Field vegetables review

Your guide to current HDC research and the results that can help your business

HDC News

AHDB Agriculture & Horticulture Development Board

2012
Welcome to the third issue of HDC’s Field Vegetables Review annual supplement. Since we published the first of these, we have been delighted by the positive response from so many readers who value it as a key reference guide to field vegetable work currently being funded on your behalf by HDC.

After reading last year’s Review, you will be aware of just how focused HDC is in trying to find solutions to the major problems encountered by UK field vegetable growers. This focus is due to the efforts of HDC staff working with the crop associations and the HDC Field Vegetables Panel, which is composed of elected growers and advisers.

Each year, the major issues facing the industry are reviewed, the research strategy revised accordingly and scientists invited to develop research projects which could help to solve the problems. You can influence this strategy by talking to me, other panel members or the HDC field vegetables staff. It is only through this contact that the wide ranging issues of concern to UK growers can be targeted with the appropriate research. Our contact details can be found at the foot of this page.

The areas of work being undertaken at present include:

- Irrigation practice on onions
- Resting spore tests for brassica clubroot
- Understanding root blemish in parsnip
- Fertiliser responses in rocket and many other crops
- Plant elicitor work for brassicas
- Precision application of herbicides

HDC and Defra are also funding the Horticulture LINK project known as SCEPTRE. This is focusing on finding new crop protection measures for pests, diseases and weeds for which we have recently lost crop protection products, and on developing future strategies to help growers cope with further losses and restrictions resulting from the impact of approvals regulations and environmental legislation.

Please ensure that you are receiving all of the new HDC publications, email newsletters and other HDC correspondence (see the communications section, p24) which are vital in keeping you abreast of all of our results. I urge you to use the HDC website which holds reports of all of our research work. If you don’t know your grower number or password, please contact Louise Arculus on 0247 647 8661 or at louise.arculus@hdc.ahdb.org.uk.

I hope you find this review informative. If there are areas where you believe work is needed then please get in touch using the contact details below.

John Sedwick
Field Vegetable Panel Chairman

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This publication reports on the findings of HDC-funded research projects only. Although it reports on the use of pesticides, it is not intended to endorse or recommend the use of any of the products or active ingredients listed. Only products officially approved for use as plant protection products should be applied to control pest, disease and weed problems. Before using any pesticides, growers should refer to the product approval and label recommendation and seek guidance from a BASIS qualified consultant.
New research to sustain field vegetable production

HDC’s Field Vegetables Panel sets the sector’s research strategy and invites proposals from researchers for projects designed to meet the sector’s needs. Below, we review some of the new projects given the go-ahead in 2011/12, on topics the panel judged to be of the highest priority to levy payers.

The project news pages of HDC News report on all new projects as soon as possible after funding has been agreed, and provide details of results when they become available.

**CP 80 Pathogen diversity, epidemiology and control of sclerotinia disease in vegetable crops**

**Term:** October 2011 to December 2014  
**Project leader:** John Clarkson, University of Warwick  
**PhD student:** Rachel Warmington  
**Industry representative:** Martin Evans  
**Location:** Warwick Crop Centre, Wellesbourne, and commercial farms

Sclerotinia disease is still a major problem in many vegetable crops. The fungus that causes it, *Sclerotinia sclerotiorum*, is very variable but we don’t know much about how this diversity affects disease development and control.

Growers use foliar fungicides as their main control strategy but the long-term approach is to reduce sclerotinia populations in the soil. In this HDC-funded studentship, Rachel Warmington will investigate the effects of organic soil amendments on survival of *S. sclerotiorum* sclerotia, or survival spores, as a new method of reducing soil populations and compare different strains of *S. sclerotiorum* for their ability to infect different carrot varieties and their susceptibility to fungicides.

This work could lead to improved soil management strategies, more effective fungicide use and better-targeted disease resistance breeding.

**FV 386 Use of gaseous ozone to prevent microbial post-harvest spoilage and reduce pesticide residue levels**

**Term:** October 2011 to March 2013  
**Project leaders:** Ian Singleton and Jerry Barnes, Newcastle University  
**PhD student:** Shreya Wani  
**Industry representative:** Thane Goodrich  
**Location:** Newcastle University, Biofresh and commercial farms

Microbial spoilage can damage vegetables during post-harvest storage but growers need ways to prevent this without using chemicals that can leave residues in the product.

Developing a way of storing crops that reduces growers’ pesticides use will enhance the industry’s ability to market the health benefits of vegetables.

In this project, PhD student Shreya Wani will be finding out whether exposing produce to ozone gas during storage can prevent or cut down contamination and spoilage. Working with input from a commercial supplier of ozone storage equipment based at the Newcastle campus, initial laboratory studies will help determine the most appropriate combinations of ozone concentrations and exposure times that achieve the best reductions in spoilage without damaging the produce. Trials will then explore whether these treatments can be used on their own to maintain produce quality in store.

**FV 389 Combining biopesticides and other treatments to increase pest control**

**Term:** April 2011 to March 2013  
**Project leader:** Rosemary Collier, University of Warwick  
**Industry representative:** Matt Rawson  
**Location:** Warwick Crop Centre, Wellesbourne

There is a lot of interest in identifying effective treatments for pests that help growers rely less on synthetic pesticides.

One way to achieve this may be by ‘combining’ treatments to improve their effectiveness. This is done routinely with pesticide mixtures and with pesticide/adjuvant combinations but there may be other improvements that could be achieved through, for example, combining insecticides or biopesticides with a treatment that modifies pest activity – and thereby pesticide uptake – or pest susceptibility.

In this project a series of small-scale laboratory tests on insect pests will evaluate the potential of a range of treatments by comparing their activity separately and together. The results will show which combinations of treatments may be worth exploring in more detail in future in trials on specific crop/pest combinations.
several sites in the UK – the pathogen *Peronospora belbahrii* is a notifiable statutory quarantine organism.

This project aims to provide information on the biology and spread of the fungal pathogens causing *downy mildew* on *sage* and *mint* (*Peronospora* *lami*), *parsley* (*Plasmodopara umbelliferarum*) and *basil* (*Peronospora belbahrii*) and to investigate a range of potential control methods.

**FV 391 Carrots: improving the management and control of cavity spot**  
**Term:** May 2011 to April 2014  
**Project leader:** Peter Gladders, ADAS, and Martin McPherson, STC  
**Industry representative:** Keith Mawer  
**Location:** ADAS Boxworth and Stockbridge Technology Centre

HDC has an ongoing strategy to improve cavity spot control and this new project will continue our investigations of both cultural and chemical methods.

Carrot growers remain reliant on a single active ingredient (metalaxyl-M) for cavity spot control. Its performance can be variable as it can be degraded by soil microbes so as part of the project soil from more than 30 fields in the main carrot growing areas of the UK is being analysed for the persistence of metalaxyl-M.

Initial results have already shown that fungicide activity halved within 10 days in soils previously associated with control failure.

There are new opportunities to improve control of cavity spot as new fungicides have become available with strong activity against *pythium* species. A range of these will be screened in the laboratory and the most promising will then be tested in field trials to investigate dose and timing. New biofungicide spray treatments will be included, along with soil calcium treatments.

The benefits of these fungicide and soil amendment measures will be compared on cavity spot resistant and susceptible cultivars so that the contribution of each element of an integrated management system can be quantified.

**FV 392 Onions: relationship between disease incidence in stored bulb onions and first-year sets**  
**Term:** April 2011 to March 2012  
**Project leader:** Steve Roberts, Plant Health Solutions, and John Clarkson, University of Warwick  
**Industry representative:** Robert Oldershaw  
**Location:** Warwick Crop Centre, Wellesbourne, Plant Health Solutions and commercial farms

Some growers and agronomists believe onions grown from sets are at greater risk than drilled crops from certain diseases – particularly the bacterial rot thought to be caused mainly by *Burkholderia gladioli* pv. *allicola* (Bga), neck rot caused primarily by *Botrytis allii* and basal rot caused by *Fusarium oxysporum* f.sp. *cepea*.

Bga is a particular problem in heat-treated red Rijnsburger onions and it is possible that the heat treatment itself may contribute to an increased disease risk.

This project is a first step in addressing these issues. It aims to determine the incidence of the major bacterial and fungal pathogens thought to be associated with onion sets of different types and establish if there is a relationship between disease incidence in sets and subsequent problems in the harvested crop.

Depending on the results, a follow-on project could then investigate ways of reducing the impact of any disease problems associated with sets.

**FV 394 Vegetable crops: development of a screening programme for plant growth enhancement products**  
**Term:** April 2011 to March 2012  
**Project leader:** Pat Croft, STC  
**Industry representative:** Martin Evans  
**Location:** Stockbridge Technology Centre, Yorkshire

High yields depend on growers’ ability to manage and optimise nutrient resources – not just nitrogen, phosphate and potassium but other essential macro and micronutrients too.

