> *"The exceptionally mild winter significantly increased the risk of infection."*

# Living with virus yellows

## Roots Virus yellows

**The threat from virus yellows is a very real one this season after a mild winter and spring. *CPM* finds out what the virus forecast is and the limited strategies available to reduce its potential effect on yields.**

*By Lucy de la Pasture and Rob Jones*

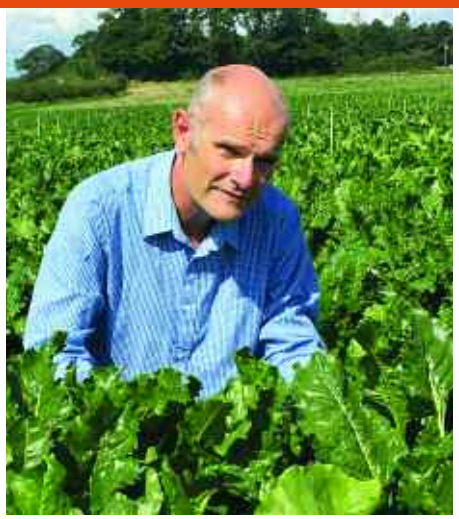
**The potential threat posed by viruses is very much in mind at the moment and for sugar beet growers, virus yellows has once more become a grave concern. After more than two decades of relatively minor risk when the metaphorical shield afforded by neonicotinoid seed treatments meant there was little need to consider other means of protection, the crop is again at threat from a problem once regarded as 'neutralised'.**

### Targeted use

"Neonicotinoid seed treatments provided a solution to virus yellows. They enabled targeted use of a highly effective pesticide," says Prof Mark Stevens, lead scientist for the British Beet Research Organisation (BBRO).

"In hindsight reliance on one class of insecticides rather than a greater integrated approach, has led to a renewed threat from virus yellows."

The threat this season is very real, he stresses. Monitoring shows that were it not for neonicotinoid seed treatments, the UK crop would have experienced seven virus epidemics of more than 50% infection since the year 2000. The risk this season is similarly severe. Forecasts indicate that upwards of 70% of the crop could be infected with one form or more of virus yellows; even early sown crops are at significant risk (see table on p98).



*Mark Stevens says the exceptionally mild winter of 2019-2020 has significantly increased the risk of virus yellows infection this season.*

"The exceptionally mild winter of 2019-2020 significantly increased the risk of infection because the main aphid migration will occur when plants are smaller and more susceptible [to virus infection]," says Mark.

The advice to growers on how to manage the risk to crops has largely focussed on practical measures, such as promoting establishment, in the hope that the crop will reach the 12-leaf stage when adult plant resistance begins to kick in without suffering any impediments to growth.

The forecast risk in 2019 was also high at more than 20% (see figures in brackets in table), but the limited reservoir of virus (partly as a result of the previous use of neonicotinoid seed treatments limiting ▸

## Why is virus yellows so difficult to control?

Virus yellows is an aphid-transmitted complex of three different viruses that includes beet mild yellowing virus (BMYV), beet chlorosis virus (BChV), and beet yellows virus (BYV). Both BMYV and BChV are persistently transmitted viruses, meaning once the vector has acquired them it remains infective for life, though it can't pass the virus onto its progeny.

BYV is a semi-persistent virus, meaning the aphid remains infective for only a short time, typically up to three days, before needing to reacquire the virus.

While all the viruses involved represent a threat to crop performance, the degree differs depending on the extent and type of infection. Trials have shown that yield losses per infected plant of up to 30% with BMYV and 47% with BYV can occur.

Peach-potato aphids (*Myzus persicae*) are regarded as the principal aphid vector. The potato aphid (*Macrosiphum euphorbiae*) and the black bean aphid (*Aphis fabae*) can also transmit some or all the viruses to sugar beet, though are less efficient at doing so and are therefore considered to be a lesser threat.

Sugar beet is most vulnerable to virus yellows infection during the seedling stage through to the point when adult plant resistance begins to develop. This is typically about 12-13 weeks after germination when the plant reaches the 12-leaf stage.

