATTENTION TO DETAIL

Ant Surrage, Technical Development Specialist at Fargro, explains how you can optimise biopesticides performance by better managing the plant microclimate

Biopesticides undoubtedly require a greater level of attention to detail in their application than a conventional alternative. As such, growers need the necessary support when adopting biopesticides to guarantee they can get the best out of the product. Biopesticides often contain an active ingredient that is a living organism and, as such, require certain environmental conditions to work. It is therefore critical that growers understand their growing environment and know what conditions are needed for a given product and how to monitor and predict when said conditions are in place.

ANYTHING BUT UNIFORM

It is often assumed that a growing environment is entirely uniform and, as such, decisions on crop protection are based around this assumption. Most growers understand their environment in a broad sense, which is a good place to start. However, single-point stationary sensors give a low-resolution image of the environment. They suggest conditions are uniform across a growing area. In practice, we know that certain areas of a growing environment show non-uniform growth, heightened pest pressure and are more susceptible to disease establishment than others, which would suggest a lack of uniformity.

Understanding a growing environment in high definition can lead to improved biopesticide performance. Having several wireless sensors centralising data in a single location allows for a higher-definition image of an environment to be created. Growers must recognise that it is likely their environment is not uniform. Hotspots, areas of high humidity and areas of damp will be key areas for pest and disease establishment. This should inform monitoring and preventative programmes, which will have knock-on effects on other elements of an integrated pest management (IPM) programme.

For even greater detail, growers can monitor and understand the microclimate. The microclimate refers to the environment around a plant, this is often significantly different to the environment we feel when walking through the crop. It is necessary to understand the microclimate as this is where the pests, disease and biopesticide are active. If we can monitor and manage the conditions at this level, then it is much more likely we will see good control levels from biopesticides.

REAL-TIME DATA

The question is often asked as to why having high-quality real-time data is important. Simply put, the better the data going in, the better the insight coming out will be. The end goal is that from the data we can gain an insight into the development of pest and disease populations. This allows us to prevent and predict said pressure and manage conditions to give a competitive advantage to the beneficial organism.

This higher quality environmental data can be used to improve the efficacy of a biopesticide. As previously mentioned, biopesticides tend to be based on living organisms and, as such, have adapted to certain niches. They therefore have certain environmental conditions that influence their activity. A good example of this is *Beaveria Bassiana. B. bassiana* is used for the control of various pests, including whitefly and thrips. It has an optimum temperature for activity of 20°C–30°C and is active above a relative humidity of 65%. However sporulation only takes place above 80% relative humidity.

A dashboard informs a grower not only when to apply the product, but the conditions pre- and post-application with relation to the environmental conditions *B. bassiana* requires. By having real-time microclimate data, a grower can be alerted as to when conditions are ideal for *B. bassiana*. They can then be certain that they will get the best out of the product from an environmental perspective. Moreover, continually monitoring the data will inform the grower as to whether the conditions post-application have also been conducive, which can inform reapplication or rotation on to another spray.

It is also important to remember that biopesticides will perform better as part of a well-constructed IPM programme. Several facets of such a programme can be marginally improved by more accurate, consistent data. For example, knowing which beneficial insect will perform best based on the microclimate environment or modelling the development of diseases based on real-time microclimate data. Aggregation of all these minor improvements can create significant improvements in a programme, which translate to savings on crop protection products and a better end-product.

> “Understanding a growing environment in high definition can improve biopesticide performance”

SAME CONTROL FEWER SPRAYS

Angela Berrie, NIAB EMR, reports on how integrated pest management approaches for strawberry powdery mildew can reduce spray numbers by half

Strawberry powdery mildew (*Podosphaera aphanis*) remains one of the most challenging diseases for strawberry growers, since the majority of production is in field tunnels, where warm, humid conditions favour infection and disease spread. A high number of fungicides are typically required to maintain quality and yield.

There is increasing pressure on the industry to develop integrated pest management (IPM) approaches, which combine cultural controls (e.g. crop hygiene), rely less on conventional pesticides and incorporate the use of biofungicides.

DECISION-BASED MANAGEMENT PROGRAMMES

Earlier trials under project SF 157 confirmed that two biofungicides, AQ10 (*Ampelomyces quisqualis*) and a bacterial product (code: HDC F208), and a biostimulant (Cultigrow), were effective, either alone or in programmes with conventional fungicides, for control of strawberry powdery mildew. These products were used in a trial in 2017 which employed simple decision-based programmes to control powdery mildew. A large plot trial was set up under tunnels at East Malling using an everbearer variety, grown in coir bags with drip irrigation/fertigation.

