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More questions than answers for LLS

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from theory to field

LLS has proven to be a difficult disease to keep on top of. *CPM* finds out what the latest research is discovering about the disease and some questions that still need to be answered.

By Lucy de la Pasture

In recent seasons light leaf spot (LLS) has increased in importance across the country, no longer a disease confined to northern parts of the UK. Research into the epidemiology of the fungus that causes LLS, *Pyrenopeziza brassicae*, has been investigated for decades but when it comes to control, growers have sometimes found themselves ill-equipped to deal with this complex disease.

Plant pathologist Dr Neal Evans has been reassessing the components of the epidemic in an attempt to develop a decision support tool. This would help growers tackle the disease by warning them at the start of an epidemic, in a similar way to the phoma forecasting tool.

Although the parameters that lead to a LLS epidemic are well defined, the disease is altogether more complex than its autumn counterpart, phoma, explains Neal.

"We were dumfounded to find that the LLS fungus produces ascospores much earlier in the season than was previously reported. Ascospores can be detected as early as May and produced throughout the summer.

Fruiting bodies

"The development of fruiting bodies and ascospore release can't be forecast in this way since there's no effective 'starting date' as such. This means that it's not possible to predict the amount of inoculum present nor the time of its arrival using computer-modelling," he explains.

The finding means that newly planted oilseed rape plants will emerge into a barrage of LLS spores, which raises some important questions regarding the current understanding of the epidemic cycle.

Chief among these is why symptoms aren't seen earlier in the season on cotyledons and young leaves, says Neal. Are there unknown resistance factors protecting young plant material and does the industry need to revisit autumn fungicide timing work targeted at LLS control?

As far as fungicide timing is concerned, he believes that LLS isn't simple to detect early in the epidemic.

"Early infection is most likely to be sporadic. LLS infects leaves, producing conidiospores which look like salt-like grains on the leaf surface. New leaves on the same plant and /or adjacent plants are infected by rain splash. So in early to mid Sept there's likely to be localised spore production within the crop, but on a minute scale.

"Just how much the disease spreads from these initial foci of infection depends on the amount of rainfall and temperature. When LLS symptoms are usually detected in the field, it's probably already the 2nd or 3rd generation that's present. If fungicide is being applied when the disease is first seen in the field then it's already too late," he reckons.

Having discovered that predicting the onset of an epidemic can't be easily

Neal Evans explains that LLS ascospores are present much earlier in the season than previously thought, with release occurring throughout the summer.

modelled, the other parameters governing the epidemic were looked at but none proved useful as a prediction tool.

"The difficulty with LLS is that the disease is so chaotic at field level. There are microclimates within the OSR canopy — areas that are wetter and some drier than others. This creates differential development of the fungus within the crop, so in effect it's present in all stages of development during the majority of the season.

"Then different parts of the field are infected at different times and because LLS is a polycyclic disease, there are different stages of infection across the field as well," he adds.

LLS infects leaves producing conidiospores which look like salt-like grains on the leaf surface.

One interesting fact highlighted by the project is that there were differences between the response of varieties across different geographic locations and between seasons. This suggests that there were differences between populations of the *P. brassicae* fungus across different areas of the UK.

"We found that some OSR varieties have some young plant resistance to LLS at a leaf level. The differences in variety performance at different sites also suggests that there may be some selection within the pathogen population taking place," he says.

"In Scotland, OSR variety Cracker used to have good LLS resistance but after a few years this seems to have eroded. Further AHDB-funded postdoctoral research is being done at the University of Herts to further understand LLS pathogen population structure."

LLS is a very similar disease to septoria in wheat in that the disease always seems to be present, but severity depends on the weather encountered in any one season.

Although a forecasting tool for LLS hasn't been produced, AHDB's Dr Jenna Watts says the headline finding of the project is of utmost importance to OSR growers.

"The fact that spores are produced much earlier in the season than previously thought emphasises the importance of early control and using resistant varieties."

Azoles are currently still effective against LLS and we need both azoles and non-azoles for control of LLS and for resistance management strategies, says Faye Ritchie.

As far as variety and fungicide selection are concerned, the information is readily available, she says.

"Varieties are rated for their LLS resistance in the AHDB Recommended List and fungicide performance information is published to help select the most effective ▸

Jenna Watts emphasises the importance of early fungicide application and using varieties with good LLS resistance.

▸ active ingredients on the disease.

Some growers have been disappointed in the ability of fungicides to control LLS and that has led to fears of a decline in the efficacy of fungicides. ADAS' Dr Faye Ritchie is leading a second project to help understand and develop effective resistance management strategies in OSR.

"Strains with decreased sensitivity to azoles have already been reported in LLS populations in the UK and we are assessing the current frequency of resistant strains and impact on control. We've already seen shifts in other economically damaging pathogens, such as *Septoria tritici*, and a consequent reduction in the efficacy of azole chemistry," she says.

"Azoles are currently still effective against LLS and we need both azoles and non-azoles for control of LLS and for resistance management strategies. It's important to prolong the effectiveness of all the modes of action we have."

Loss of Refinzar

One of the big problems in OSR is the very small number of active ingredients with different modes of action, a problem that's set to worsen with the looming loss of Refinzar (penthiopyrad+ picoxystrobin) at the end of Nov in 2018 (see panel on p23) which offered an SDHI plus strobilurin alternative in the autumn. Azoles are predominantly used in the control of the major OSR diseases — phoma, LLS and sclerotinia — but there's a strong rationale that reliance on a single mode of action is a poor anti-resistance management strategy, says Faye.