This new project will compare the performance of plant enhancers (non-NPK macro and micronutrient products) under strictly controlled conditions.

Many growers are uncertain about using plant enhancers because of the similarity of the performance claims for different products and the variability in their results. However, it is known that micronutrients are increasingly being identified as crucial to crop productivity and quality. This means that plant enhancers may have an important role to play in crop and yield improvement and so it’s essential to provide growers with independent data on their performance.

**FV 395 Strategies for broccoli management to improve quality and extend storage life**  
**Term:** April 2011 to November 2013  
**Project leader:** Richard Colgan, Natural Resources Institute  
**Industry representative:** Gavin Willerton  
**Location:** commercial farms

Broccoli is a particularly perishable crop with industry estimates of post-harvest handling losses in the range of 5 to 7% (£3 to 4 million) while wastage in the field costs UK growers up to £7 million.

Defining strategies for pre- and post-harvest management could reduce waste and crop losses both in the field and post-harvest. The results will also help the industry maintain content of vitamin C and other compounds in broccoli associated with human health benefits, through the supply chain.

**FV 400 Biology and management of spinach mites**  
**Term:** March 2012 to February 2013  
**Project leader:** Rosemary Collier, University of Warwick  
**Industry representative:** Thane Goodrich  
**Location:** Warwick Crop Centre, Wellesbourne

During late summer and autumn 2010, outbreaks of mites damaged outdoor spinach crops at several locations in southern England. It is likely that the mites are a species of *tyrophagus*, possibly *T. similis* which is a pest of spinach in Japan.

The aim of the project is to confirm the identity of the mites; develop a technique to breed them in the laboratory for experiments on their control; collate and summarise information on their biology relevant to predicting and controlling infestations; and identify potential control methods and test them on a small scale.

The results will contribute to our understanding of this sporadic but damaging pest and identify possible methods of predicting and controlling infestations.

**FV 403 The potential of the coriander bacterial blight pathogen to infect parsley**  
**Term:** January to May 2012  
**Project leader:** Steve Roberts, Plant Health Solutions  
**Industry representative:** Tom Davies  
**Location:** Garden Organic (HDRA), Ryton

A recent scientific study in the USA suggests that strains of the coriander bacterial blight pathogen *Pseudomonas syringae* pv. *coriandricola* can also infect parsley and celery. This challenges current thinking on the host range of the pathogen, based on previous scientific publications from Germany. The pathogen is seed-borne and clearly this potential for cross-infection would have implications for disease management both for seed, field and protected production of both crops as they are often grown in close proximity.

This short project is testing the host range of recently isolated UK strains of the bacterium from Steve Roberts’ collection to clarify the potential for the seed-borne *coriander* pathogen to infect parsley.
Breeding

Parsnip varieties assessed as trials continue

The HDC-funded trial of parsnip varieties, FV 336, the first independent evaluation for many years, showed the importance of assessing varieties for yield, quality and disease tolerance.

The project
Ten established and three new parsnip varieties are being trialled in this extension to FV 336. The roots were lifted in January to assess yield and size. Two further harvests will be taken in early April and approximately two weeks later, in early May, to look specifically at glassiness. Assessments are also being made for bruising and mechanical damage and natural winter dormancy and bolting.

Results so far
With harvesting not yet complete it's too early to give meaningful results and details will be made available in the summer. Growers were invited to view samples of harvested varieties in January.

The full Grower Summary for project FV 336a will be available soon at www.hdc.org.uk.

Onions compared on merit

An independent assessment of new onion varieties helps growers to compare yield, quality and storage potential with standard varieties.

The project
HDC has supported the independent assessment of onion varieties for some years, in projects FV 348 and 348a. The current trials continue the work, testing the performance of a range of red and brown varieties grown from seeds and sets. Field records are taken of plant establishment, vigour, disease incidence, bolting and plant maturity.

After grading, a sample of 100 bulbs from each plot is stored and assessed twice to record the number of sound and sprouted bulbs, rots and bulb quality.

Results so far
Growers were invited to view the field plots for FV 348b during the summer of 2011. In November, the graded bulbs were also available for inspection before going into store. Results from FV 348a from 2009/10 are summarised in factsheet 12/11.

NIAB onion trials continue to provide a useful assessment of new and existing varieties, allowing growers to review their variety choices against independent performance data.

Tom Will, Vegetable Consultancy Services

The full Grower Summary for project FV 348b and factsheet 12/11 can be found on HDC’s website www.hdc.org.uk.
A map to better peas

The soaring cost of nitrogen fertilisers has led to predictions that more peas and beans will be incorporated into crop rotations in future. But growers choosing in favour of legumes need to be confident of the high quality of the marketable crop. One way of achieving this is to develop more scientific indicators of quality to determine, for example, the best time to harvest and also to assist breeders in selecting for quality.

The project
This Sustainable Arable LINK project is looking at how crop quality is affected by various compounds in the developing pea and examining the genetics that control those.

Help to choose peas to schedule

With sowing dates of vining pea dependent on their scheduled maturity, variety choice is key to ensure a programmed harvest.

The project
This project was commissioned to provide more information on performance and relative maturities of new varieties when sown at a commercial timing. Early varieties were sown in February/early March, early maincrops in March/April, and maincrop varieties in April/May.

Results in 2011
Many of the early and second early varieties did not yield well compared with Bikini because of the dry conditions in 2011 – except for Premio which yielded as well as Bikini. Arubis also yielded well at TR120. Avola yielded peas in a very large size grade. Peas of several varieties, including Hesbana, Romance and Premio, were much smaller in size than Avola.

Varieties in the mid-season group benefited from rain in June and yields were higher than in the early sown trial. Ashton and Spandimo yielded the most, and significantly more than Bikini. Peas produced by Chinook and Tommy were smaller than other varieties. Most varieties had good to excellent standing ability, with the exception of Ashton which had lodged by harvest. Ashton is the only variety in this group with conventional leaves.

Bikini’s yields in the late-season trial were lower than in the mid-season trial. Most varieties in this group were standing well at harvest. Maturities had been a little later than expected in 2010 but in 2011 were similar to previous trials’ results. All varieties out-yielded Bikini at TR100. Butana was the highest yielding followed by Ambassador and then significantly out-yielded Bikini at TR120 as well. Peas from most varieties were medium-large in size, but Ambassador’s were particularly large.

Some of the chemistry changes that occur in vining peas leading up to, during and after optimum harvest time are being investigated.

The full Grower Summary for project FV 154c can be found on HDC’s website www.hdc.org.uk.

This BBSRC/Defra LINK project will assist pea breeding by improving our understanding of the genes involved in producing good quality peas.

Milika Buurman, Limagrain

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More information on project FV 351 can be found on HDC’s website www.hdc.org.uk.

FV 351 Understanding quality determinants in pea seeds to improve market opportunities that promote sustainable agriculture (BBSRC/Defra Sustainable Arable LINK)
Term: January 2010 to July 2013
Project leader: Claire Domoney, John Innes Centre (pictured)
Industry representative: Milika Buurman, Limagrain
Location: John Innes Centre, Norwich

The full Grower Summary for project FV 351 Understanding quality determinants in pea seeds to improve market opportunities that promote sustainable agriculture (BBSRC/Defra Sustainable Arable LINK) can be found on HDC’s website www.hdc.org.uk.

This work continues to provide an independent assessment of vining pea varieties.

Richard Fitzpatrick, Holbeach Marsh Co-operative

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The full Grower Summary for project FV 154c can be found on HDC’s website www.hdc.org.uk.

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The project
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The full Grower Summary for project FV 154c can be found on HDC’s website www.hdc.org.uk.

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The full Grower Summary for project FV 154c can be found on HDC’s website www.hdc.org.uk.
Winter brassicas put to the test

Autumn/winter cauliflower growers schedule programmes using 30 main cultivars, with a further 20 to spread production through from late September to the end of May. In spring cabbage, three main, and three subsidiary, varieties are currently grown.

To decide which varieties to grow, producers depend on detailed information on yield, quality, harvesting period and susceptibility to pests, diseases and bad weather. So new introductions need to be assessed alongside current and standard varieties.

The project
Originally established to give growers in the south-west information about variety performance under local conditions, this series of trials, run by Bill Herring of Duchy College, is now widely used by growers from Lincolnshire and other brassica producing areas too. The trials evaluate new varieties of autumn and winter cauliflower and spring greens on a commercial farm site.

Results in 2010/11
Due to a particularly cold winter in 2010/11, yields were reduced during the December/January heading period with many of the later planted cauliflowers struggling to make a large enough frame to produce a marketable head. Later heading cauliflowers grew well during the spring with a number of varieties yielding well from the end of February onwards. But the cold season did highlight varieties that were more frost tolerant than others.