Three decision-based managed treatments were compared with an untreated control and a routine seven-day fungicide treatment. Disease risk was used to determine which biofungicide or fungicide mode of action was appropriate to apply. All three managed treatments were based on the use of biofungicides (F208 or AQ10), with conventional fungicides substituted only when disease risk was high. One managed programme received no additional products, one had an additional monthly spray of Cultigrow (flavonoids) and one had an additional fortnightly spray of the silicon-based product Sirius.

As the trial was conducted from July to September (high risk for mildew), there was little opportunity to omit sprays. There was reduced fruit quality and yield loss in the untreated control. However, in the managed programmes, mildew control was largely maintained through use of biofungicide HDC F208, substituted only twice by a conventional fungicide during high-risk periods. This trial demonstrated that programmes based around appropriate product choice (including biofungicides) according to disease risk gave good disease control comparable to a programme using conventional chemistry alone.

In 2018, a further decision-based trial was set up on the same site using the same everbearer variety, planted in April in coir bags under polythene tunnels and cropped from early July to mid-September. Again, three managed treatments were compared with a routine seven-day fungicide treatment and an untreated control. However, this year, the managed programmes incorporated decision-based information for both Botrytis and/or powdery mildew. To test a simplified approach, 'look-up' tables were produced from powdery mildew and botrytis computer models for use in conjunction with the forward weather forecast to determine disease risk for spray decisions (Table 1).

Temperature	Humidity	Mildew risk
< 14°	Not relevant	Low
≥ 14°	< 82%	Moderate
≥ 14°	≥ 82%	High
Temperature	**Humidity**	**Botrytis risk**
Not relevant	< 82%	Low
< 16°	82%–87%	Low
< 16°	≥ 87%	Moderate
≥ 16°	≥ 82%	High

Table 1: Simplified strawberry powdery mildew and Botrytis risk in relation to daily average temperature and relative humidity

The high risk of Botrytis in August and September provided few opportunities to 'save' Botrytis sprays in the managed plots, compared with the seven-day fungicide treatment. For powdery mildew, a low incidence of disease at planting, coupled with low risk in June and July (hot dry weather), meant that mildew failed to establish

in the crop. In the combined mildew and Botrytis managed programme, this led to significant savings in spray numbers, with 15 conventional fungicides applied, compared with 27 in routine treated plots, with no loss in quality or yield. Another advantage was that the use of biofungicides while conditions were low-risk for powdery mildew meant that applications of conventional fungicides were 'saved' for use during high-risk periods later in the season. Perhaps of greatest interest to growers is the overall reduction in cost of the combined managed mildew and Botrytis programme (£1,579 per ha) compared with the routine fungicide programme (£2,278 per ha).

USEFUL PROGRESS IN IPM AND COST SAVINGS

Trials have shown that spray programmes incorporating biofungicides, with product choice and application timing determined according to disease risk, can provide equivalent control of powdery mildew to routine fungicide programmes. Advantages included reduced spray numbers overall, with associated cost savings. Under favourable conditions for powdery mildew, growers will inevitably be concerned about losing control, but as a starting point they should consider adopting the managed approach as a trial for some of their crops to give them confidence to develop the approach across their business.

Full details of the materials and methods employed in this work can be found in the annual reports for Project SF 157 on the AHDB Horticulture website, horticulture.ahdb.org.uk

> "Of greatest interest is the overall cost reduction of the combined managed mildew and Botrytis programme"

THE UPS AND DOWNS OF VERTICAL

John Swain, FEC Energy, looks at the benefits and drawbacks of vertical farming in horticulture

grow save
helping horticulture save energy

> “Vertical farming can offer a practical solution in places where space is limited”

> “Air movement is important to maintain an active climate”

The term vertical farming (VF) can be used to define a variety of concepts. For some it might conjure up images of tall structures with plants growing on the outside, while others may imagine stacks of shipping containers. In essence, VF refers to the practice of building upwards (or downwards in the case of underground set-ups) to maximise production area for a given footprint.

Vertical farming can offer a practical solution in places where space is limited or land value is high, such as in cities, or where conventional greenhouses would not be viable, perhaps due to space or climate. It may also be possible to create a vertical growing set-up within a conventional greenhouse, if an arrangement of layers can be set up adequately, without compromising crop quality – although height of the structure could limit what is practical.

