

Performance stems from good genetics

“It’s often the disease in the stem, rather than the leaves, that causes the majority of the yield loss.”

Inside traits

No one likes a flat oilseed rape crop, but how much do you know about the health of the stems that support it? *CPM* investigates the genetics of stem-based diseases.

By Tom Allen-Stevens

Your oilseed rape crop may already have taken you on a see-saw of emotions this season. But as the canopy closes over, there’s one aspect of the crop that’ll lurk unseen and can pull you from a harvest high to a crop disappointment: the health of the stems.

“Stem-based diseases often go undiagnosed, partly because you have a job to actually inspect it during the growing season,” says arable crops development officer Liam Wilkinson. “But no grower wants to end up with a flat crop.”

Although it’s related to important diseases, stem health seldom gets the attention it deserves, he believes. “The AHDB Recommended List scores diseases by the extent of their foliar severity. But there can be a difference between the

cleanliness of leaves and stem symptoms, and varieties also differ in how the disease is expressed on the leaf and stem. What’s more, it’s often the disease in the stem, rather than the leaves, that causes the majority of the yield loss.”

Key diseases

There are some key diseases that affect stem health (see panel on p54). Some, such as sclerotinia and verticillium stem stripe are sporadic, while phoma that causes stem canker, and light leaf spot, resulting in cylindrosporium are prevalent in most years. While there are fungicides that offer good control of sclerotinia and phoma, azoles are losing their efficacy on LLS, while there’s no chemical control at all of verticillium wilt.

So what protection can genetics offer? “Stem health is a basket term, rather than a trait with a defined set of genetics,” explains Limagrain UK OSR breeder Maeve O’Rourke. “But it’s been a key focus for us across the LG European breeding programme. We select plants with good strong stems that stand well as a matter of course. But we’re also looking for resistant genes to specific diseases.”

Phoma stem canker is the obvious one here. “It’s more of a problem on the Continent than in the UK, and we’ve been successful at ensuring all our hybrids now have the *Rlm7* gene, as well as good

background resistance, offering very good protection for growers,” she says.

Verticillium stem stripe is a relatively new disease, in breeding terms, and its sporadic nature makes it hard to select for. “There’s no genetic resistance yet, but we have identified QTLs (quantitative trait loci, or sections of DNA) of interest. We currently have material in year two of National List trials showing very promising resistance to the disease. It’s important we bring this forward as climate change is ▶



Stem-based diseases often go undiagnosed, partly because you have a job to actually inspect the crop during the growing season, says Liam Wilkinson.

Good LLS score essential in Scotland

For Scottish OSR growers, there's one key disease threat to keep an eye on, according to Scottish Agronomy trials manager Adam Christie: light leaf spot.

"We've never seen much in the way of verticillium leaf stripe and phoma stem canker, but LLS is endemic in Scotland," he says. "However, in 14 years of Scottish Agronomy trials, we've had no response to an autumn fungicide treatment."

Scottish Agronomy is the largest trials operator north of the border with 25,000 combinable crop plots. Much of the northern information on the AHDB Recommended Lists as well as the National Lists comes from the plots it operates across various locations. Adam draws his conclusions on OSR disease from the 2000 small plot OSR trials

the company has as well as 7000 mini tussock plots, which are all assessed for LLS.

"It's a swine of an opponent — LLS has such a flexible genotype it adapts itself to its situation. It's no surprise that prothioconazole is losing its efficacy as we've been relying on it for years. The one line of defence we do have is the robustness of the genetics. The Limagrain varieties have that robustness built in, so it's no surprise they're performing very well in trials," notes Adam.

The trials don't specifically monitor levels of cylindrosporium, but another aspect he's noticed from results is that there's little response to an autumn spray. "There's a shift in focus up here to the early flowering fungicides where you get better

returns for your spend. That suggests that late season protection is reducing LLS transfer to pods and stems."

Among the LG varieties, he picks out LG Aviron as one that's particularly strong. "It consistently performs well against LLS and there's little difference between its treated and untreated yield scores," he notes.

"It's essential for Scotland that OSR stays in the rotation as there are few other break-crop choices. It's good to see rotations extend as that will ease the clubroot pressure, but the crop will always come under pressure from LLS, so it's good to have a choice of varieties with the right genetics," adds Adam.

► predicted to make verticillium more of a problem for growers."

Maeve believes that cylindrosporium may be a disease where there are differences that are seldom apparent from

disease scores on the RL. "LLS is now the biggest OSR disease threat in the UK, and becoming harder to control. There are now plenty of varieties with good resistance. But this is where there can be a big

difference between the severity of foliar symptoms and resulting damage to the stems."

It's again a disease more common on the Continent than in the UK, and Maeve's

Stem-based diseases

There are a number of key diseases in the UK that affect the stems of OSR crops, and for some there's limited fungicidal control.