The trials continue this year as project FV 202f. Regularly updated trials data is available via dedicated web pages at the Duchy College website (www.cornwall.ac.uk/research/herring) and performance data for 2010/11 is summarised in HDC factsheet 26/11.

The full Grower Summary for project FV 202e can be found on HDC’s website www.hdc.org.uk.

Trials show the beans to count on

Until last year there had been no independent evaluation of broad bean varieties for more than a decade and none of the new varieties introduced over that time had been compared on performance with older ones in UK conditions.

The project
Shona Johnson of PGRO tested a range of broad bean varieties to generate information to help growers improve both yield and quality. The trials targeted both freezing and fresh markets, which have different criteria, and also identified those varieties with the best disease tolerance.

The evaluation looked at a wide range of performance factors, such as relative maturity, yield, haulm length, number of pods per plant, percentage of beans to whole pods and difference in length of snag attachment.

Results
Of the 12 varieties trialled, Suprifin and Statissa were the highest yielding. Lisra had the highest number of pods per plant and Monica and Witkiem Manila were the earliest to mature.

With variety selection a key element in broad bean production, the findings will help growers to integrate new varieties into drilling and harvesting programmes.

The full Grower Summary for project FV 369 and a factsheet summarising the trials’ results (factsheet 05/12) can be found on HDC’s website www.hdc.org.uk.

As there hasn’t been any independent evaluation of broad bean varieties carried out in the UK for over 10 years, this work is most valuable and welcomed by the industry.

Matthew Hayward, Swaythorpe Growers

The large-seeded Suprifin was the highest yielding variety in the trial.
Irrigation matched to variable crop demand

Current concerns regarding water availability are highlighting the importance of improving irrigation efficiency on high value field vegetable and salad crops. Even in years when water supplies are normal, more efficient irrigation will result in more even crop growth, yields and quality, cutting both energy and harvest labour costs. Matching irrigation input to crop demand will also help growers meet environmental regulations.

The project

Developing innovative precision irrigation techniques that combine information about soil moisture patterns with new ways to control water application will enable growers to match irrigation to crop demand. Currently in its third year, this project aims to design an intelligent irrigation management system which integrates soil moisture sensing, wireless communication, and technology to control water application effectively.

Results so far

Studies on commercial crops in 2010 revealed how soil moisture status and irrigation distribution can vary across fields. In 2011 the project has tested electromagnetic and near infra-red sensors that can measure in-field soil variables including clay content, soil organic carbon and soil moisture – all of which have a role in crop water demand. These will be further tested on a commercial scale in 2012.

Field experiments at Harper Adams University College have investigated the links between crop water use and yield under different watering regimes in both lettuce and onion. The work also tested crop sensing technology for estimating soil water and plant water status, finding out how crop water status varies with soil moisture.

In 2012, research at Harper Adams will study crop responses to water to provide information on which irrigation scheduling regimes can be based. Onion crops at Elveden Estate, Norfolk, will be monitored to collect data on the impacts of soil and irrigation variability on yield and quality, which will be used to create mathematical models that will be incorporated in the precision irrigation system.

Field trials and simulation modelling is also under way to assess the technical, practical and economic benefits and challenges of variable rate sprinkler application using individual solenoid valves and computer control.

Onions like their water little and often

An estimated 85% of Rijnsburger dry bulb onion crops are irrigated following a recent move in the industry to production on light soils to improve quality and aid crop management. There is little scientific evidence to support current irrigation practices and some growers are concerned that they may be compromising crop yield, quality and storage.

The project

This project builds on previous HDC work (FV 326) which suggested that irrigation has a significant impact on crop performance. It is extending the original study to a field trial on a commercial scale together with a trial in a rain shelter over three seasons.

Results so far

Onions respond well to water, which can vary water delivery across a field.

Watering onions little and often results in the best growth and yields.

Continuing to irrigate through to 50% fall-over increased yield by around 18% compared with a regime that included the typical commercial practice of imposing water stress as this stage is approached. Although commercial experience suggests that late applications of water can affect storage potential, analysis of 2010 samples coming out of store indicated little reduction in bulb quality as a result.

We are under pressure to reduce water use so this project will help us to manage our irrigation scheduling better and improve onion quality.

Tim Jolly, Roudham Farm

Frequent applications of smaller amounts drive canopy development and crop vigour more than a typical irrigation regime of about 25mm every seven to 10 days – resulting in slightly increased yields. Water stress during the main canopy development period (up to bulb initiation) can significantly reduce yield potential by 20-30%.

The full Grower Summary for project FV 363 can be found on HDC’s website www.hdc.org.uk.

The full Grower Summary for project FV 326 and Year 1 and Year 2 annual reports for FV 326a can be found on HDC’s website www.hdc.org.uk.
Harvesting of UK-grown leeks finishes when the old season’s crop runs to seed. But in other similar biennial crops, such as onions, carrots and parsnips, sprout suppressants can reduce bolting and regrowth, extending the season and improving quality and shelf-life.

example, at soil index 1 or below, a dose of between 60 and 85kg/ha of P₂O₅ is often recommended for vining pea crops which, at spring 2011 prices, would have cost around £75/ha.

The phosphate levels suggested for vining peas are based on long-standing data and perceptions that have not been validated in the context of modern production techniques and varieties, environmental influences and current costs.

The project
In this project Nathan Morris, farming systems and soils specialist at NIAB TAG, aims to improve guidance to growers on the soil phosphate indices that will maximise both yield and quality of vining peas.

Phosphate fertiliser rates are being matched more closely to crop demand

Growing regulator brakes bolting in late leeks

Harvesting of UK-grown leeks finishes when the old season’s crop runs to seed. But in other similar biennial crops, such as grown on a range of soil types. The project will also provide new information on how soil type influences crop response to fresh phosphate fertiliser.

Results so far
The first stages of the project have involved making phosphate applications at a range of doses to the trial sites. The first pea crops are being grown in 2012 and preliminary results from the first year will be available after autumn 2012.

With ever increasing phosphate costs, this project is essential for us to find out the right levels of phosphate needed for our crops

Richard Fitzpatrick,
Holbeach Marsh
Co-operative

Extending the season for UK leeks would benefit the industry because it would mean we could be less dependent on imports late in the season

Patrick Allpress, Allpress Farms
**Novel crops could boost vegetable pest control**

The industry is under pressure to take a more rational approach to pesticide use while still maintaining pest populations below the thresholds at which economic damage occurs. Use of natural predators in crops is usually limited by the absence of supplementary food sources for them, such as pollen and nectar. Introducing flowering plants as part of a combined cropping system could enhance natural pest control.

**The project**
The research is working to increase the numbers, diversity and activity of beneficial insects in vegetable crops by growing alongside them flowering plant species which will both attract biocontrol agents and have a marketable value. Plants such as pharmaceutical crop species or nectar-producing vegetables would enable growers to help natural biocontrol without compromising on cash-crop acreage.

**Results so far**
Only the first and second years’ experimental data has been analysed so far. It shows that beneficial insects do use the flowering plants and then move into the crop. Significantly higher populations of parasitoid insects have been found in plots containing buckwheat or broad bean, while buckwheat and tansy boost the numbers of other beneficial insects such as hoverflies and predatory beetles.

This pattern does not occur for all pest natural enemies. More spiders and scuttle flies (some species of which eat aphids) were found in plots where just the standard vegetable plants were growing, for example. These species are not so dependent on nectar and pollen so may be more influenced by other factors.

**PROJECT PROFILE**

Phillip Effingham, GreenTech Consultancy

An area of pollinating plants within a commercial brassica crop

"This project will deliver significant advances in the understanding of, and approaches for, more sustainable pest control in vegetable crops, effecting a reduction in pesticide inputs"

Phillip Effingham, GreenTech Consultancy

**Natural enemies shelter in field margins**

With growers looking to reduce pesticide use, researchers are exploring other ways to keep pest populations below a point at which they cause economic damage. As well as meeting the criteria for stewardship schemes, managing the farmed environment in a way that enhances biodiversity and favours beneficial insects can encourage natural biological pest control.

**The project**
This Horticulture LINK project is studying field margins in vegetable crops to see how they can be used to increase pollinator and insect predator populations, as well as biodiversity in general. A seed mix consisting of 22 flowering plant species was designed for sowing in experimental field margins. The species were chosen based on their likely benefits to pollinators and natural enemies of pests, and also to farmland birds.

**Results so far**
The margins established well in early spring to late autumn. Plant surveys in 2011 suggest that, as expected, the perennial flowers have been found in plots containing buckwheat or broad bean, while buckwheat and tansy boost the numbers of other beneficial insects such as hoverflies and predatory beetles. The pattern does not occur for all pest natural enemies. More spiders and scuttle flies (some species of which eat aphids) were found in plots where just the standard vegetable plants were growing, for example. These species are not so dependent on nectar and pollen so may be more influenced by other factors.