As vertical farming establishes itself as a viable alternative to traditional methods, sustainability is really the key. Building vertically not only saves space but can also allow unconventional spaces, such as underground tunnels, to be used for growing. Additionally, VF has also been demonstrated to reduce the amount of soil and water required, with many using hydroponics, making it an option in arid regions where conventional glasshouses are not viable.

LIGHTING

An important consideration for vertical farms is to ensure sufficient light reaches all layers of the crop. Even if using daylight, shading of the lower layers, especially in built-up areas, will reduce the amount of light reaching the crop. Most VFs will require supplementary lights – a light fitting above each layer of crop is likely to be necessary.

Growing Underground, a London-based set-up, uses a hydroponic system to grow micro-greens on four levels in 500 m^2 of tunnels, 33 metres underground. With no natural light, high-efficiency LEDs are vital to give the crop the light spectrum it needs, but these still consume a large amount of energy and produce a considerable amount of heat.

Chris Nelson from Growing Underground says, “The aim is to become carbon-neutral, but it is still an energy-intensive business. With closely packed layers, it is easy for a microclimate to form, so it is important to have good, effective climate monitoring and control to ensure sufficient air movement and to maintain an optimum growing environment.”

THE IMPORTANCE OF CONTROLLING CLIMATE

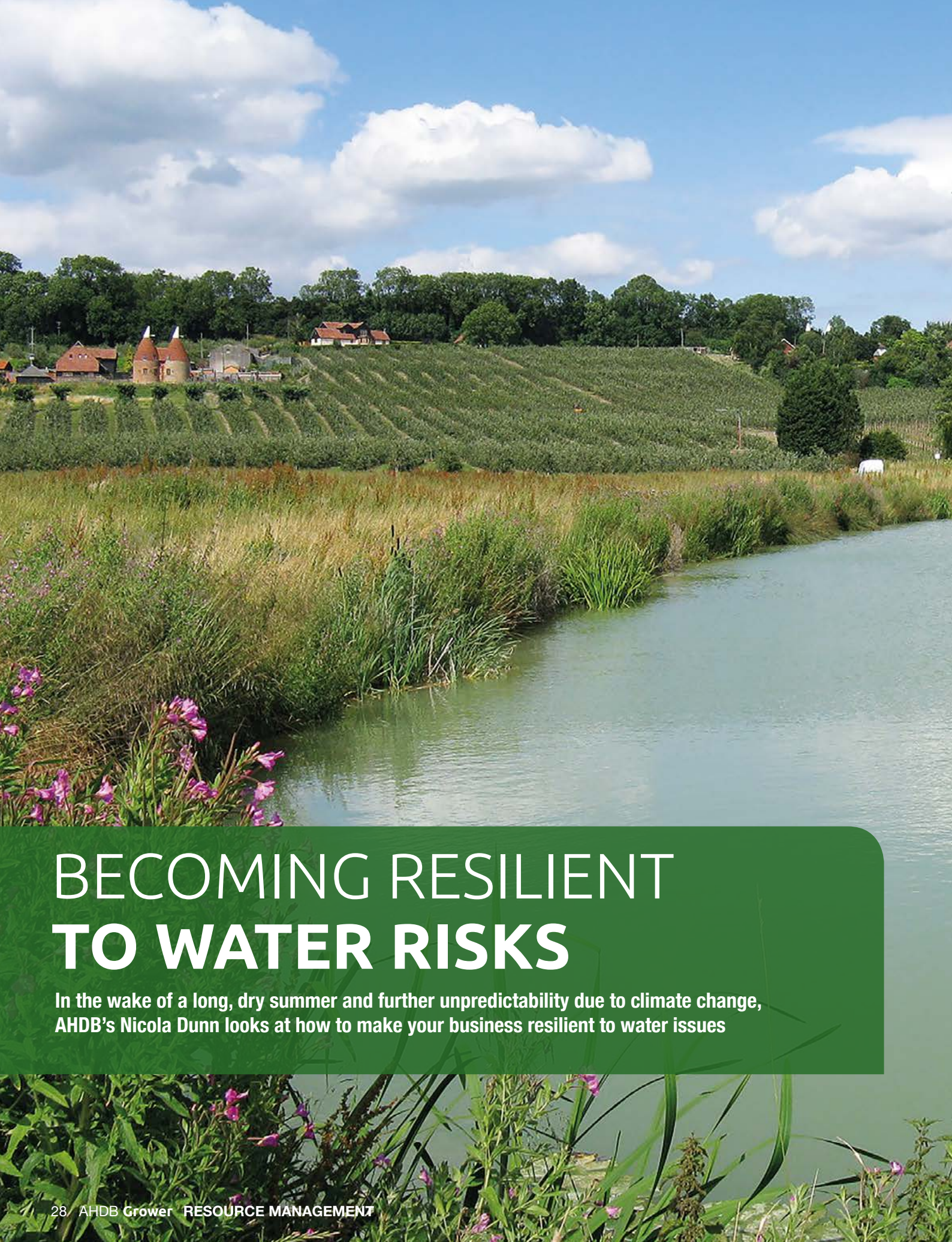
Fully enclosed farms (i.e. with no windows) demand complete control over the environment. While the number of external factors is reduced, it can also be expensive, as there is no access to free daylight. This could be an interesting option for anyone with access to an underground space, but “a clear business case is crucial”, warns Chris Nelson.