*The peach potato aphid is the most important vector of the virus yellows complex.*

▸ sources of infection) from which the aphids could acquire infection meant the actual rate of infection was low.

"Although 55% of crops showed symptoms of one kind or another, the actual level of infection was only 1.8%. Without intervention in the form of an insecticide to break the cycle of infection, the reservoir of virus will increase exponentially and with it the real risk to crops," he explains.

Herein lies one of the problems facing growers. What can else can they do to reduce the growing risk?

"Ultimately it will be the weather through the season that determines our fate, but growers would be sensible to err on the side of caution," says Mark. "We have a sizable aphid population and there are many reservoirs of infection, especially sprouting sugar beet root remnants, volunteer potatoes, and brassicas, while many other crops provide sanctuary to the virus vectors during the winter months. Limiting the sources of infection and controlling aphid populations by using insecticides are our only means of protection."

In a bid to support growers, the BBRO was successful in its application for an emergency use approval for Biscaya (thiacloprid) and Insyst (acetamiprid). Under the EAMUs, sugar beet growers are able to apply Insyst once and Biscaya twice in addition to the full-label approval for one application of Teppeki (flonicamid). A recent announcement from Bayer that Biscaya has supply difficulties this season means Insyst is a welcome addition but, in reality, insecticide options for virus control are still likely to be limited for many this season. ■

## Non-chemical solutions

Efforts by breeders to identify major sources of resistance have proved unsuccessful so far, though several minor genes have now been mapped and are being introduced into elite varieties, explains Ben Bishop, UK country manager for KWS sugar beet.

For these genes to be effective, they need to be stacked to provide durable resistance without yield drag in the absence of disease. Such varieties have yet to be developed, though KWS claims to have a variety with tolerance to beet mild yellowing virus (BMYV) in official trials.

"Even as neonic seed treatments were gaining popularity across Europe, KWS was developing virus-tolerant varieties. In 2003 we had Jemina KWS, a variety with tolerance to BMYV, in official trials. BMYV is a persistent form of the virus yellows complex and has been found to cause losses of up to 30%," says Ben.

Once it became clear that the EU was seeking to withdraw approval for products containing neonicotinoids, KWS revived its virus yellows breeding programme. Jemina KWS was a useful starting point and meant KWS didn't have to screen wild relatives for sources of tolerance, he says.

"KWS has made rapid progress in meeting the needs of UK growers. Following two years of inoculated trials in the UK, we had two tolerant varieties in official trials during 2019 and will have three in 2020. All have demonstrated good tolerance to BMYV and are yield competitive, even under non-inoculated conditions, so will form a valuable component on an integrated strategy."

But tolerant varieties are only part of the solution. "Breeding will contribute in other ways, such as varieties with better bolting resistance, as well as advances in seed treatment technology. Both will support earlier sowing and improve the chances of the plant reaching the 12-leaf stage before the peak in aphid migration," he comments.

A preference for varieties suited to early sowing has been a priority for the UK for several years and progress is being made, but Ben warns that as other agronomic features increase in importance, growers may see the rapid pace of gains made in other areas slow.

"The last decade has been all about yield progression and, to this end, all breeders have made great strides. But as the suite of plant protection products decreases, breeders are under pressure to produce varieties with stronger inherent resistances and tolerances," he explains.

"Needs such as beet cyst nematode tolerance, better disease resistance, lower bolting and higher sugar contents are now of equal or, in some cases, greater importance than yield, so it's perhaps inevitable that delivering improvements in some areas will restrict the progress made in others," he adds.

*Ben Bishops says that breeding for tolerance to virus yellows is only likely to be part of the solution.*

**2020 Virus yellows forecast (2019 forecast in brackets)**

| Region | 15th March | 30th March | 15th April | Mean temperature (Jan -Feb) |
|---|---|---|---|---|
| East (Bury, Cantley, Wissington) | 71.9 (29.9) | 82.2 (39.5) | 91.4 (54.3) | 6.53°C (5.28°C) |
| North (Newark) | 79.6 (22.0) | 88.5 (31.2) | 95.3 (47.0) | 6.51°C (4.6°C) |

*Source: BBRO, 2020.*