**PROJECT PROFILE**

FV 334 Perennial field margins with combined agronomical and ecological benefits for vegetable rotation schemes (Defra Horticulture LINK)

**Term:** December 2008 to November 2013

**Project leaders:** David George, Lancaster University (above left), and Felix Wäckers (above right)

**Industry representative:** Nathan Delcott

**Location:** Stockbridge Technology Centre, Yorkshire

"Beneficial insects attracted by the flowering field margins include soldier beetles, seen here on yarrow"

Rosie Atwood, HDC knowledge transfer manager

"The work so far has shown some very promising results with the field margins attracting a range of pollinating insects and natural predators"

Rosie Atwood, HDC knowledge transfer manager

Results from both 2010 and 2011 have shown that the project’s margins consistently outperform their non-flowering counterparts in terms of attracting bees, hoverflies and parasitoid wasps. In several cases flowering field margins seem to be having a positive effect on pest control in the crop. Testing on commercial farms will begin in 2012 to confirm results on a larger scale.

**PROJECT PROFILE**

CP 61 Cross-crop benefits: developing crop combinations to promote conservation biological control in horticulture

**Term:** October 2009 to December 2011

**Project leaders:** Andrew Wilby, Lancaster University (above left) and Felix Wäckers (above right)

**PhD student:** Georgina Key

**Industry representative:** Phillip Effingham

**Location:** commercial farms

The full Grower Summary for project CP 61 can be found on HDC’s website www.hdc.org.uk.

The last two years of the project looked at deploying the findings in commercial crops and the results are still being analysed.

The full Grower Summary for project FV 334 can be found on HDC’s website www.hdc.org.uk.
The future for overwinter carrot storage

The practice of storing carrots under polythene and straw in the field over winter is under increasing threat from the rising cost of straw, plastic and land rents and poses agronomic issues for long-term sustainable production.

The project
Consultant Tim Lacey reviewed established and novel strategies or technologies that might offer an alternative solution for winter storage of carrots that could satisfy the requirements of the UK market – protecting skin finish and flavour and keeping disease to low levels, all at an economically viable cost.

Each option was assessed for its suitability for the UK compared to the current practice, including estimated costs, and for further research.

Results
Lacey’s findings suggest there is room for a more combined approach to storage. For instance, with the advent of newer, more frost-tolerant varieties, there may be opportunities to leave crops in the open ground until January without significant risk.

For mid-winter to late spring supplies, field storage under polythene and straw still appears to be the best method – with no substitute insulating materials that offer the right properties at the right price on the horizon. Refrigerated storage has potential but needs adaptation to be of any use in UK production systems.

Spot sprayer on target

Vision guidance technology, successfully used to steer mechanical weeding in an earlier HDC-funded LINK project, is now being developed to target application of herbicides to weeds. The technique is intended to help the industry overcome the loss of herbicides resulting from European approvals legislation, which is leaving many combinations of crops and weeds without anything suitable to use.

While mechanical weed control has been considerably improved there are still circumstances when it doesn’t work well, for example in wet weather or for controlling perennial weeds.

Results so far
The most recent field trials resulted in good control of large weeds using selective herbicides with little risk of crop damage.

Spot applications can now be targeted accurately enough to enable the use of non-selective herbicides, such as glyphosate, or other herbicides to which the crop has little or no tolerance, improving weed control with very low levels of crop damage.

A novel oscillating ‘alternator’ nozzle has been designed especially for this work which has a very small and sharply defined spray ‘footprint’ and which can be switched on and off within 15 milliseconds.

The nozzle has proved successful in targeting volunteer potatoes and other large weeds but the large droplets it produces, while good at minimising drift, don’t work well against small weeds so the project has developed a cassette assembly that can accept nozzle inserts of different designs – the oscillating nozzle for large broadleaf weeds or an ‘even-spray’ insert for patches of smaller weeds, including grasses.

With straw costs ever-increasing we need to investigate alternative technologies. This project has been a great starting point for future investigations into novel carrot storage systems.

Ian Hall, Tompsett Burgess Growers

Project profile
FV 398 Carrots: overwinter storage – a review of future opportunities
Term: April to June 2011
Project leader: Tim Lacey, VCS (Developments) (pictured)
Industry representative: Ian Hall
Location: VCS (Developments), Norwich

Weeds
Natural chemicals to send root fly packing

Female cabbage root flies lay eggs at the base of brassica plants or in the soil near the roots. Emerging larvae move through the soil to locate host-plant roots to feed. Information about how they detect and find roots is limited but the consensus is that chemical cues released in brassica plant root exudates, either as volatiles or in solution, play a key role and manipulating them could form the basis of control strategies to help growers rely less on the few insecticides left.

The project
Cabbage root fly larvae are attracted to low concentrations – and repelled by higher concentrations – of brassica host-plant chemicals, hence eliciting plant defence responses and, when applied to brassica plants, may disrupt normal larval host-plant location behaviour, development and survival.

The target for this project is to develop a novel strategy for cabbage root fly management based on the use of attractant or repellent compounds, plant extracts and plant defence elicitors to hinder larvae from locating host-plant roots.

It will identify substances released by broccoli and Chinese cabbage roots, and analyse their effects on cabbage root fly larvae. The potential of a liquid biofumigant formulation along with foliar or root applications of plant elicitors is also being assessed.

Results so far
Substances from healthy and damaged brassica roots have been isolated, analysed and tested alongside other known attractant and repellent compounds for their effect on cabbage root fly larvae behaviour. A field trial has looked at induced resistance in broccoli and the effect of a biofumigant product against cabbage root fly adults and larvae.

One substance produced by many plants in response to pest attack, methyl-jasmonate, was shown to increase cabbage root fly egg-laying but some of the other plant defence elicitors tested reduced cabbage root fly damage and protected yields to at least the same degree as treatment with the insecticide chlorpyrifos.

The mustard-derived biofumigant Caliente, applied as a root treatment, proved phytoxic to test crops.

The project is continuing to look at some of the larval behavioural responses to the different chemical compounds in more detail.

With the imminent loss of chlorpyrifos a range of controls is required to avoid reliance on one method. This project may provide us with these additional tools.

Richard Haacker, East of Scotland Growers

Aphicides against whitefly on brassicas

Whitefly is becoming increasingly difficult to control, particularly on kale and Brussels sprout crops, and outbreaks appear to be more severe in hot, dry years.

HDC trials on treatments for brassica aphids have found evidence that some insecticides approved for aphid control on brassicas also suppressed whitefly numbers while a novel insecticide looked promising but further information is needed on their effectiveness against whitefly. There are also questions about the best ways to apply spray treatments for whitefly control, and about spacing crops to ensure effective distribution of sprays.

The project
The project tested insecticide spray programmes and application strategies that might improve control of brassica whitefly, in field trials, pot trials and spray application tests in a wind tunnel. Four organisations collaborated to undertake this programme of work: University of Warwick (Warwick Crop Centre), Allium & Brassica Centre, TAG and Elsoms Seeds.

Results
Field trials were carried out on Brussels sprout and kale in which most of the spray programmes tested were based on approved insecticides (10 programmes on Brussels sprout and eight on kale). One novel insecticide was also included.

Some of the programmes which included Movento (spirotetratram) were particularly effective and the sequence or timing of the Movento treatments within a programme appeared to make a difference to levels of control.

The pyrethroid Decis (deltamethrin) was completely ineffective, confirming a recent study that has shown that some UK populations of whitefly are resistant to pyrethroids.

With whitefly becoming increasingly problematic for our industry and this project will help us to identify the best methods for its control.

Matt Rawson, Pasture Farm
Model answers to clubroot

Clubroot can slow growth and delay harvesting in brassicas – and severe infections can result in total crop failure. One of the worst aspects of the disease is that its resting spores can live for up to 18 years in the soil.

Detecting and measuring levels of resting spores in the soil would enable growers to make more informed planting decisions and could even lead to the development of control regimes that are based on clubroot risk. However, it is difficult to detect low numbers of clubroot resting spores using traditional methods. And with no currently approved fungicides for clubroot, alternative control measures are urgently needed.

The project
This project aims to design quicker and easier detection methods for clubroot resting spores in soils that can be used to predict the risk of infection in a brassica crop. It is also investigating methods of clubroot control.

Results so far
The project is making good progress both in developing a test kit to detect and count clubroot resting spores in field soils, and on using a lime-based product to manage soil pH as a way of reducing the risk of infection from any spores which are present.

The test kit will be based on a lateral flow device similar to those already developed in HDC projects for other brassica diseases and would be suitable for use in the field. More work is needed to ensure its reliability – with its performance being compared with that of existing laboratory-based ‘genetic fingerprint’ tests which are already available but which are more expensive.