The temperate UK climate means conventional glasshouses work well – heating demands can be met easily and light levels are usually acceptable. As such, vertical farms have typically been aimed at supplying niche markets: low volume, high value. Vertical farming may not be the ‘greenest’ solution compared with crops grown under glass in warm, sunny climes, but it does allow produce to be grown close to market. As such, food miles can be drastically reduced.

A self-contained set-up lends itself well to consistent, year-round production with a quick turnover time. A closed system, i.e. with water and nutrient recycling and heat recovery from vented air, can help improve efficiency, but disease control is vital. Careful climate management is necessary. Depending on the location, vertical farms often need a significant amount of heating or cooling, as well as some form of humidity control. Air movement is also important to maintain an active climate. All of these will use energy and contribute significantly towards operating costs, but sustainable, local food production is a benefit in itself and offers a degree of security against the myriad of factors that can adversely affect conventional production methods.

Although VF may not yet drastically reduce the industry’s environmental impact, in the UK at least, it does offer a solution to food production in areas where conventional methods just would not work. This is one of the main drivers behind VF, which can help combat the need to produce more food for an ever-expanding world population.

For more information, please contact the GrowSave team on 024 7669 6512 or visit growsave.org.uk.



BECOMING RESILIENT **TO WATER RISKS**

In the wake of a long, dry summer and further unpredictability due to climate change, AHDB's Nicola Dunn looks at how to make your business resilient to water issues

> “Water scarcity is a challenge that will be faced more regularly in future”

Last year provided some difficult conditions for growers, with extreme temperature and rainfall at both ends of the scale. While there's never any certainty when it comes to the weather, climate projections suggest that water scarcity is a challenge that will be faced more regularly in the future.

Predicting a drought, however, remains difficult. Following the dry summer of 2018, autumn and winter rainfall has largely meant that river flows have been restored, reservoirs are being filled and groundwater is being recharged. A lot can change in a short period of time, however, and dry weather at the end of winter could put more pressure on the water situation.

In the absence of timely warnings, growers will need to consider short- and long-term actions that can help to lessen the risk of prolonged dry weather impacting on their business.

IMPROVING RESILIENCE

Reviewing the licenced water available using a tool such as d-Risk (d-risk.eu) can provide insights into abstraction-related risks in crop production. The tool can help you gauge resilience to drought or reduced headroom on licenced volumes.

Licence holders are encouraged to formalise any increased amounts of water abstraction granted in 2018 during the drought. You will need to speak to the Environment Agency (EA) about varying your licence. If you use trickle irrigation, please remember that this is no longer exempt from licencing and you will need to apply to the EA for a new authorisation in good time to meet the December 2019 deadline.

It might be time to update your irrigation equipment or invest in new technology. If considering a change in equipment, the UK Irrigation Association (ukia.org) has a wealth of information. Increasing efficiency of water use doesn't always mean investing in technology though. Simple actions such as checking that water is being applied as uniformly as possible, avoiding the creation of run-off and repairing damaged or leaking equipment will conserve water.

There may also be opportunities to store water. Reservoirs come at a large cost, but funding has been available in the past. Projects that are otherwise approved and ready to commission will be in a good position to secure funding if any becomes available again in the future. Doing some legwork now to investigate site suitability could be worthwhile. Even if a reservoir is not on the cards, businesses can consider opportunities for storing water in tanks on-site and rainwater harvesting to provide a small amount of extra water in times of need.

There has also been renewed interest in diversifying supply of water to enable 'switching', should restrictions to supply occur. Abstracted water is also a cheaper source than mains, though raw water will not be of the same quality. Many farms have invested in alternative sources of water through installation of boreholes or abstraction from watercourses. Remember that anyone abstracting more than 20 cubic metres per day needs a licence from the EA.

