

“It’s important to consider how we’re going to manage OSR in the future, in the presence of CSFB.”

Lodging a war on flea beetle

**Technical
Spring agronomy**

As cabbage stem flea beetle continues to be a key concern for oilseed rape growers, ADAS discussed the relationship between the beetle and the risk of lodging at a recent webinar held in conjunction with BASF. CPM joined to find out more.

By Charlotte Cunningham

Lodging can be a very serious problem in oilseed rape, with the architecture of the crop meaning it relies on a single tap root for anchorage.

Though it can be a huge issue, over recent year’s OSR growers focus’ has perhaps been elsewhere — namely on cabbage stem flea beetle and the destruction an infestation can cause — but what happens when you look at these two problems in tandem?

While lodging can be caused by a number of factors, stem strength has an obvious role to play, which has led a team of researchers at ADAS to look further into whether or not there’s a relationship between CSFB damage and the risk of lodging.

But before you delve into the detail regarding the effect of CSFB on lodging, it’s firstly important to understand the impact the condition has on crops and the cost involved.

This is an area that’s been largely under reported says ADAS’ Dr Pete Berry, who has been involved in the studies into the cost of lodging. “When we first started this bit of work, we realised no one had tried to quantify how much lodging occurs in the UK.

“So we started off by doing an aerial survey back in 2012 of quite a large area — more than 2000ha in East Anglia — to estimate the percentage of area lodged at the end of July.”

Aerial images

Pete says that while it’s really easy to identify lodging in cereal crops from the air, it’s not quite so straightforward in OSR, so the aerial images had to be scrutinised very carefully. “We found that in 2012, 35% of the area we observed was lodged.

“Looking further, we found 99% of the fields contained evidence of lodging — 40% of fields were 36% lodged or more, and 20% of fields were 70%+ lodged.”

The same survey was replicated in 2014, but this time the photos were taken at the beginning of July and surveyed more than 1000ha in North Yorks, Lincs, Cambs. “In 2014, we found that 27% of the area lodged in this season.

“Drilling down into the detail, in this year 32% of fields had 35% lodging or more, and 5% of fields had 70% lodging or more. In this year, all fields surveyed had some degree of lodging in them,” he adds.

“I think it’s important to stress that these weren’t particularly bad lodging years, and we were surprised by just how much lodging

we were seeing.”

Pete stresses that the main take-home point for him from both of these surveys was that there was more lodging present than expected. “It’s one of the big issues, particularly in OSR, as you often don’t actually see how much there is until you get in the combine and get on top of the crop.”

The next part of the project looked at how yield is lost on a lodged patch. “This is quite a difficult thing to do with natural lodging, so we artificially lodged a number of crops — we had to do that very carefully to try to mimic natural lodging as much as possible.

“We went out on a wet day and took time to push down that crop as much as we could without buckling stems and made sure we lodged at different degrees — 22.5°, 45° and 90°.

“The results were published in an international journal which was peer reviewed and in summary it was shown that high yield losses do occur as a result of lodging.”

The results showed that almost 50% yield losses occurred when crop was lodged flat at 90°, from any point from early flowering right up to the start of seed fill. Slightly lower losses were seen when a crop was lodged flat at mid seed-fill.

“We also found that severe lodging reduced oil content by up to 8%, which is a really significant reduction for both growers and end-users,” warns Pete.

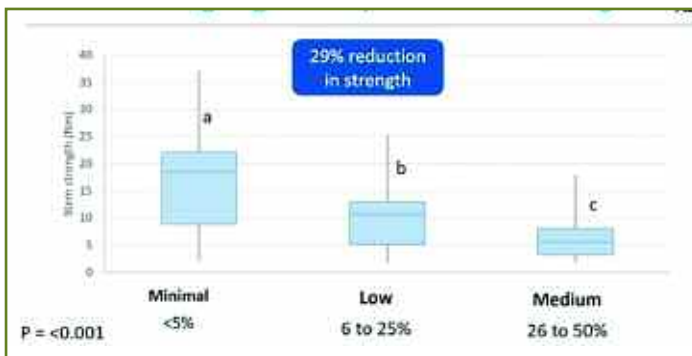
At the other end of the scale, he says it’s also important to acknowledge that significant losses can still occur when the crop is just slightly leaning — with the study



ADAS ranked OSR samples from 1-5 to illustrate the level of damage caused by CSFB. Photos: ADAS



The studies found that even low degrees of lodging can cause significant yield losses. Source: ADAS



Even low levels of CSFB damage were found to reduce stem strength. Source: ADAS

showing these losses can be anything from 7% to 16%, depending on the timing.