One potential control measure has already been identified in field trials on clubroot infested land. Limex at between 7.5 and 12 tonnes per ha reduced the number of clubroot galls forming on roots.

A nitrogen, phosphorus and potassium model (N_ABLE) has been modified for clubroot risk assessment by incorporating calcium, magnesium, pH and weather components. The interaction between pH, calcium and magnesium has a significant effect on disease risk which is also influenced by soil moisture, rainfall and temperature.

Project leader Roy Kennedy says information on disease levels in the soil from the genetic fingerprint test could be combined with the forecast model to provide information about whether and when to apply control measures.

Rot defences triggered in broccoli

Head or spear rot is a major problem for broccoli, costing the industry more than £15 million each year. The disease, which occurs both in the field and during storage, is caused by soil bacteria including pseudomonas species.

The copper-based compound Cuprokylt is currently the only approved treatment against this disease but problems associated with its use include the development of bacterial resistance to copper and phytotoxic damage to broccoli buds. Restrictions on the use of copper-based compounds are also being proposed by the EU.

The project
The effectiveness of plant defence elicitors – compounds that trigger natural resistance in the plant – as alternative controls were assessed in this project. One is already a standard treatment overseas against rice diseases caused by xanthomonas bacteria. Data from the most effective formulations will be used to support applications for new approvals or extensions of authorisation of products for broccoli. Azoxyostrobin fungicides may also lend protection against head rot bacteria so were also tested.

Results
Eight trials were run over two years. Several plant defence elicitors gave some reduction in broccoli head rot but additional work is needed to prove their effects.

Head rot in broccoli is a devastating disease for our industry which our customers don’t tolerate. We need a reliable control that is not based on copper.

Richard Haacker, East of Scotland Growers

The bacteria which cause head rot in broccoli are ubiquitous in soils and are opportunistic pathogens, and our trials confirmed that environmental conditions play a large part in whether symptoms develop. The bacteria were found to be present even on healthy-looking plants which had not been deliberately infected.

The full Grower Summary for project FV 378 can be found on HDC’s website www.hdc.org.uk.

Head in broccoli: plant defence elicitors may have a role in control

Collecting soil samples for clubroot testing on a commercial farm in Scotland

Project leader: Roy Kennedy, University of Worcester (pictured)

Industry representative: Alistair Ewan

Location: University of Worcester and commercial farms
Aphid control timed to halt virus spread

Oilseed rape is thought to be a massive reservoir of turnip yellows virus which is spread to horticultural brassicas by aphids. In FV 365, which ran for 12 months from May 2010, John Walsh of the University of Warwick investigated the disease incidence in Brussels sprout and cauliflower and even though it was a season with relatively few aphids, up to 55% of sprouts and 60% of cauliflowers were infected. Although very few leaf symptoms were caused in either crop, yields were significantly reduced.

The project

FV 365 has been extended to find out at what stage crops are being infected, using samples collected from commercial crops in Lincolnshire and Kent over one growing season.

Glasshouse experiments will study the impact of insecticides on virus spread over four weeks post-transplanting.

Results so far

A commercial Brussels sprout crop in Lincolnshire transplanted on June 2, 2011, was almost completely (96% of samples) infected by July 10, and completely infected by August 10. Transplanting had coincided with the start of peach-potato aphid migration with trap catches at Kirton peaking between July 4 and 10.

The first infection (4% of samples) in cauliflower in Lincolnshire was October 4 from an August 18, 2011, transplant date, reaching 8% infection by October 17.

Numbers of peach-potato aphids trapped at Kirton peaked between September 25 and October 2 and continued to be trapped up to November 27. In Kent, first infection (2% of samples) in cauliflower was detected on October 3 but no further infection has been detected so far. The numbers of peach-potato aphids trapped in Kent peaked between November 7 and 13 and continued to be trapped up to November 27. The numbers flying in autumn in both locations were much lower than in summer.

Several viruses affect asparagus, some being associated with a condition known as ‘asparagus decline’ which weakens vigour. Infection may go unnoticed as asparagus tends not to show any clear virus symptoms but overseas research suggests yields are reduced.

The three viruses thought to be most responsible for the decline are asparagus virus I (AV-I), asparagus virus II (AV-II) and cucumber mosaic virus (CMV).

A preliminary survey of UK asparagus crops in 2010 showed that all samples were infected with AV-I and most were also infected with cucumber mosaic virus. Only a few samples contained AV-II, together with strawberry latent ring spot virus and tobacco streak virus (TSV). Asparagus virus III, which affects crops in Japan, was not found here. There was no clear correlation between reported crop performance and the incidence of virus infection in this small survey.

The project

The project was extended to survey a larger number of sites in 2011 with a broader geographical spread. Ten crops which had been sampled in 2010 were sampled again to see if the viral load had increased. Crop, cultivar, location, pesticide and yield data was included. Recent international research papers were also reviewed for new information on links between virus infection and asparagus decline.

Results

Fern samples were tested from 37 crops for the presence of AV-I, AV-II, CMV and TSV – the predominant viruses in the 2010 survey.

AV-I and CMV were the most common, with AV-I being found in 96% of samples and CMV in 63%. AV-II was found in 27% of samples, and TSV in about 7%.

Many of the crops tested in 2011 were newly established that year and although some infection, particularly with AV-I, was found these crops were significantly less infected with multiple viruses at this stage. A more detailed analysis of all the collected data is in progress. Studies elsewhere indicate that mixed virus infections, particularly if also associated with other asparagus root pathogens such as fusarium, can reduce crop yield or quality significantly.

Understanding virus in asparagus

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The project shows that virus has a broad geographical spread in UK asparagus crops and indicates its probable influence on ‘decline’. In the short term, as well as focusing on harvest hygiene and method, we should consider location and cultural options to reduce the viruses’ effect.

Peter Knight, consultant
Leaf miners stopped in their tracks

Leaf miners blemish the leaves of chard and spinach, reducing crop quality and hence value. But the problem becomes much worse when the leaf or stem mines go unnoticed and the larvae are able to feed. Before pupating, the white maggots grow to 6mm long and their presence in specialty salad crops is completely unacceptable to growers, retailers and consumers.

The project

The project set out to improve insecticide-based leaf miner management strategies for chard and spinach, to generate new information on the biology of the key pest species and develop ways of monitoring their populations to refine the timing of insecticide applications.

The market won’t tolerate the presence of leaf miner larvae in specialty salad leaves.

The promising new chemistry and the potential for an integrated control system based on monitoring mean there are good prospects for effective management of this pest.

Jim Dimmock, HDC research manager

Answers to damping-off in spinach

Damping-off can damage spinach at the cotyledon stage and again when the canopy is closing over. Growers had a major problem with the disease in baby-leaf crops in late summer of 2008 and asked HDC to investigate. In 2010 the main disease problems were linked to heavy rainfall in August and losses reached 70-80%. Few problems were encountered earlier in the season.

The project

The pathogens responsible for damping-off are being identified and the factors that contribute to disease outbreaks and severity, such as environmental conditions, variety and seed vigour, are being studied. The effectiveness and persistence of seed treatments and pre-emergence fungicide soil treatments are also being tested and management practices evaluated.

Results so far

Species of the fungal pathogens pythium and fusarium were frequently isolated from seedlings affected by damping-off but there may be others causing or contributing to the problem. The pathogenicity of the pythium species isolated from diseased seedlings has been demonstrated in pot experiments but the fusarium isolates were less able or unable to cause disease in the test plants. Various seed treatments and two fungicide products tested achieved good leaf miner control, even without additional protection from mesh crop covers.

John Allan, Emmetts

The full Grower Summary for project FV 397 can be found on HDC’s website www.hdc.org.uk.

FV 397 Management, monitoring and biology of chard and spinach leaf miners

Term: April 2011 to March 2012
Project leader: John Colvin, Natural Resources Institute (pictured)
Industry representative: Thane Goodrich
Location: Natural Resources Institute, Kent, and commercial farms

Results

Leaf miner population monitoring showed that there are three generations a year and that the white leaf miner eggs could be easily spotted and identified.

Adult females produce relatively few eggs compared with other insect pests, such as moths, so there are good prospects for developing an effective, easy-to-implement monitoring system.

In field trials, several of the products tested achieved good control.
Biological agents get to work on onion rots

White rot remains a major problem in the UK bulb and salad onion industry while fusarium basal rot is likely to become even more difficult to manage with predicted climate change. There is only one approved fungicide treatment for fusarium. All commercial onion varieties are susceptible to white rot and varieties that show resistance or tolerance to fusarium basal rot don’t have the same qualities as susceptible varieties.

