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# Virus Yellows 2021: cold winter weather prevents a 2020 style epidemic but what does the situation look like in 2022?

In the past two years we have seen the two extremes of virus yellows scenarios in the crop and we cannot yet predict how your 2022 crops may be impacted. However, there is a lot to learn from the contrasting seasons, and new research from BBRO, to help you mitigate the damage caused by virus yellows in the year ahead.

Firstly, back to basics.

It's worth reminding ourselves of why tackling virus yellows has been so difficult to date. This is because there are three different viruses which make up the virus yellows complex, all of which potentially need different resistance strategies.



**Fig. 2.** Beet mild yellowing virus (BMV) which causes up to 30% yield loss

All of the viruses are transmitted by the same aphid vectors, most significantly *Myzus persicae*, the peach-potato aphid, which migrates into your crops during the spring and early summer. When a winged virus-carrying aphid lands on a plant, it will feed from the leaves and also transfer the virus. The aphid will also likely give birth to several live young (green wingless aphids) which will then colonise the plant. The adult may then take flight

**Fig. 1.** Beet chlorosis virus (BChV) which causes up to 25% yield loss



**Fig. 3.** Beet yellows virus (BYV) which causes up to 50% yield loss

again and move further across a field, spreading the virus further and producing additional young that can also lead to secondary spread of the virus(es).

## **What caused 2020 to be such a bad year for Virus Yellows?**

2020 was a perfect storm for virus yellows in sugar beet crops across the UK, but also in the fields of our European counterparts. This crisis was brought about by the extremely mild winter of 2019/20 and unprecedented aphid numbers surviving, migrating and reproducing on very immature beet plants throughout the spring.



**Fig. 4.** Green wingless aphids on the first true leaves of a sugar beet plant in early 2020.

**Why didn't 2021 turn yellow like 2020?**

Fortunately, in 2021 we experienced a very different set of circumstances for the crop, the aphids and the viruses which has resulted in a much lower incidence of virus yellows this campaign.



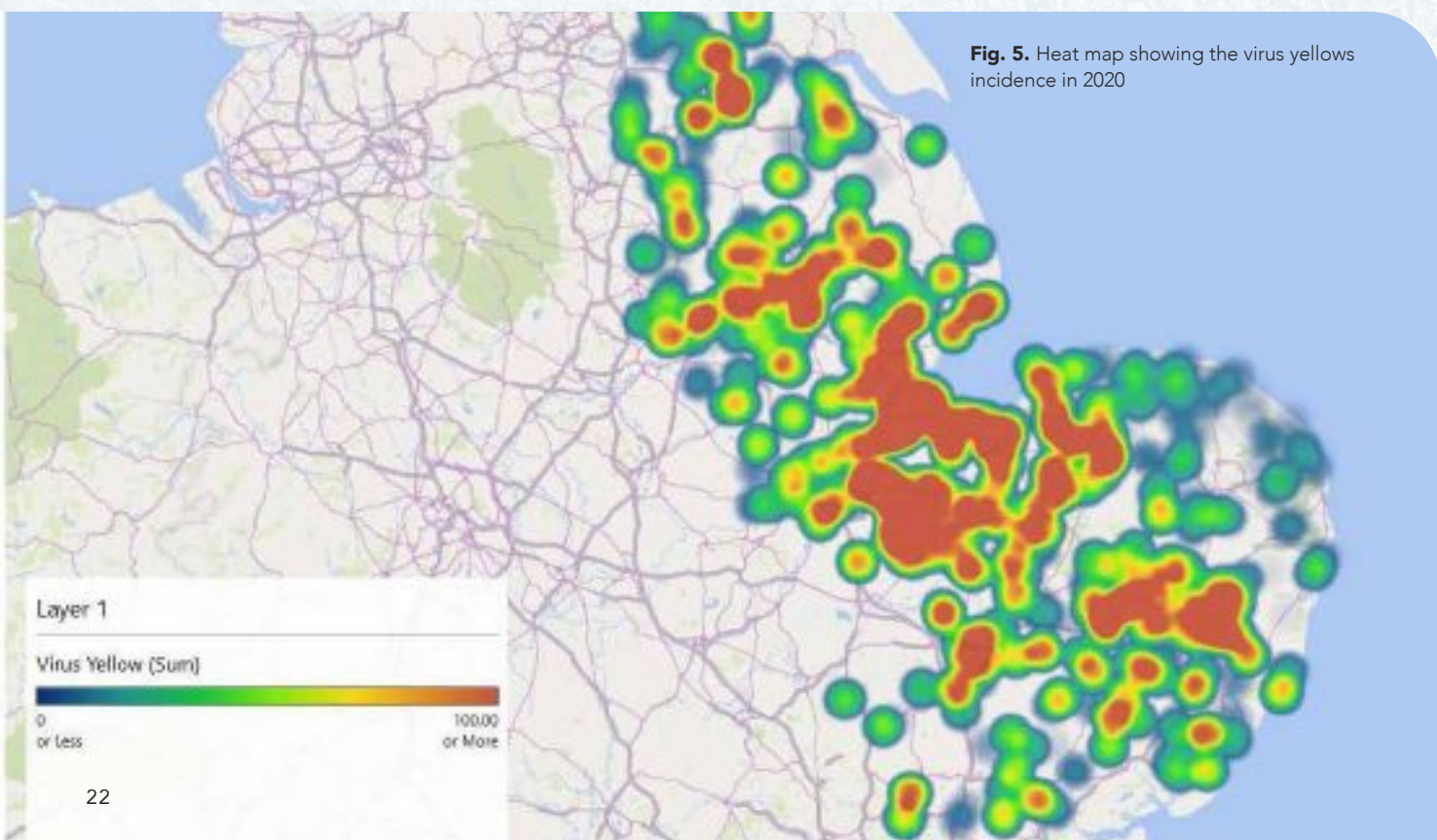
**Fig. 6.** Small patches of virus yellows