Verticillium stem stripe

Previously known as verticillium wilt, this sporadic disease was initially confirmed in England in 2007 and is caused by the pathogen *Verticillium longisporum*. A persistent soil and seed-borne pathogen, it lasts for over 10 years and can build in the soil when susceptible hosts, including vegetable brassicas, are regularly grown. The disease is now widespread, with most severely affected crops located in eastern England and found as far north as Yorkshire and west as Herefordshire.

Verticillium causes canopy collapse and seed shedding with yield drops recorded in trials of 3-34%. These are highly variable and weather-dependent with high temperatures and drought stress in the run-up to harvest exacerbating losses.

The soil-borne microsclerotia infect the seedling and the fungus colonises the vascular tissue and upper plant during stem extension. Leaf yellowing may occur from April onwards and warm spring temperatures will encourage this.

Yellow, followed by brown, vertical stripes occur on stems towards the end of June and early July. These lengthen and become more visible as harvest approaches — scraping an infected stem surface can reveal grey discolouration of the vascular tissue beneath the stripe. There is no chemical control of the disease.

Stem canker

Phoma leaf spot leads to stem canker in its latter stages and is caused by two closely related pathogens — *Leptosphaeria maculans* and *L. biglobosa*. It's one of the most important diseases of winter OSR in the UK, especially in central, southern and eastern England, causing economic losses estimated at £100M each season and yield losses of up to 0.5 t/ha.

Warm, wet and humid weather in the autumn releases ascospores from infected stubble. These land in young leaves causing the characteristic spotting symptoms visible on the upper surface. The pathogen grows along the leaf petiole to the stem, killing plant tissue cells around the leaf scars at the stem-base.

These develop further and girdle the stem, restricting water and nutrient transport, resulting in premature senescence. In extreme cases, the stem can sever, the crop lodges and plants can die. It can be controlled with a well-timed autumn fungicide and the earliest infections cause the largest cankers.

Cylindrosporium

This is the stem-based stage of light leaf spot, a disease caused by the pathogen *Pyrenopeziza brassicae*. LLS is a polycyclic disease, producing more than one infection cycle per season, and *Cylindrosporium concentricum* is its asexual stage. Once known as a Scottish and northern disease, all areas of the UK are now at risk, and it's prevalent

across much of northern Europe, too. LLS has taken over from phoma as the key threat to OSR in the UK, and can cause yields losses of up to 1 t/ha.

Small apothecia develop on infected crop debris, releasing airborne ascospores. These spores can travel for several miles, infecting new crops as they emerge. During winter, rain-splashed spores (conidia) spread the disease up the plant or to adjacent plants, with warmth and moisture favouring spread. The pathogen remains active below temperatures required for crop growth, so the disease multiplies on plants during winter, cycling every four to eight weeks.

Often invisible to the naked eye, light-green circular lesions on the leaf surface are the first signs of the disease. In late winter and spring, leaves may curl, distort, become brittle and crack.

When the disease spreads to stems and lateral branches, elongated fawn lesions appear, surrounded by black speckling. The stems may form horizontal cracks as they extend. Under favourable conditions, the disease can spread to and distort pods, which turn brown and shatter prematurely. While azole fungicides have offered good control, LLS populations are becoming increasingly resistant and efficacy is waning.

Sclerotinia stem rot is another disease that can affect stems, infecting plants during flowering if conditions are favourable. But it is highly sporadic and fungicides currently offer effective control.

Source: AHDB Knowledge Library

Limagrain's UK OSR portfolio of Recommended varieties at a glance

	LG Auckland	Ambassador	LG Aviron	Aurelia	Artemis	Acacia	Annika	Aardvark	Aspire	LG Adonis	LG Antigua	Amarone
Variety type	Hybrid	Hybrid	Hybrid	Hybrid	Hybrid	Conv	Conv	Conv	Conv	Hybrid	Hybrid	Conv
Scope of recommendation	UK	UK	UK	UK	UK	UK	UK	UK	UK	E/W	E/W	N
Gross output (% treated control)												
United Kingdom	107	106	105	105	104	104	103	100	100	-	-	-
East/West region	108	106	105	105	104	104	103	100	100	108	104	-
North region	(104)	104	104	105	102	104	(102)	102	100	-	-	105
Untreated (UK)	-	107	110	107	103	104	104	104	101	-	106	-
Agronomic Features (1-9)												
Stem stiffness	7	8	7	8	8	9	8	8	9	8	8	8
Plant height (cm)	155	154	156	150	157	145	149	149	140	149	156	143
Earliness of flowering	7	7	8	7	6	6	6	7	7	7	7	7
Earliness of maturity	7	6	6	5	6	5	4	5	4	5	6	5
Pod shatter	6	R	R	R	R	-	-	-	-	-	R	-
N-Flex	R	Y	Y	-	-	-	-	-	-	-	Y	-
Disease resistance (1-9)												
Light leaf spot	7	7	8	7	6	6	7	7	7	7	6	7
Stem canker	7	7	7	7	7	5	6	6	5	8	7	6
RLM7	Y	Y	Y	Y	Y	-	-	-	-	Y	Y	-
TuYV	R	R	R	R	R	-	R	-	R	R	R	R