KEEPING UP TO DATE

The AHDB WeatherHub is updated daily and collates weather data from various sources, including the Met Office and the EA. Analysis of rainfall by region can also be carried out to show how one or more months compares to historical rainfall data.

The monthly hydrological outlook provides an insight into the future water situation. The outlook uses information on current weather and historical climate patterns to produce projections on the likely water situation over a short to medium timescale (one to three months). The current or projected situation is compared to those under 'normal' conditions. You can find out more at **hydoutuk.net/latest-outlook**

A number of AHDB resources are available to help you deal with water-based issues, including information on new authorisations for trickle exemption and precision scheduling of irrigation. Discover them at horticulture.ahdb.org.uk/water

PICK OF THE BUNCH

Soft fruit grower Christine Snell explains how the principles of Champion Picker are helping her business to battle labour shortages

SMARTHORT

Christine Snell, with her partner, Anthony Snell, run Windmill Hill Fruits and A.J and C.I Snell, a large soft fruit growing business in Herefordshire. They've been using the principles of Champion picker to improve their labour productivity for over ten years, but explain why it is now more important than ever on their farm.

Q: WHY DO YOU USE CHAMPION PRINCIPLES IN YOUR BUSINESS?

We have been using the Champion picker film for several years as part of our induction programme for new employees arriving at the farm and it has been very effective. It introduces them to the workplace and helps manage expectations by showing them what they should expect to see when they get to the field.

Champion picker is all about success for each employee. It gives everyone the feeling they can become a Champion picker. It isn't competitive; everyone can benefit if they employ the techniques they learn in the film.

I believe a lot of growers use Champion Picker as part of their induction programme, it could be applied to lots of other crops in horticulture.

Q: THE LACK OF AVAILABILITY OF ACCESS TO LABOUR IS NOW WELL-DOCUMENTED IN HORTICULTURE. HOW DOES CHAMPION SPECIFICALLY HELP TO ADDRESS THAT CHALLENGE?

We rely very heavily on seasonal labour. It is seasonal work, the majority of the work is not 12 months of the year, so therein lies one of the difficulties in recruiting and retaining labour.

As the (labour) market tightens it is not easy to bring in new people in large numbers, if employee performance isn't very good then we need to invest extra time in training each employee to meet the work standards in our business, the principles of Champion picker help us to do that.

Sometimes we would encourage the people who are having difficulty developing a technique to work alongside the fast pickers, which is an effective way to improve performance.

Q: HOW SIGNIFICANT IS THE LABOUR SHORTAGE FOR YOUR BUSINESS?

We tend to recruit from Bulgaria, in the main part, with small numbers from Romania and other parts of Eastern Europe. Over the last year we've noticed a tightening up of the labour market. There may be the uncertainty created by Brexit, the strength of the Pound versus the Euro and the economy of their home countries where the labour generally comes from have improved, particularly in Romania.

In 2018 there was a tendency for us to have to top up the staff levels, bringing more people in, more often, than normal.

Overall, the risk of a shortfall is extremely serious and of great concern. If we aren't able to recruit enough workers for our harvest period in particular, then we, as a business, are at great risk. Crops will simply rot in the field if we don't have people here to pick them. So it could become a really serious problem very quickly. The next couple of years are going to be very telling for horticulture.

Q: AS WELL AS USING THE CHAMPION PICKER FILM, ARE THERE OTHER ELEMENTS FROM THE CHAMPION PRINCIPLES YOU EMPLOY IN YOUR BUSINESS?

Our general view of labour when they arrive on the farm is that they have made a significant effort to get here and a commitment in their life, and our policy is that we are going to try our best to make it a success for them.

We believe a happy workforce is a productive workforce, so we do take time to look after them. We encourage local Romanian and Bulgarian delicatessens to visit us on site. During the autumn months and early spring, I have been employing a local business to come in with hot food, provided by the farm. They serve pizzas, Bulgarian meatballs, moussakas, all the food we know the workers like at the end of the working day.

We are trying to get the message across that we care about our staff. That, I think, does limit turnover and people becoming unsettled and giving up.