The project FV 219a demonstrated that a strain of the beneficial fungus Trichoderma viride (S17a) can successfully colonise compost which, when incorporated into soil before planting sets, can control white rot. This follow-on project is testing the best substrate or pellet carrier for introducing trichoderma or other biofungicides to control white rot and looking at whether such an approach could also control fusarium. It is also looking at the minimum effective rate and best time to apply onion waste compost, as a control of white rot, in different types of soil.

Results so far
In the first year of the project, drench or granular applications of two biological control agents significantly controlled fusarium and white rot in pot experiments. Field tests with one of the drench treatments also resulted in significant control of white rot at one of two sites. Further field tests with both treatments will be conducted during the project’s remaining two years. Pelleted onion seed has been produced carrying high populations of spores of several biocontrol agents and further experiments will examine how effective this alternative way of applying biological control agents is for disease control.

Advise warning of onion mildew

Foliar diseases can cut bulb and salad onion yields by 60% or more. The problem is particularly bad in salad onions as downy mildew infections can render the entire crop unmarketable.

The project
More precise timing of fungicide sprays will help reduce onion crop losses from foliar diseases. This project is looking at how downy mildew could be reliably detected in the field before any visible symptoms are present. This would inform growers when to time sprays to improve protection from the disease and cut the need for fungicide applications after the disease has already established.

Results so far
A prototype handheld lateral flow device, similar to the ones already available for detecting brassica leaf diseases, has been developed that will detect the airborne downy mildew spores. Field tests have shown that it can detect downy mildew seven to nine days before symptoms can be seen in the crop. Further tests this year will explore the best ways of using it to time fungicide applications.

With limited control options for fusarium and white rot, this research is showing some promising biological alternatives for control

Robert Oldershaw, Moulton Bulb Co. Ltd

Pest & Disease

Fusarium. It is also looking at the minimum effective rate and best time to apply onion waste compost, as a control of white rot, in different types of soil.

PROJECT PROFILE

FV 219b
Optimising field-scale control of fusarium basal rot and white rot of onion using trichoderma amended substrates and pellets, and onion residues (Defra Horticulture LINK)
Term: March 2011 to August 2013
Project leader: Ralph Noble, East Malling Research (pictured)
Industry representative: Robert Oldershaw
Location: Pershore College, Worcestershire, and commercial farms

PROJECT PROFILE

FV 356 Onions: further development and calibration of detection tests for conidia of onion downy mildew in combination with the Morph forecast model MILIONCAST
Term: August 2009 to September 2012
Project leader: Roy Kennedy, University of Worcester (pictured)
Industry representative: Andy Richardson
Location: University of Worcester and commercial farms

PROJECT PROFILE

FV 356 Onions: further development and calibration of detection tests for conidia of onion downy mildew in combination with the Morph forecast model MILIONCAST
Term: August 2009 to September 2012
Project leader: Roy Kennedy, University of Worcester (pictured)
Industry representative: Andy Richardson
Location: University of Worcester and commercial farms

This project will give us the ability to detect spores prior to infection, allowing more timely fungicide applications to be made

Andy Richardson, Allium & Brassica Centre

The full Grower Summary for project FV 219b can be found on HDC’s website www.hdc.org.uk.

The full Grower Summary for project FV 356 can be found on HDC’s website www.hdc.org.uk.

HDC Field Vegetables Review 2012
Bulb rot caused by the bacterium *Burkholderia gladioli* pv. *alliicola* (Bga) is the main bacterial rot in onions, responsible for losses of up to 40% during storage. Bga is prevalent in soil but can also be found on plant roots and in water. Plants have natural defences against attack from pathogens and these can be stimulated using certain chemical compounds known as elicitors. Such compounds are already in use on some crops – for example, one is used in Asia to protect rice against bacterial diseases.

The project

This project was set up to test whether elicitor compounds that strengthen the plants’ own defence mechanisms against a broad range of ‘opportunistic’ plant pathogens can prevent or reduce the level of bulb rot in onions caused by Bga.

Treatments were chosen on the basis of their reported activity against a number of different pathogens in other horticultural or arable crops.

Results

The elicitors tested were shown to reduce the level and incidence of Bga infection in red onions – the onion type in which the disease is particularly economically damaging. None of the products tested are currently approved as crop protection products in the UK but the results from this project will support any future applications for approvals.

Internal bacterial infections cause significant losses in stored onion crops in most years. This project has shown that elicitors have the potential to improve control further over currently approved products.
Free-living nematodes, which move freely through the soil to feed on plant roots, are important pests of onions and leeks. But with control options limited it’s important to be able to find out where a crop can be grown without the risk of damage.

A reasonable assessment of the risk can be gained from knowing the field history and previous cropping and by representative soil sampling but until this project there was little information about which species of free-living nematodes were most damaging to onions and leeks and at what population levels they caused economic loss. Work was also needed to determine when to sample soils, as free-living nematodes move up and down the soil profile in response to moisture and temperature.

The projects
In the onion work, the effects of the different nematode species on crop growth were measured and historical sampling data reviewed for background information on field populations. It also studied the vertical distribution of nematodes in soil in relation to various soil environmental factors to find out the best times, conditions and depth for soil sampling. Pot experiments were used to test the effectiveness of nematicides and biopesticides. After the onion project was started, the Leek Growers Association asked if it could be extended to investigate the impact of free-living nematodes specifically on leeks. The main aim of FV 377a is to measure the effect of different populations of stubby root, needle, stunt/spiral and root lesion nematodes on the growth of leeks, to find out which species and in what numbers are potentially most damaging.

Results so far
Examination of historical sampling data showed that stunt/spiral nematodes are the species most commonly recovered from soil samples. Stem nematodes and root knot nematodes were rarely found in samples, where they did occur they were in large numbers. Stubby root nematodes were the most likely to exceed current guideline thresholds.

However, the results from the pot experiments suggest that populations of stubby root, root lesion and stunt/spiral nematodes well above current guideline thresholds have no effect on onion growth — which suggests that revised guidelines could enable growers to make significant savings on nematicide use and potentially allow more flexibility in deciding where to plant. Based on these experiments all but exceptionally high nematode numbers would require nematicide treatment.

Stem and root knot nematodes remain the main nematode threat to onion crops. Pot experiments on leeks suggest that numbers of needle nematodes up to approximately 1,000/litre of soil and of root lesion nematodes up to 4,900/litre of soil have limited if any impact on the crop. These levels are also well in excess of the guideline thresholds for leeks of 50 needle nematodes/litre of soil and 2,500 root lesion nematodes/litre of soil. With no currently approved nematicide for use on leeks these findings could have a significant impact on planting decisions.

This project should help us to target our nematicide use on onion crops and should make a big difference to field selection for leeks.

Andy Richardson, Allium & Brassica Centre

Nematodes are being extracted and counted in soil samples from different depths and the results correlated with weather data

The full Grower Summary for project FV 377 can be found on HDC’s website www.hdc.org.uk. That for FV 377a will be published shortly.
Survey highlights herb blight risks

The fungal plant pathogen *Itersonilia perplexans* was confirmed on dill for the first time in the UK in September 2009 and later on coriander. The British Herb Trade Association asked HDC to find out the extent of its incidence and the severity of infection.

*Itersonilia* species have a relatively wide host range. They can cause disease on members of the umbellifer family which includes carrots, parsnips, coriander, parsley, fennel and dill and the daisy family which includes tarragon.

A small-scale survey in 2010 (FV 381) found *Itersonilia* leaf blight on 13 of 14 dill samples submitted by growers and on parsley, fennel and the common field weed groundsel but none was detected on coriander samples.

The findings over both years suggest that *Itersonilia* leaf blight is predominantly a problem in dill crops but is also present in coriander, parsley and fennel.

Samples of dill and coriander from protected crops were not infected with *Itersonilia* species, which supports the view that cool, wet conditions are more likely to lead to infection, development and spread of the disease – the drier, more controlled environment under protection would appear to reduce the risk of infection.

This project made herb growers aware of disease symptoms which may have been confused with other causes in the past. Although only sporadic occurrence was reported, the study highlighted the disease could spread rapidly where it established and quickly result in considerable economic loss. This was valuable information, prompting growers to seek preventative measures.

Tom Davies, Malvern View Herbs

No evidence of UK resistance in peach-potato aphids

The neonicotinoid insecticides are highly effective against aphids – but aphids can quickly become resistant to insecticides. Previous research to assess the risks of neonicotinoid resistance in the peach-potato aphid, *Myzus persicae*, funded by AHDB’s cereals sector body HGCA, identified the need to safeguard the contribution neonicotinoids and other novel aphicides make to aphid control.

**The project**

This LINK project, to combat insecticide resistance in aphids, investigated a broad range of chemicals for aphid control, again focusing mainly on *M. persicae*. It built on approaches already developed for monitoring changes in response to neonicotinoids and characterising the conditions under which resistance is most likely to arise.