Our sector experienced its worst virus yellows epidemic since the mid-1970s, and just two years since the withdrawal of the neonicotinoid seed treatments, 38.1% of the national sugar beet crop was infected with virus yellows (Fig 5). Many growers in Cambridgeshire, Norfolk, Suffolk and South Lincolnshire experienced up to 100% infection despite the use of up to 4 aphicide sprays when the crop reached the recommended spray thresholds.

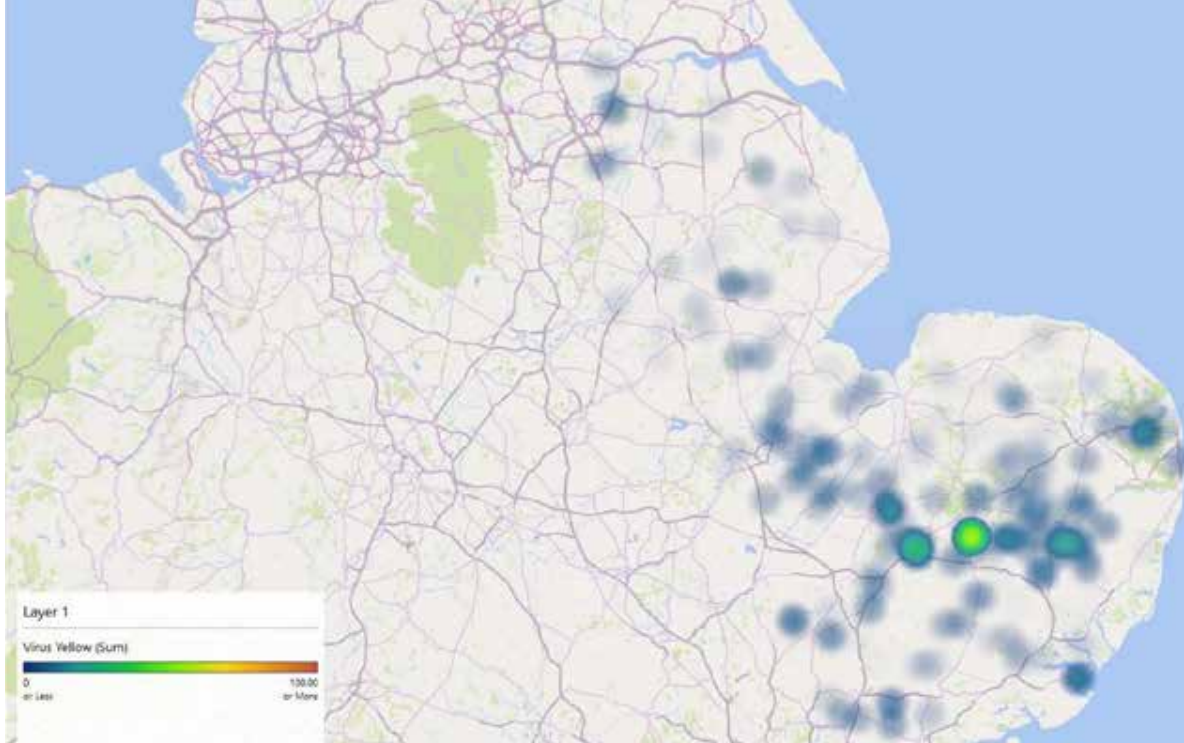
As we are sure you will remember, affected crops saw significant yield losses of up to 50% from decreased root weights and sugar content (and in some cases as much as 80%) and many affected crops were more susceptible to cercospora leaf spot too later in the season; sugar extraction was also impacted by increased impurity levels in the infected roots.

