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Virus Yellows: tackling the challenge with an integrated approach

Without doubt, Virus Yellows remains a major threat looming over British sugar beet production, and memories of the virus yellows epidemic in 2020 remain for many. The severe incidence of virus that year cost the industry around 30% of yield nationally, but those growing in the virus hotspots saw even greater losses of up to 80%.

Despite a relatively warm winter again in 2021/22, the incidence of virus yellows was less severe. This was helped by the use of Cruiser SB, its application granted via an emergency authorisation from Defra, as well as the judicious use of aphicide sprays complementing an array of other agronomic measures used on farm to limit aphid build up.

In this article we summarise key factors influencing the impact of virus yellows in 2022 and look to the future at what BBRO is undertaking to deliver reliable, sustainable and economic control measures for Virus Yellows in your crops.

Virus Yellows: What happened in 2022?

In 2022, following the Rothamsted Virus Yellows Forecast on 1st March, all growers had the option to use Cruiser SB (thiamethoxam) on their seed, as the 19% threshold, as set by Defra as part of the emergency authorisation conditions, was exceeded. In reality, 71% of the national crop was treated with Cruiser Force and it is clear from the incidence of virus that the seed treatment assisted in limiting aphid spread and subsequent virus transmission during the first 10 weeks of crop growth (Stevens 2022).

If required, all growers also had access to one application of flonicamid (either Teppeki or Afinto) and one application of acetamiprid (Insyst), at the appropriate green wingless aphid threshold. Each product should give protection for at least two weeks, but this can be highly dependent on drilling date, soil conditions, weather, growth stage, aphid numbers and overall plant establishment.

As aphids migrated throughout late April, May and June, some Cruiser-treated crops were exposed to late virus-carrying aphids and warranted a spray application when green wingless aphid numbers exceeded the spray threshold; under the terms of the emergency authorisation for Cruiser SB this had to be flonicamid. For growers not using the seed treatment, aphicides could be applied in any order and an additional foliar spray was made available (Movento), if needed, via a further emergency authorisation granted by Defra.

VIRUS YELLOWS 2022: THE FACTS

- As predicted by Rothamsted, early aphid migration started from 18th April 2022, peaking in mid/late May
- Protracted emergence for some growers affected plant populations and the attractiveness of crops to aphids
- Proximity to winter OSR was influential on aphid numbers in beet
- Summer drought impacted on plant growth particularly in East Anglia
- General crop yellowing was caused by many factors in 2022 including water stress and beet moth as well as virus yellows
- Seed treatments coupled with timely sprays all contributed to decreasing the incidence of virus yellows
- Seed treatment usage has decreased the need for secondary follow up aphicide applications

Growing into the future

Since the formal withdrawal of neonicotinoid seed treatments in 2018, BBRO has increased its efforts each year to find new solutions for virus yellows. At the time of writing (late November) our virus yellows variety trials were about to be harvested by the BBRO trials team. The data from these experiments will undoubtedly further help with variety choices in the future and form part of IPM strategies for aphid and virus yellows management.

'Goliath', our strategy for assessing varieties with specific trait claims for one or all of the yellowing viruses, remains our flagship trial for variety testing. Hosted by kind permission of Rougham Estates, near Bury St Edmunds, the trial site has performed well despite some of the challenges from the 2022 season.

This year we have tested a total of 16 entries from KWS, DLF Beet Seed, Betaseed and Strube and new for 2022 was the inclusion of Beet chlorosis virus (BChV) for the first time (Figs 1 & 2).

The data from BChV infested plots will complement that of the closely related Beet mild yellowing virus (BMYV) and allow us to look at any similarities in variety performance of these varieties. Alongside the BChV and BMYV plots are those inoculated with the most aggressive virus, Beet yellows virus as well as the uninfested control plots which seemed, via judicious management, to avoid the worst of any invasion by wild aphids.

Fig. 1. Preparation to take the BChV carrying aphids to the field for the first time

Fig. 2. A close-up of the infected aphids carrying BChV

Sitting alongside Goliath is its sister experiment 'Verde'. Here, we test existing varieties from all breeding companies which you will be growing in 2023. Now in its second year, the methodology and virus treatments are the same as its neighbour. However, these data serve a different purpose as most entries have no claim for VY tolerance.

Use our findings as a guide when it comes to drilling. Consider sowing varieties which may have higher levels of yield loss due to the viruses earlier, giving them longer to grow and become less attractive to any aphids, than varieties which may be more tolerant to any or all the yellowing viruses.

Keep a lookout for further details of the results of these experiments when they are published. Full details can be found at bbro.co.uk or join us at BeetTech '23 at Newark (7th February)

and Newmarket (9th February) where Alistair will guide you through the key findings.