**Results**

No significant resistance to neonicotinoids, pymetrozine or flonicamid was detected in UK samples of potato aphid (*Macrosiphum euphorbiae*). Peach-potato aphids carrying strong resistance to neonicotinoids and capable of causing control failures are now present on peach in localised outbreaks in southern Europe.

This has confirmed that the peach-potato aphid in the UK is not resistant to the neonicotinoid insecticides tested. It’s important work because it will enable us to maintain effective control of peach-potato aphids.

David Norman, Fresh Produce Consultancy

Project: FV 344 Sustaining the effectiveness of new insecticides against aphid pests in the UK (Defra Sustainable Arable LINK)

Term: January 2009 to December 2011

Project leader: Steve Foster, Rothamsted Research (pictured)

Industry representative: David Norman

Location: Rothamsted Research, Hertfordshire

FV 381 Herbs: a survey into the prevalence and severity of *Itersonilia* spp. in UK crops 2011

Term: February to November 2011

Project leader: Cathryn Lambourne, STC (pictured)

Industry representative: Tom Davies

Location: Stockbridge Technology Centre, Yorkshire

FV 381a can be found on HDC’s website www.hdc.org.uk.
New actives tested against pests

Some of the most important vegetable crop pests are difficult to control with the range of treatments currently available and this armoury may be reduced as a direct or indirect result of approvals regulations and environmental legislation. So it’s important to ensure that any potential new control measures are evaluated for appropriate pest and crop combinations.

The project
The project assessed new controls for the combinations of pests and crops causing growers the most difficulties. The trials included novel treatments for cabbage root fly on cauliflower, broccoli florets and radish; aphids, whitefly, flea beetle and caterpillars on leafy brassicas; carrot fly and aphids on carrot; thrips and bean seed fly on leek and aphids on lettuce.

Results
Potential new solutions have been identified to control key pests of brassicas, carrots, leeks and lettuce.

One novel active ingredient was effective against a range of brassica pests when applied pre-planting or as a foliar spray. It controlled cabbage root fly on roots and broccoli florets; and aphids, caterpillars, flea beetle, leaf miners and whitefly on foliage. Gaucho (imidacloprid), Movento (spirotetramat) and a novel seed treatment showed activity against whitefly. In carrot, a novel active ingredient was more effective than Hallmark with Zeon Technology (lambda-cyhalothrin) for carrot fly control and it also controlled willow-carrot aphid.

For leek, a novel seed treatment gave some early control of thrips and several sprays were partially effective, the best being Mesurol (methiocarb) which is not approved for this use in the UK. Several biological products were assessed but showed little promise. A novel insecticide is showing promise against a range of pests including cabbage root fly.

Forecasts on the cards for sclerotinia

Sclerotinia disease, caused by the fungus Sclerotinia sclerotiorum, is becoming an increasing problem in a range of crops in growers’ rotations, including carrots and beans. The losses and increased production costs may ultimately make it uneconomic to grow some susceptible crops in the UK. There are two phases that could be controlled: the resting bodies (sclerotia) in the soil, and airborne spores.

The project
One aim of this Defra LINK project is to target fungicide applications more accurately, by timing them according to spore detection and/or disease forecasting, across a range of crops. It also includes modelling the longer term impacts of different crop rotations and land use strategies, and field experiments to investigate soil management treatments.

Results so far
In oilseed rape, spray timing according to flowering stage and a spore infection model worked well in 2010 but not in 2011, when exceptionally dry conditions meant that early infections were missed, so ways to amend the model and improve its performance are being investigated.

For peas and beans, using infection risk models to time sprays is more difficult because plants are in flower for only a short period. But models can still help to justify spraying decisions. ‘Genetic fingerprint’ tests on samples from spore traps taken continuously during flowering will indicate when spores are in the air.

Contans, an approved biofungicide which attacks sclerotia did not reduce sclerotial viability significantly when applied when oilseed rape was being drilled.

Different crops produced varying amounts of sclerotia and of different sizes: sclerotinia on carrots, for example, produced small sclerotia but in the largest numbers of the crops tested. The consequences of these differences are being assessed. The next step is to feed the data gathered so far into models that will help us investigate long-term control of sclerotinia in crop rotations.

This project is a great example of joined-up thinking. Sclerotinia affects a wide range of crops across rotations so it’s vital that partners from both industry and research get together to improve its management.
Crop protection

New generation of controls for vegetables

Numerous crop protection products once widely used by vegetable growers have been lost from the market – and many more are predicted to follow suit over the next decade – as a consequence of European approvals reviews and new legislation. The resulting crop protection gaps threaten the profitability of some crops – such as carrots and lettuce – and will dent the economics of many others.

Despite work by HDC to secure a range of ‘off-label’ approvals (now known as Extensions of Authorisation for Minor Uses or EAMUs) to maintain a range of active ingredients for the vegetable industry, it is essential that sustainable long-term crop protection measures are also developed.

The project
This Defra Horticulture LINK project (known as SCEPTRE) is assessing new chemistry, biopesticides and novel technologies and developing new integrated pest management programmes for sustainable pest, disease and weed control in a range of edible crops.

For field vegetables, the disease work is focusing on downy mildew, powdery mildew, ringspot and alternaria in brassicas; rust in leeks; and botrytis in lettuce. The pest work is focusing on aphids in brassicas, lettuce and carrot; cabbage root fly, whitefly and caterpillar in brassicas; and thrips in alliums.

There will also be a programme working on IPM in brassicas, lettuce and carrot.

In weed control, herbicide residue studies have been undertaken on a range of crops and the project will also investigate herbicides for control of broadleaf weeds across various vegetable crops, and some alternative non-chemical control methods.

The field vegetable work is being conducted by ADAS (diseases and weeds), Warwick Crop Centre (pests) and the Allium & Brassica Centre (weeds).

Progress
The first experiments were undertaken in 2011 and included:

- A trial of fungicides and biofungicides to control dark leaf spot on young brassica plants
- A trial of fungicides and biofungicides to control downy mildew on brassica seedlings
- A screening trial to identify novel insecticides against caterpillars on Brussels sprout
- A screening trial of novel insecticides for aphids on Brussels sprout
- An evaluation of conventional and biological pre-transplant drench insecticides to control the larvae of cabbage root fly on cauliflower
- A comparison of conventional and biological insecticides for the control of currant-lettuce aphid on lettuce
- A screening trial of novel conventional and biological insecticides to control thrips on leek
- A screening trial of novel conventional and biological insecticides for the control of willow-carrot aphid on carrot
- Evaluation of a herbicide for crop safety and weed control on 14 crops
- Residue studies on two herbicides to obtain data to support new applications for EAMUs on products where satisfactory effectiveness and phytotoxicity data is already available.

The summary results from these experiments are available to download from the SCEPTRE web pages (www.hdc.org.uk/sceptre) by following the link from the HDC website home page. You will also find other information about SCEPTRE including the latest presentations made at grower conferences.

Given the continual loss of pesticide active ingredients for our industry, it was essential for HDC to collaborate in this research to identify alternatives for the most pressing pests, diseases and weeds. Although in its infancy, this Horticulture LINK project is likely to provide growers with welcome alternatives.

John Sedgwick, Stewarts of Tayside
Working to secure crop protection for field

Most growers know HDC for the research projects it undertakes on the industry’s behalf as the results are widely publicised through HDC News and its sector review supplements, in factsheets and crop guides, at industry events and through the project reports available on the HDC website.

What is not always so visible is the vast amount of work that HDC undertakes to ensure all growers have available the crop protection products they need to make sure their crops yield enough produce of the right quality for them to satisfy customer demands and fulfil contracts. To achieve this, HDC employs two crop protection managers, Vivian Powell and Bolette Palle Neve, to liaise with the industry, agrochemical manufacturers, the UK’s Chemicals Regulation Directorate (CRD) and a range of pesticide groups across Europe and further afield.

For the field vegetables sector, their starting point is to work with HDC Field Vegetables Panel members, grower associations and research managers Cheryl Brewster and Jim Dimmock, both to identify current gaps in the armoury and predict potential gaps that are likely to appear with pending withdrawals of crop protection products from the market.

Armed with that information, they identify potential crop protection products from both this country and abroad which may fill these gaps. In many cases, new residue data is required for new products which may replace outgoing ones. Vivian and Bolette work with agrochemical manufacturers to co-ordinate the generation of such data to support important new uses in field vegetables. Most commonly this results in HDC co-ordinating applications to CRD for new EAMU ‘extension of use’ authorisations (formerly called SOLAs). In some instances, further work is needed to liaise with partners in mainland Europe to acquire the necessary data which can be used in EAMU applications.