"It's worth looking at that a bit more because we were surprised

that you do get such a yield loss when you're just leaning the crop slightly.

"The reason for this is because the crop is photosynthesising and

filling its seeds — if you end up squashing the canopy, even just slightly, the pods aren't held in a favourable condition to capture light and as a result, fills seeds less effectively."

Turning the focus to costs, ADAS put the two studies together and were able to use the information to estimate that lodging can cost the UK OSR sector anything from £47m-£120m, depending on the severity.

"Comparing this with other key OSR issues, phoma losses are estimated to cost between £60m and £80m, while light leaf spot infections can attribute to costs of between £80m and £160m.

"Additionally, you've got other costs from uneven ripening, the extra drying and the admixture in the seed sample, as well as of course the extra time to harvest the crops — which can be anything from 5-25% longer."

Often underestimated

Pete believes that the issue here is that we often underestimate how much lodging has occurred because it's not easy to see. However, it's fair to say that the studies have shown that lodging can be a hugely expensive event on farm, and while the researchers based their work on replicating 'natural' lodging, the bad news is that CSFB can exacerbate this.

But the good news is that there are actions that be taken to minimise the impact of CSFB on lodging in OSR.

Fran Pickering, entomology consultant at ADAS has been



Little research had been done to quantify how much lodging in OSR occurs in the UK, according to Pete Berry.

looking into the impact of CSFB on stem strength and lodging risk in OSR in the UK.

"CSFB isn't a new problem, and it's something that's increasing in the UK," she says. "This is largely due to a lack of good chemical control for this kind of pest, due to both increased pyrethroid resistance and also the loss of neonicotinoids.

"This means it's important to consider how we're going to manage OSR in the future, in the presence of CSFB.

Fran says that something they've been particularly interested in is seeing the impact that the larvae have in the stems. "CSFB larvae enter the plants around Oct time and can stay all the way through to May — feeding on the stem from the inside.

"So it's long been assumed that this would be affecting the ▶

Larvae levels – advice on checking for infestations

With the ADAS research showing specifically how damaging the presence of CSFB larvae can be, what's the best way to check for it in crops?

"I recommend taking a few plants from field — from varied areas if possible," says Fran. "Then the simplest way to then check for larvae is by quartering the stems and taking a look inside.

"If larvae are present, then they're likely to be at the bottom of the stem or near the leaves — specifically where the leaves join the stem.

"As a good rule of thumb, we've found that if you've got about 10 larvae in the stem, you could get a 0.5t/ha yield loss — so keep that in mind when you're looking and counting larvae."

While a number of crops will undoubtedly have high levels of CSFB burdens this season, Pete says to weigh up all the factors carefully before giving up on crops this spring.

"Last year we had crops that went backwards through March and a lot of the blame was put on to CSFB as there was undoubtedly a lot of it

around, but our analysis proved that losses last year were mainly due to weather issues.

"Therefore, I wouldn't want to advise a knee-jerk reaction based on last year's experience, because in previous years OSR has become famed for its ability to compensate low early growth for decent yields.

"I think I'd only give up if a crop was looking very poorly and had been like that for several weeks."



ADAS research, headed up by Fran Pickering, has shown CSFB can have a huge impact on stem strength and the risk of lodging in OSR.

► strength of the stem, but we didn't know by how much, so we wanted to look into this further."

And there was another step the team wanted to take, explains Fran: if the stem strength is affected by CSFB, what does this mean in terms of the risk of lodging, and what can growers do about it?

To test this, ADAS carried out a field trial, collecting 50 plants from two sites in East Anglia at the end of flowering in May, which were then taken back to the lab for analysis.