Embracing Alternatives

Work on our alternative strategies for aphid control will also continue into 2023. We continue to shape this area, although early engagement with industry and media piqued interest from around the world. This included a feature on BBC Look East, articles from the Financial Times and being featured on BBC Radio 4's Farming Today (Fig. 3a & 3b).

We continue to think ABCD for aphid IPM and have added an E for 2023! BBRO's dedicated research plan will undertake this work in the following areas:

Fig.3a. Our research caught the eye of Farming Today's Anna Hill at the Royal Norfolk Show where she featured our ABCD of Aphid IPM

Fig.3b. It was then picked up more widely by the BBC and other news agencies around the globe

Fig.4. We have been using strips of oilseed rape and radish in Goliath & Verde since 2019 to minimise the spread of aphids around the trials and are looking to refine this approach to see if it can be a commercially viable option to protect your crops

A – Attractants

Deploy alternative host plant species, such as brassicas, to pull aphids away from sugar beet. We have already used this strategy to protect Goliath and Verde since 2019, but much more research is needed to work out optimum planting densities and the areas of fields which are influenced by such attractants.

B – Beneficials

Harbour natural populations of beneficial insect species (including dedicated flower strips) or deploy commercially reared options into fields to manage aphids. (Figs. 5a & 5b)

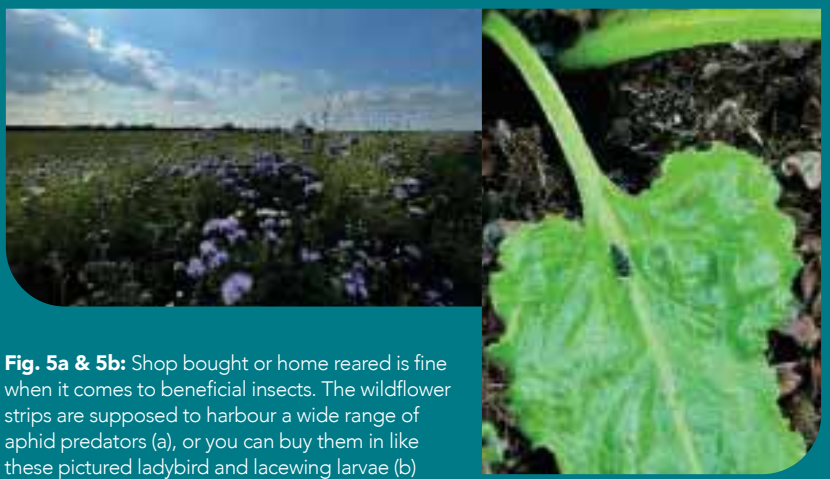

Fig. 5a & 5b: Shop bought or home reared is fine when it comes to beneficial insects. The wildflower strips are supposed to harbour a wide range of aphid predators (a), or you can buy them in like these pictured ladybird and lacewing larvae (b)

C – Camouflage

Use cereal cover crops or naturally derived dyes to disguise young sugar beet plants in plain sight. The cover is designed to confuse the aphids as they migrate into the crop and remove the soil-plant contrast which the aphids rely on for landing on a host plant.

Fig.6. BBRO is dying to see some benefits of camo-cropping. We have been spraying coloured fabric-dyes to see if it can reduce aphid numbers by hiding the plants in plain sight by reducing the leaf-soil contrast.

D – Deterrents

Instead of killing the aphids once they appear in the crop, we are looking at using naturally derived plant oils to repel incoming winged aphids. Oils such as lavender, orange, mint and garlic are all currently under the spotlight to see which may show promise.

Fig.7. Endophytes may be our saviours. The strip pictured here in the summer is showing reduced virus symptoms compared to the control next to it.

New for 2023: E – Endophytes

Following two years of basic strip trials, we are formalising our endophyte grass research. In 2022 we set up two sites with randomised plot trials which will be over-sown with sugar beet in 2023. The hope is that the beneficial impact of the endophyte (a fungus within the grass, which produces alkaloids to protect its host) can be transferred into the sugar beet. The areas at Morley in 2022 looked promising and certainly greener (Figs. 7 & 8), but we need to send samples to New Zealand for analysis to confirm that the alkaloids made it into the sugar beet. If successful, we will optimise this approach to minimise competition for resources from the grass. One option could be to substitute the living grass for hay or grass-seed meal from which the alkaloids can leach out and be taken up by the sugar beet.

Fig.8. Aerial shot from the BBRO Drone clearly showing the effect of endophyte grass. This remained evident in the crop through to harvest in October.

Integrated pest and virus management strategies will clearly become the future of virus yellows control, and whilst it is too soon to draw any conclusions from this research, we are making progress in this area, often with global collaboration. We encourage you to contact BBRO if you have any thoughts or insights into strategies you deploy on your own farms: info@bbro.co.uk

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References

Stevens (2022) Aphids 2022: Did the aerial threat materialise and did Cruiser SB help? British Sugar Beet Review vol. 90, pages 26-27