Source: AHDB Recommended List Winter oilseed rape 2022/23; R/Y – believed to be resistant to (R) or have (Y) the trait but this has not been verified in RL tests.

colleagues in France and Germany have brought lines through under extreme cylindrosporium pressure, to tease out those that fare best. “The next generation

of LG lines are looking really clean for all the major stem-health diseases. These will begin to appear on the UK market this autumn, and will be more widely



Stem health has been a key focus across the Limagrain European breeding programme says Maeve O'Rourke.

available in 2023,” she says.

Liam points out that all of the LG varieties currently on the RL have been scored for cylindrosporium in the company's own trials, as well as for LLS in the RL programme (see chart on p56). He picks out LG Aviron, Aurelia, Ambassador and newcomer LG Auckland as frontrunners.

“All of them are fully loaded hybrids, with pod-shatter and turnip yellows virus resistance, as well as the *Rlm7* gene. ▶

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Inside traits

► They have an RL score of 7 or 8 for LLS and have shown few symptoms of cylindrosporium in UK trials.

“Aurelia and Ambassador are proving farmer favourites, both with canopies that are easy to manage. Aurelia is a strong performer in the North, and sits a bit more, with a shorter stem.

Ambassador has the N-Flex trait that helps crops utilise nitrogen more efficiently in low N conditions. Auckland is the highest yielding variety in the UK with pod-shatter resistance and has the edge on its stable mates for spring vigour. Aviron is the quickest in the autumn of the four.” ■

Inside traits

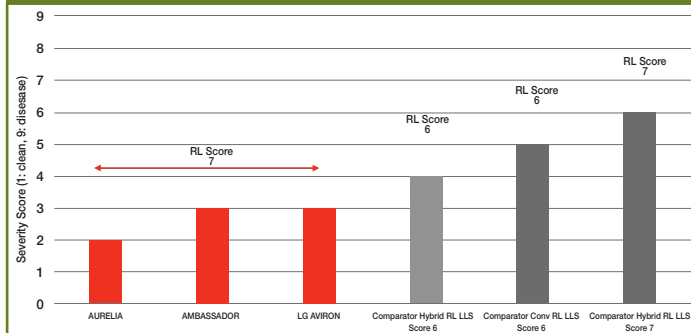
Sustainable agriculture is moving to a new era in which plant genetics play a greater role in the integrated crop management toolbox growers utilise to get the best from their crops. In this series, CPM has teamed up with Limagrain to give growers insight into these new tools. Through privileged access to staff and related research these articles look inside the traits, explore the genetics and unlock the secrets of a successful crop.

Limagrain started 50 years ago as a farmer-owned co-operative in France, and is now the fourth

largest seed company worldwide. With an annual turnover of nearly €1.9 billion, 16% of this is spent on R&D. By developing varieties with higher yields, improved resource efficiency and reduced environmental impact, Limagrain is a major contributor to meeting agriculture's sustainability goals. And this guides the company's raison d'être: to cooperate for the advancement of agriculture everywhere, for everyone.

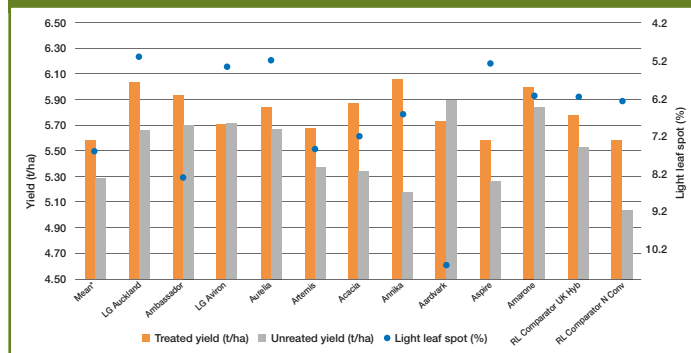


Varietal performance on cylindrosporium



Source: Limagrain trial network results, UK site, harvest 2020.

Performance of LG varieties in Scottish trials



Source: AHDB Recommended Lists 2021 Harvest Results; *Treated yield is average over five sites, untreated yield is average over two sites, LLS score is average over four sites; The two RL Comparator varieties are a hybrid with UK-wide recommendation and a conventional recommended for the North.

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