**The Crop**

In spring 2021, around 92,000 hectares of sugar beet were sown in the UK. Seed delivery was, compared to previous years, delayed for those growers who had requested the use of Cruiser SB as the industry awaited the outcome of the Rothamsted virus yellows forecast on 1st March. The use of Cruiser SB (Thiamethoxam) treated seed was conditional on the 9%



**Fig. 5.** Heat map showing the virus yellows incidence in 2020



**Fig. 7.** Heat map showing the infection levels of virus yellows in 2021

economical threshold for its emergency authorisation. Due to the cold winter of 2020/21 this trigger point was not reached and none of the UK seed was treated with Cruiser SB. Consequently, processing of the entire national seed order could not be completed until early March. Following the dry conditions experienced at the end of March, good drilling progress was made and 75% of the UK crop was sown by the week beginning 5th April and 99% by week beginning 26th April. However, the crop experienced one of the coldest and driest ApriIs on record, which was followed by a cool, but wetter, May.

At the end of May the crop was at a wide range of growth stages from cotyledon to 8 true leaves across the four factory areas, with British Sugar estimating that only 18% of the crop had reached establishment (6 true leaves) by 24th May; this was the slowest development of the crop for the last 10 years. However, conditions in June ensured that the canopy developed rapidly and by the end of this month, many fields were at or close to canopy closure and not attractive to aphids.

### The Aphids

Fortunately, the conditions through which the crop established were not particularly favourable to the aphids. Rothamsted Research originally predicted *M. persicae* flight in eastern England from the third week of May 2021, six weeks later than 2020. However, the first *M. persicae* was caught in the Broom's Barn suction trap (near Bury St Edmunds) on 27 April, followed by a second on 11th May. Up until the 20th June the Rothamsted

suction trap data showed that 190 *M. persicae* had been recorded at the Broom's Barn suction trap (compared to almost 4,000 in 2020).

BBRO's yellow water pan and aphid monitoring sites were established on 30th April. Aphid numbers recorded at sites were much lower than 2020, although a north-south divide was observed with higher numbers of aphids being recorded in Essex, Hertfordshire, south Suffolk and Cambridgeshire. Up until 20th June only 50% of sites had received an aphicide spray (Teppeki) and none of the 51 sites had received two sprays.

### The Viruses

In 2021, the first symptoms of virus yellows were recorded in the 3rd week of June in Cambridgeshire and Suffolk, over a month later than in 2020. National incidence of virus yellows was far lower in 2021 at less than 3% vs

the 38.1% in 2020 and yield losses as a result have been far lower.

### What can you do to prepare for 2022?

Without a crystal ball or flux capacitor, writing this article in November 2021, **it is extremely difficult to predict the weather conditions in January and February 2022, the key months for limiting the build-up of aphids.** However, virus yellows is sure to continue to be of major concern and this will be even more pertinent if the weather outside, as you are reading this article, is more tropical rather than arctic! With that in mind, it is worth arming yourself with the latest data and advice from BBRO to give your crop its best chance this season.

## Operation Emerald

BBRO launched Operation Emerald in 2021 which brings together all aspects of our variety research against virus yellows for at least the next three years. Keep an eye out over the coming months and years we will be releasing our findings from this programme of research.

The major aspects of Operation Emerald are as follows:

Project Goliath – Screening new varieties with specific traits against the yellowing viruses.

Project Titan – The largest and most complex experiment, assessing the impact of sowing date, virus type and variety.

Project Verde – Screening the entire Recommended List for BYV and BMVY yield tolerance to guide your on-farm decisions.

These data will start to feed down into your virus management strategies in the future, especially as new varieties tested through Project Goliath are made commercially available.