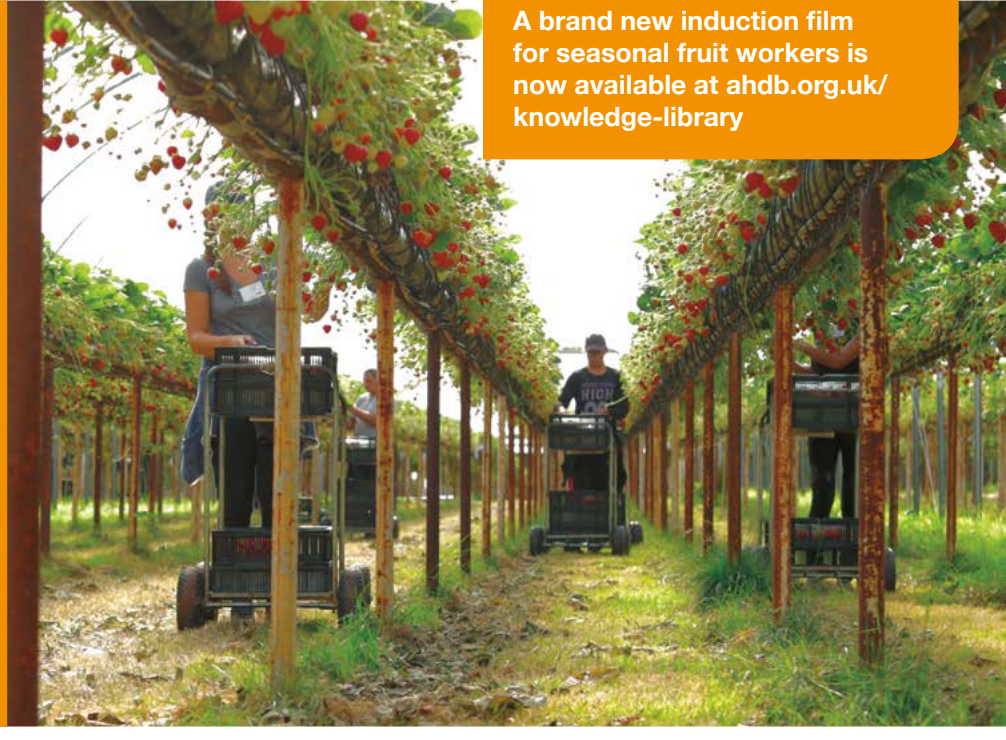
Q: ARE THERE ANY OTHER STRATEGIES YOU ARE USING TO HELP RETAIN OR RECRUIT LABOUR?

We've been working closely with other growers locally, looking at how we can ensure continuity of employment within the crops that we're each growing. There's a certain complement between, for example, asparagus, soft fruit, apples and then back to soft fruit. This would ensure continuity of employment, we believe this will motivate people to come in the first place, then help our business to retain them for the period required.

> "Crops will simply rot in the field if we don't have people to pick them"

'Becoming a champion picker'

A brand new induction film for seasonal fruit workers is now available at ahdb.org.uk/knowledge-library



GETTING A **FEEL FOR IT**

Could robots soon replace humans on a farm near you? Dr Vishuu Mohan, University of Essex, gives us an insight into the project aiming to create a robot to do just that

> “The project will help to replace a declining manual workforce”

Ask any grower what their biggest worries are for the future and you won't have to wait long to hear mention of labour availability. Compounded by Brexit, the pool of seasonal workers has slowly been dwindling for many years as the value of the pound has slumped and uncertainty over foreign workers' rights to work in the UK has taken its toll.

In the soft fruit industry, this is of particular concern as the delicate nature of the fruit requires a human hand to pick it without causing damage, and current robots are unfit for this purpose.

Fortunately, a team of researchers at the University of Essex are on the way to help mitigate (and hopefully solve) this impending staffing crisis. They've been developing a 'soft-touch' robotic arm that can sense and feel and therefore has the dexterity to pick the fruit without impairing it.

The project will develop an efficient and effective means of picking and packaging strawberries, helping to replace a declining manual workforce with a long-term cost-effective harvesting solution. A fixed-base prototype strawberry-picking platform is now functional and experiments are underway in relation to the 'Perception-Action' loop. Other research areas, like bimanual robot operation taking inspiration from human pickers, crop intelligence, data analytics, human–robot collaboration in farm environments, and organic/pesticide-free farming, are in the pipeline.

"There is a long way to go, and we are right at the beginning of this journey, but we remain optimistic for the interesting opportunities which are already presenting themselves," said Dr Vishuu Mohan, from the School of Computer Science and Electronic Engineering, who is leading the project.