"Assessments were made by looking at the stem diameter and the breaking strength of the stem — using a force meter. We also dissected the stem to look inside and see how much damage the beetle had caused, meaning we were then able to give it a CSFB internal damage score," explains Fran. Damage scores were given based on the percentage of area damaged:

- Category 1 = Minimal (<5%)
- Category 2 = Low (6-25%)
- Category 3 = Moderate (26-50%)
- Category 4 = High (51-75%)
- Category 5 = Severe (76-100%)

According to Fran, most of the stems selected in the study were in category 1-3. "But it's worth pointing out that any stem that had very severe damage inside the stem was visible from the outside of the plant too. In field, these plants appeared quite stunted and distorted."

Results from site one showed that there was a clear trend between the diameter of the stem and the stem strength. "Generally, higher damage was associated with thinner stems. So the next question is, why might we get getting thinner stems in damaged plants?"

To understand this, it's important to look at the type of damage CSFB is causing, explains Fran.

"Mining and browning is often seen at the base of the plant, and what we think here is that the CSFB is restricting water and

Cost of lodging study conclusions:

- A significant area of OSR found to lodge – 35% in 2012 and 27% in 2014.
- Lodging can be easily missed and not identified until harvest.
- Severe lodging at flowering reduced yield by about 50% and reduced oil content by up to 8%
- Late leaning can have substantial effect on yield though it's often considered to have no detrimental effect.
- Seeds per m² most affected by lodging – reduced seed per pod and pod abortion
- Cost of lodging shouldn't be ignored and is usually significant.

nutrient uptake into the plant, leading to thinner stems."

But this is not the only type of damage that was seen.

"On site two, similar trends were seen in that there was a link between diameter and stem strength, but as well as this, when we plotted the best fit trend lines on the graphs, we found that they were slightly different for each type of damage category," she says.

But what does this mean?

Fran explains further: "If you take a certain diameter, for example in this case of 17mm, if you had a low damage category, you'd be likely to have a stem strength of 23Nm.

Higher damage

"But a higher damage category (2, for example) would at the same diameter — only have 15Nm of stem strength. Leading us to conclude that for any given stem diameter, more damage makes it weaker."

And it seems even low CSFB damage can significantly reduce stem strength, she adds. "When we move from a minimal damage category to a low (6-25%) category, we're actually still getting a significant reduction in stem strength — up to 29%."

So the studies have confirmed CSFB definitely reduces stem strength, and by how much, but what implication does this have on lodging risk?

"ADAS uses a model to assess the risk of lodging in OSR, developed through a collaboration between wind engineers, remote sensing experts and crop physiologists. The whole idea behind this is that you can take certain parameters of a crop — for example, it's height, stem strength or canopy size — and use this to

predict the risk of lodging," explains Fran.

The data from the study was put into the model. Looking at the example of a plant that has low larval damage (6-25%), while the plant outwardly exhibits normal development, a 29% reduction in stem strength means lodging risk increases from 1-in-10 to 1-in-3.

However, all is not lost, as the model also gives suggestions of how to reduce the risk, she points out. "In this case, a reduction in height would be required to counteract the risk of lodging — around a 25% reduction in height would be adequate in this situation.

And while growers don't really have much in the way of options for tackling the actual beetles themselves, from a practical point of view there are a number of things they can do to counteract stem weakening and reduce the risk of lodging.

"The first thing you can do is at establishment, namely avoiding an overly dense plant population, as this results in plants with weak stems. Growers could also use a PGR to reduce height and therefore the risk of lodging. This is a really good option as you can reduce the height of your crop by 5-15% — so this will counteract some of the damage caused by the beetle in the stem.

"And finally, if you've got a crop that's growing away quite nicely, you could delay or reduce the first spring nitrogen application. Here, we're only really talking about crops that have a GAI of over 1.5-2 but the principle behind this is that applying a large amount of early spring N to a crop which is already quite large can lead to leggier crops which are more prone to lodging. ■

'Impact of CSFB on lodging risk' study conclusions:

- Stems with higher internal damage have reduced stem strength.
- This is primarily due to reduced stem diameter in damaged plants.
- There may be an additional reduction in stem strength due to stem hollowing and decrease thickness of the stem wall.
- Reduced stem strength caused by category 2 damage is estimated to increase the chance of lodging from 1-in-10 to 1-in-3.
- There are measures you can take to counteract the stem weakening caused by CSFB.