HDC is submitting increasing numbers of applications for EAMUs for biopesticides on field vegetable crops. Biopesticides are commonly assessed for their potential to control vegetable pests and diseases, alongside conventional chemical products, as part of HDC’s ongoing R&D projects and,
Working to secure crop protection for field vegetables

HDC continues to work with growers, marketing groups and crop associations to keep abreast of the gaps that are appearing in the crop protection armoury and to identify suitable solutions. Additional collaboration with manufacturers and overseas partners ensures that we continue to deliver essential crop protection products for horticultural crops.

Vivian Powell, HDC crop protection manager

### Recent Extensions of Authorisation for Minor Use secured for field vegetable growers

<table>
<thead>
<tr>
<th>Target</th>
<th>Product</th>
<th>Active ingredient</th>
<th>SOLA/EAMU No*</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Herbicides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeds</td>
<td>Callisto</td>
<td>Mesotrione</td>
<td>1113/2011</td>
<td>Asparagus</td>
</tr>
<tr>
<td>Weeds</td>
<td>Corel</td>
<td>Phenmedipham</td>
<td>1769/2011</td>
<td>Chard, seakale, spinach and herbs</td>
</tr>
<tr>
<td>Weeds including grasses</td>
<td>Devrinol</td>
<td>Napropamide</td>
<td>1741/2011</td>
<td>Brussicas (Chinese cabbage)</td>
</tr>
<tr>
<td>Weeds</td>
<td>Dow Shield 400</td>
<td>Clopyralid</td>
<td>3236/2011</td>
<td>Herbs</td>
</tr>
<tr>
<td>Weeds including grasses</td>
<td>Dual Gold</td>
<td>S-metolachlor</td>
<td>1006/2011</td>
<td>Red beet, swede, turnip</td>
</tr>
<tr>
<td>Weeds</td>
<td>Galag</td>
<td>Fluoroxypr</td>
<td>1770/2011</td>
<td>Alliums (leeks)</td>
</tr>
<tr>
<td>Weeds</td>
<td>Garnit 36 CS</td>
<td>Clomazone</td>
<td>3169/2010</td>
<td>Celeriac</td>
</tr>
<tr>
<td>Weeds</td>
<td>Lentran WP</td>
<td>Pyridate</td>
<td>0267/2012</td>
<td>Salad onion</td>
</tr>
<tr>
<td>Weeds</td>
<td>Pyranin DF</td>
<td>Chloridazon</td>
<td>1574/2011</td>
<td>Various alliums</td>
</tr>
<tr>
<td>Weeds</td>
<td>Springbok</td>
<td>Dimethenamid-P and metazachlor</td>
<td>0919/2011</td>
<td>Leek</td>
</tr>
<tr>
<td>Weeds including grasses</td>
<td>Stomp Aqua</td>
<td>Pendimethalin</td>
<td>2451/2011</td>
<td>Various brassicas</td>
</tr>
<tr>
<td>Weeds</td>
<td>Wing-P</td>
<td>Dimethenamid-P</td>
<td>1628/2011</td>
<td>Leeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1831/2011</td>
<td>Onions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1830/2011</td>
<td>Cabbage</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1829/2011</td>
<td>Salad onion</td>
</tr>
<tr>
<td><strong>Insecticides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphids</td>
<td>Gazelle SG</td>
<td>Acetamiprid</td>
<td>1994/2011</td>
<td>Leafy salads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3144/2011</td>
<td>Chard and spinach beet</td>
</tr>
<tr>
<td>Aphids</td>
<td>Plenum WG</td>
<td>Pymetrozine</td>
<td>1664/2011</td>
<td>Chard, spinach, spinach beet</td>
</tr>
<tr>
<td>Caterpillars including diamond-back moth and silver Y moth</td>
<td>Explicit</td>
<td>Indoxacarb</td>
<td>2093/2011</td>
<td>Brussels sprouts</td>
</tr>
<tr>
<td>Flea beetle and symphylids</td>
<td>Cruiser SB</td>
<td>Thiamethoxam</td>
<td>1292/2011</td>
<td>Sweetcorn</td>
</tr>
<tr>
<td>Scaiid and thrips</td>
<td>Met52 granular bioinsecticide</td>
<td>Metarhizium anisopliae</td>
<td>1997/2011</td>
<td>Herbs, leafy vegetables</td>
</tr>
<tr>
<td>Thrips</td>
<td>Agrimec</td>
<td>Abamectin</td>
<td>2505/2011</td>
<td>Salad onion</td>
</tr>
<tr>
<td><strong>Fungicides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botrytis</td>
<td>Switch</td>
<td>Cyprodinil and fludioxonil</td>
<td>1317/2011</td>
<td>Leafy salads</td>
</tr>
<tr>
<td>Downy mildew</td>
<td>Prevour Energy</td>
<td>Fosetyl-aluminium and propamocarb hydrochloride</td>
<td>2452/2011</td>
<td>Spinach</td>
</tr>
<tr>
<td><strong>Post-harvest treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-harvest disease</td>
<td>SmartFresh</td>
<td>Methylcyclopropene</td>
<td>1503/2011, 1502/2011</td>
<td>Brussicas</td>
</tr>
</tbody>
</table>

Vivian and Bolette are also currently working closely with CRD to ensure that the implementation of the new European pesticide approvals regulation 1107/2009 will not jeopardise economic production of crops such as field vegetables.

Growers and grower groups in the field vegetable industry who have any concerns about pending losses of crop protection products should find suitable solutions. During the past year, HDC has secured a number of important extensions of authorisation for crop protection products for field vegetables, which are listed in the table.

*Where several EAMU numbers are shown, ensure you use the correct one for your crop, and check it is specifically covered by the EAMU*
Keeping you informed in 2012

Apart from producing this HDC News supplement, HDC undertakes a whole range of activities to ensure that the field vegetable industry is fully briefed about new research results as they become available, along with best practice guidance based on HDC research projects and other information in the public domain.

**HDC News magazine**
We publish 10 copies of HDC News each year. It is now widely regarded as the leading source of technical information in the industry, bringing you news of new and current projects, crop protection product approvals, conference reports and features on how to use the research results to improve your business.

**Electronic communications**
HDC circulates a weekly email communications newsletter which alerts HDC members, which alerts you to new project reports as they become available, extensions of authorisation for new project reports as they become available, along with best practice guidance based on HDC research projects and other information in the public domain.

**Factsheets**
HDC factsheets provide best practice advice and summarise project results on a range of crop production themes from pest and disease control to variety selection. During the past year the following factsheets have been published for the field vegetables sector:

- **Factsheet 08/11** Downy mildew of basil
- **Factsheet 10/11** Leafminers of cruciferous salad crops
- **Factsheet 12/11** Onion variety trials 2010/2011
- **Factsheet 14/11** Leek rust
- **Factsheet 19/11** Control of sclerotinia disease of carrots
- **Factsheet 21/11** Virus diseases of carrots
- **Factsheet 25/11** Control of bruchid beetle on broad beans
- **Factsheet 26/11** Brassica variety trials 2010/2011
- **Factsheet 05/12** Broad bean variety trials 2010/2012

**Crop Walkers’ Guides**
These pocket-sized books are very popular with farm staff responsible for monitoring crops in the field as aids to identifying all the major pests, diseases and disorders. New guides have recently been published for alliums, asparagus, carrot & parsnip and pea & bean.

**Events**
Conferences, technical seminars, grower walks and workshops allow you to learn about the latest R&D results direct from the researchers and to find how other growers are using them. HDC field vegetable events in the past year have included:

- SCEPTRE vegetable herbicide trials, where the work could be viewed and discussed
- Protecting your field vegetable crop – a technical seminar featuring HDC projects followed by a viewing of the perennial field margins trials (FV 334)
- HDC onion variety trials open day (FV 348b)
- Broom’s Barn open day where growers could visit and discuss HDC's onion irrigation trials (FV 326a)
- The 2011 Onion and Carrot Conference, and 2012 Brassica Conference, included presentations on the results from a range of HDC projects.

**Field vegetable growers**
Field vegetable growers are currently served by research managers Cheryl Brewster and Jim Dimmock and knowledge transfer managers Rosie Atwood and Grace Choto.

- Cheryl Brewster (Research manager) Tel: 01757 269242 Email: cheryl.brewster@hdc.ahdb.org.uk
- Jim Dimmock (Research manager) Tel: 0247 647 8883 Email: jim.dimmock@hdc.ahdb.org.uk
- Helen Williams (Research co-ordinator) Tel: 0247 647 8662 Email: helen.williams@hdc.ahdb.org.uk
- Rosie Atwood (Knowledge transfer manager) Tel: 0247 647 8665 Email: rosie.atwood@hdc.ahdb.org.uk
- Grace Choto (Knowledge transfer manager) Tel: 0247 647 8664 Email: grace.choto@hdc.ahdb.org.uk
- Louise Arculus (Communications co-ordinator) Tel: 0247 647 8661 Email: louise.arculus@hdc.ahdb.org.uk