As with any project, there have been roadblocks to overcome. The main challenge that the team has faced is the unstructured, dynamic nature of the problem: berries grow with time, come in different shapes, sizes, order of ripeness, hidden between the leaves, and the environment cannot be fully controlled (unlike an industrial work cell). So, in such conditions, solving the 'Identification or What (could be a ripe berry)', 'Localisation or Where (is it in space)' and 'Motion planning or How (do I move to reach, grasp, cut it)' are the main challenges. Then comes learning to tackle a changing environment and operate with precision, speed, safety and adaptation (a human picks a berry in a fraction of a second!). In this sense, while humans are very good in such tasks, getting a robot to 'perceive, act, plan and interact' in unstructured, dynamic environments is an important challenge for robotics today. Good progress has been made though, and so far the robot is able to accurately identify/localise and reach the berry and the team are working on a new version of end effector to pick/cut the stem, and have a bimanual berry-picking robot (similar to humans).

Although in its early stages, does the project's successes so far and the problem they're trying to solve give an insight into a possible future where our fruit farms are run entirely without humans?

"There will always be a need for people in fruit farming – their knowledge, input and attention to detail is ultimately the key to success, but the physical involvement of pickers and planters will change as more innovation and technology is introduced," explained Mohan. "The human eye and brain is (currently) quicker and more effective at identifying problems and resolving issues than today's robots, but this may change in years to come. The project aims to provide a technological solution to the critical shortage of labour to perform 'repetitive, laborious' tasks in the farm and does not intend to completely replace humans. Further, this is expected to bring in skilled workforce – for example, robotics engineers, technicians into the farming industry (hence inversely generating new skilled jobs)."

While the project is currently focusing on strawberries, the technology could be applicable to other sectors, providing benefit across the horticultural landscape. In addition to picking and packaging tasks, mobile robots can be used to gather data for crop intelligence and several other related applications.

Whatever the future holds, it is likely to be one where humans and machines share the burden together.

Vishuu and Andrey spoke at the SmartHort 2019 conference. You can watch their presentation again at ahdb.org.uk/smarthort-conference-2019.

SMARTHORT

SETTING COURSE **FOR A STRONGER FUTURE**

Mark Yates, Wyeplants Ltd., explains how joining an AHDB panel has allowed him to have a vital say on his industry

I'm sure it won't come as news to anyone that horticulture, and the UK in general, is facing some uncertain times. I, and many others, see that the industry will face many challenges over the next few years and that AHDB will have an important role in research and development in order to help keep businesses competitive in the marketplace. That's why I joined AHDB's Hardy Nursery Stock Panel. I wanted to be able to have some influence on how resources are allocated to meet the most relevant challenges for both our own business and the sector as a whole.

One of the main challenges facing the industry is sustainability. I am committed to working towards a sustainable approach for our business's use of resources, and increasingly our customers are demanding such an approach. Key areas for sustainability are growing media, pots, packaging, plastics, fuel, and pest and disease management. The challenge is to develop growing and production techniques to minimise environmental impact while still meeting the demands of our customers in terms of supply, quality and price.

Pest and disease control is an important area I think that AHDB needs to continue to focus on, now more than ever. The ongoing withdrawal of plant protection products means that meeting customer demands of quality and price becomes more difficult. An integrated approach to growing is now essential and the use of biopesticides, biological control and biostimulants and appropriate growing techniques is the only way forward. There are many products now on the market and how they are best applied can be confusing. I think AHDB

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> “The challenge is minimising environmental impact while still meeting the demands of our customers”

can help in involving as many growers as possible to trial and gather information to understand how some of these products are best used and put some science behind it. Involving some of the manufacture and supply companies who have the commitment to this approach will help in getting some of this information across. While a holistic approach needs to be taken to growing, with no single easy-fix solution, it also represents an exciting time to meet these challenges. The gathering and sharing of as much information on this as possible can only benefit the sector as a whole.

Labour is the biggest resource used in horticulture and probably one of the biggest concerns for businesses, in terms of the supply and quality of labour to meet customer demands. The continued development of our own business, and I’m sure most businesses in the sector, could not have been possible without the strong availability of labour, particularly at peak times. While the trend over the last few years had already led us to believe that supply could become increasingly difficult, Brexit, whatever the outcome, could be the biggest challenge yet. With this in mind, the focus needs to be on techniques to maximise the efficiency of labour and the development and use of technology where possible. AHDB can have an important role to help businesses achieve this and is indeed doing so with their excellent ‘SmartHort’ work.

Aside from seasonal labour, I do see a skills shortage at all levels of the business and we need to attract more people into the industry. I don’t think as an industry we are very good at selling ourselves as a sector with good career opportunities, but I think the increasing need to apply science and technology within the industry should give us the opportunity to compete with other sectors such as engineering.