# Five factors to fight Virus Yellows in 2022

1

## Seed treatments

At the time of writing, we are still awaiting the outcome of the emergency application for Cruiser SB seed treatments on the crop in 2022. However, even if granted and the virus threshold is reached, we know not every grower will want to use neonicotinoid treatments. If approved, the derogation will, as with that granted in 2021, be for a lower rate of active ingredient than you were used to before Cruiser SB was banned. As a consequence, the activity of the seed treatment may not last for as many weeks, and we imagine that it will only be effective for 8-10 weeks after sowing instead of the 12 you would have been used to. Therefore, later migrations of aphids may still need alternative control strategies even if you have used the seed treatment.

2

## Foliar Aphicides

Crop monitoring and the application of foliar aphicides is likely to remain an important factor in virus management. The yellow water pan network will once again be operating in 2022, providing you with local early warnings of when aphid migrations have begun. Use this information to then regularly check your own crop. Spray as soon as the crop reaches threshold (one green wingless aphid per four plants up to twelve leaves, changing to one aphid per plant from twelve to sixteen leaves). Teppeki (Fonicamid) is currently the only registered chemical for aphid control, and therefore will be the first chemical you will be needing to think about spraying. BBRO, on the behalf of NFU Sugar and British Sugar, will continue to support the registration of new aphicides for sugar beet and apply for emergency authorisations as necessary.



**Fig. 8.** Use a BBRO aphid magnifier to closely check plants for green wingless aphids

3

## Field Hygiene

On-farm hygiene remains critical to limit the number of sources of infection which could spread into your crop. Clear away any beet spoil heaps or left over beet as these will provide perfect green bridges for virus and aphids will pick up virus from any fresh foliage growth in the spring from carried-over roots.



**Fig 9:** Managing spoil heaps and general on-farm hygiene will be important steps in reducing potential green bridge.



## Sowing for success

We know that a well tilled seedbed and moist, warm conditions will ensure that your seeds germinate well and get off to the best start. Research from Project Titan in 2021 clearly demonstrates that more established, mature plants suffer less yellowing and yield loss under virus. More mature plants will also limit the reproduction of aphids due to mature plant resistance mechanisms.



## Seeds of change – Project Verde

2022 is an exciting year for the Recommended List as the UK welcomes Maruscha KWS to the market and some of you may have ordered this variety to try. It's a good first step on the road to overcoming virus yellows using genetics, but with its significantly reduced yield potential (93.5% of RL control varieties in the absence of virus infection) and the fact it only is claimed to be partially tolerant to BMV means there is still a long way to go until we can rely on varieties solely for virus yellows control.

However, BBRO has also tested the 2022 varieties for their reaction to either BMV or BYV infection. This is the first time that the entire RL list has been infected (in trials) and provides an insight into their relative performance with and without virus infection.

These results should be used to highlight any varieties on farm that appear to be more susceptible to either BMV or BYV and therefore should be sown earlier than any less susceptible varieties. It is important to consider that this data set will only be a guide, since it is only from one year and one site, and the dataset will evolve every year in line with changes to the Recommended List. Other agronomic factors, such as susceptibility to bolting and the condition of individual fields and seedbeds must also be considered when sowing varieties, but we hope this new data set will be a useful addition to guide your sowing sequences, especially if virus incidence is forecast to be high. We will release a comprehensive guide to these data and how to interpret it on [bbro.co.uk](http://bbro.co.uk) and present it at BeetTech'22.

Importantly, good aphid control still remains critical to virus management. In the longer-term virus resistant varieties will hopefully become more widely grown in the UK, but a successful variety will need to possess both the ability to overcome all three of the viruses and yield in the absence of any virus infection too. However, sugar beet breeders have an excellent track record of developing such varieties as previously demonstrated with rhizomania and BCN.

## Tolerance vs. Resistance

These traits are often confused with each other and therefore it is important to remember the differences between them:

Tolerance – this is a trait related to the yield of the plant. Tolerant varieties will yield well even in the presence of a pathogen.

Resistance – A trait related to the reproduction of a pathogen. Resistant varieties actively suppress or reduce population levels of a pathogen and doesn't necessarily yield as well.

## Gene Editing Update

The recent announcement from the government (29 September 2021) regarding the future use of Gene Editing is very encouraging for the sugar beet industry. This policy change will allow for important advancements and speed up the breeding process for traits against all the virus yellows complex.

BBRO will continue to explore the benefits GE will bring to our sector and champion the integration of GE varieties into the UK. Our trials methodology, spearheaded by Project Goliath since 2019, will be rapidly adaptable to test GE varieties for virus yellows traits and assist in getting these new varieties into your hands as quickly as possible.