When LLS symptoms are usually detected in the field, it's probably already the 2nd or 3rd generation that's present.

"We will still have azole/non-azole co-formulations as well as non-azole chemistry that can be used in the crop in the spring for LLS control," she points out, using Pictor (boscalid+ dimoxystrobin) as an example.

"Selection for fungicide resistance isn't

LLS isn't textbook anymore

According to Velcourt's technical director Keith Norman, the 2016-17 season wasn't a bad one for LLS, unlike the previous season.

"That means it's not a foregone conclusion that because we have a bad year for LLS, as in 2016, that it will be followed by another bad one. In trials, yields in both treated and untreated plots have been very similar."

But in a difficult season LLS can be a yield robber, especially if it reaches the pods when it can result in a 0.5t/ha or more loss in yield in a 3.5t/ha crop, says Keith.

The aim of the Velcourt trials was to look at fungicide timing, intervals between fungicide applications and product choice but at harvest there were no significant differences between treatments, due to a lack of LLS pressure. The trials will be repeated in the 2017-18 crop, where LLS may be more prevalent.

Keith believes in-field monitoring technology will provide a useful tool when it comes to detecting LLS early in the epidemic.

"LLS appears in foci and these can often be spotted later in the season as patches which aren't as tall and have brittle leaves, often whitish in colour," he explains.

Spotting these very early infections would help give warning of an epidemic and enable a first fungicide to be applied in good time. And this is where Keith believes drone technology will advance agronomy when it comes to making fungicide decisions for LLS.

"We're working with Hummingbird technologies to develop an algorithm for LLS in OSR which will enable early infection to be picked up and provide an indication of when reinfection has occurred," he explains.

One of the problems he identifies with LLS is that identification can be a problem in the field. "Herbicides and fertiliser can cause scorch symptoms which appear similar to LLS so the disease can be overlooked. Placing leaves in a plastic bag with some moistened kitchen paper and leaving them in the airing cupboard for a couple of days will incubate the disease, which will sporulate if present," he advises.

Wax on the leaves of OSR provides the crop with a first line of defence against disease but anything that dewaxes the crop, such as pesticide application, wind or rapid growth, encourages LLS.

"For many growers, the priority in the autumn is applying a sequence of herbicides for blackgrass control which allows LLS infection to get a foothold," he says.

A worrying problem identified in the 2016 season was that fungicide activity didn't appear to be as good, indicating that perhaps resistance was building.

"We sent samples to Rothamsted who confirmed that there had been a shift in sensitivity.

Keith believes drone technology will advance agronomy when it comes to making fungicide decisions for LLS.

When LLS pressure is high, it's a very difficult disease to control. Because it's a polycyclic disease, the rate of re-infection is very high — sometimes as soon as 2-3 weeks after fungicide application," he says.

Frequent application of fungicides leads to selection pressure so Keith believes we should look towards genetic resistance to LLS to ease the pressure.

"Regularly monitoring crops is essential because the disease isn't textbook anymore. It may be that there's more pathogenicity in the population or it may be environmental change that's causing more background pressure," he suggests.

just driven by products that are used in the autumn, it's about the chemistry that's applied when LLS is present in the crop — even if it's not the primary target.

"It's the period over which the pathogen population is exposed to a fungicide that's directly related to the amount of selection for fungicide resistance that occurs. So a treatment targeted at one pathogen can also cause resistance selection in other pathogens that are present, even at very low levels," she explains.

One aim of the project, which has now been running for a year, is to determine the risk of fungicide resistance developing in the three key diseases of OSR using an existing model. Anti-resistance management strategies will then be put the test to find which are most effective at slowing fungicide resistance selection in *P. brassicae* by comparing application of solo products against mixture and alternation strategies.

"Bart Fraaije at Rothamsted is testing samples from field experiments within the project to look at whether different strategies are selecting for azole insensitivity in the LLS population," she adds.

Light leaf spot symptoms can be confused with scorch.

The final aim of the project is being funded by crop protection industry partners and will conduct an economic analysis on the fungicide anti-resistance management strategies to assess their cost-effectiveness for growers.

The Fungicide Resistance Action Group UK (FRAG-UK) has just updated its guidance on fungicide resistance management in oilseed rape with a range of cultural control options, including managing inoculum sources, drilling date, extending rotations and using resistant varieties. All of which Faye believes are important to consider as part of an integrated control strategy for OSR diseases. ■

Research round-up

AHDB project 2012-3814, Investigating components of the oilseed rape light leaf spot epidemic responsible for increased yield loss to the UK Arable Industry, ran from Aug 2013 to Dec 2016. Its aim is to develop and validate a novel decision support tool to predict light leaf spot epidemic onset and help improve the understanding of LLS epidemics. Its cost to AHDB is £77,711 and the project has scientific partners Weather Innovations, ADAS, SRUC and Rothamsted Research, together with industry partner Bayer CropScience.

AHDB project 21120015, Maximising the effective life of fungicides to control oilseed rape diseases, through improved resistance management. The project runs from Jan 2017 to June 2021 at a cost of £160,966. It aims to determine the risk of fungicide resistance affecting fungicides used against the major oilseed rape diseases, test which anti-resistance management strategies are most effective at slowing fungicide resistance selection in *P. brassicae* by comparing application of solo products against mixture and alternation strategies. An economic analysis of fungicide anti-resistance management strategies for the industry will be funded by contributions from the crop protection industry.