Got an opinion or idea you want to share? Get in touch with the panel representative for your sector by visiting: horticulture.ahdb.org.uk/panel

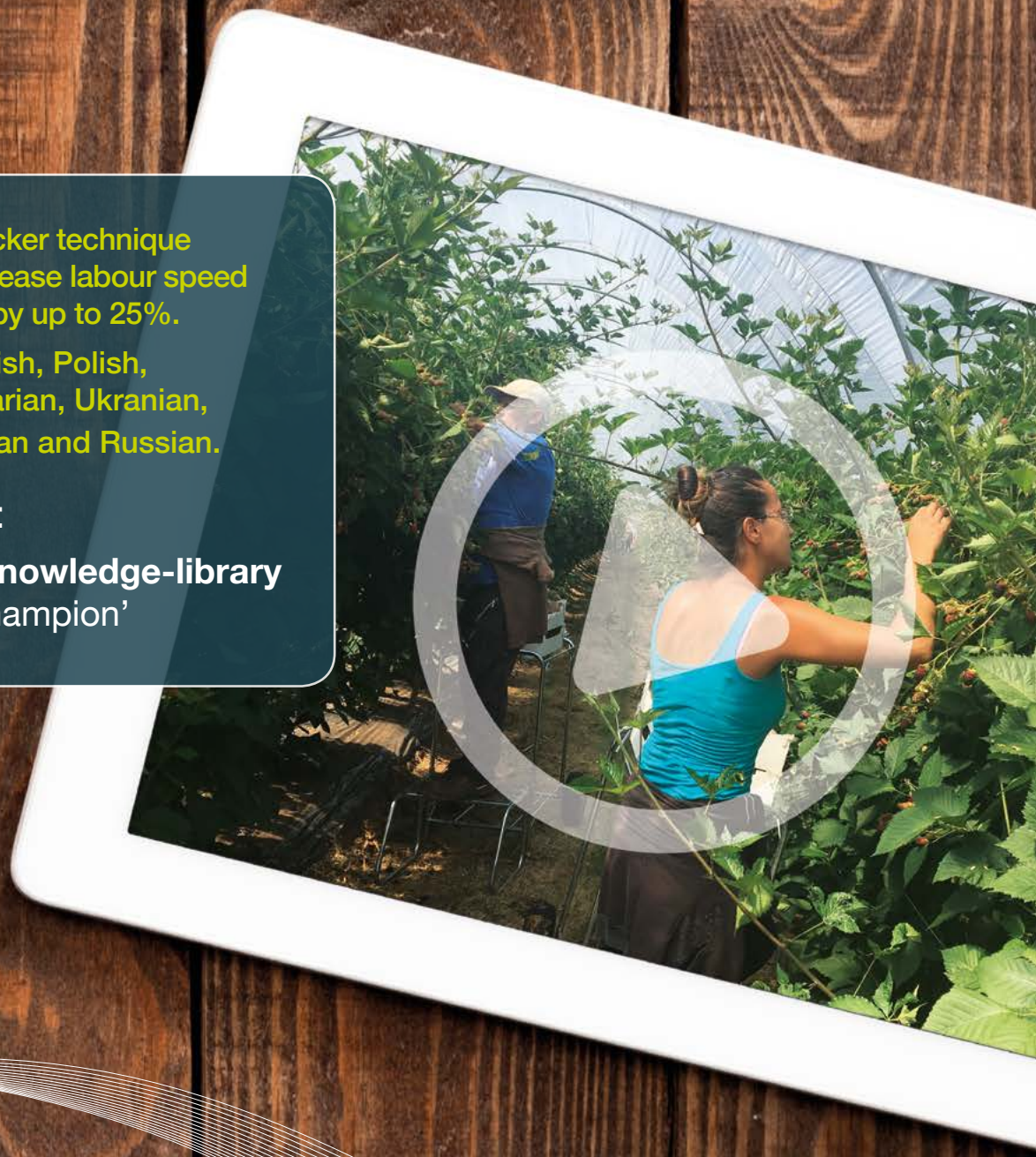
AHDB

SMARTHORT

Becoming a champion picker

How to pick soft fruit.

A brand new induction film for seasonal fruit workers, helping to get the best from your workforce.



The champion picker technique could help to increase labour speed and productivity by up to 25%.

Available in English, Polish, Romanian, Bulgarian, Ukranian, Latvian, Lithuanian and Russian.

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