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Beet the ‘bridge’ and improve biosecurity

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The term ‘green bridge effect’ is used to describe any green plant material which survives over-winter and acts as a host for pests, viruses and diseases. Effectively these plants ‘bridge the gap’ between cropping seasons, enabling early spread and infection of subsequent crops.

Weed species, cover crops and crop volunteers can all act as a green bridge, as well as any leaf growth on spoil heaps and clamps. It is increasingly important to ensure we reduce green bridging as the trend to warmer winters is providing greater opportunities for overwinter survival of pest and diseases. The increased overwintering of aphids is an obvious example.

A recent scientific report estimated that a 1°C warmer temperature related to approximately 12-day earlier flight of virus-carrying aphids*. Additionally, with fewer crop protection products available and their increasing cost, it is also essential to improve our levels of biosecurity on our farms alongside new biological approaches.

In this article we focus on breaking the green bridge, and how we should manage and move soil and spoil to improve biosecurity between fields and farms. With changing cultivation practices and the recent outbreak of new pests such as beet moth in the UK raising some interesting questions in this area.

Attention to detail is key to controlling the green bridge, and we bring you some key target areas to think about as you approach the 2023 season.

Controlling leaf growth on clamps

- Number one on our list is destroying any leaf growth on clamps especially before the new sugar beet crop emerges, but ideally as soon as it develops. Any virus and disease may be transferred onto other intermediate hosts creating a green bridge to sugar beet crops. Figure 2 was taken on the site of a beet clamp in Lincolnshire on 17th May 2022. This was a month later than the predicted date of aphids arriving in UK crops, but before many UK crops had emerged, providing the perfect source for green-bridging virus.
- Make sure clamps are free of leaf growth during storage and cleaned thoroughly after loading.

Fig. 1. Extensive leaf growth on clamp





Fig. 2. Regrowth of beet left behind after the clamp had been cleared

Manage spoil carefully

After cleaning and loading, spoil is another source of green-bridging. Green leaf regrowth can develop from very small fragments of beet and, of course, from whole beet left in the spoil. The two photographs shown in Figure 3 are from a spoil heap in Norfolk; shoots were found developing from beet half a metre below the surface of the spoil heap. If you ever wanted a reminder of how many sources of growth there may be, why not just wait until they are vernalised and producing seed as in Figure 4 (another spoil heap in Norfolk in 2022).

Make sure cleaner loaders are maintained and working properly and are not losing too many large roots into the spoil. If there are a lot of roots in the spoil, consider disposing in non-crop areas rather than returning to fields.

Fig. 4. Fragments just left to grow and vernalise



Fig. 3. Large beet and small beet fragments reshooting

If returning soil to fields, always aim to return spoil to the field of origin to minimise the risk of contamination and spread. Remember the risk of spread will depend on the disease, virus and pest level in the previous crops. Identify your high-risk crops and consider managing spoils separately.

Remember that both free-living nematodes (FLN) and beet cyst nematodes (BCN) will be spread via infected soils so paying attention to

soil from infected fields is important from this perspective. Of course, cleaning and removing as much soil as possible from equipment when moving between fields should be standard practice.



Fig. 5. Assess the risk of roots in spoil and think carefully about where you dispose of it

Remove groundkeepers and weed beet to reduce sources of infection

Check the previous season's sugar beet fields for groundkeepers or if you are still harvesting, monitor harvesting carefully for roots being left behind. Remove/glean as many roots as possible. Keep volunteers under control with herbicides (where necessary) to avoid creating a green bridge to the next season's crops.

Remember groundkeepers will not only create green-bridging problems but will also create a weed beet problem in field if not dealt with effectively.

Managing cover crops

Whilst growing an overwinter cover crop can be a valuable approach to improving soil health, it is important to manage any risk of cover crops acting as green-bridges. Certain species such as brassicas which include mustards and radishes are better hosts of the aphid *Myzus persicae* than other species; except for white mustard which does not host the virus. Very few of the other more commonly grown cover crop species are hosts of the virus.

A pragmatic approach would be to reduce the use of brassica-based cover crops to help reduce the potential build-up of aphid numbers. Many growers use rye or oat-based cover crops, these are likely to be poorer hosts of *Myzus persicae* and therefore good choices.

Inclusion of another partner species such as buckwheat, vetch, or phacelia should not be an issue although BBRO continue to test these species



Fig. 6. Bolted groundkeeper in the spring

as potential hosts of the three key viruses. Check crops for aphid activity early in the spring. If numbers are high, consider destroying the cover crop early to limit aphid populations increasing further.

Ensure that cover crops are destroyed thoroughly, so no green material is left to create a green bridge on which aphids can survive. Buckwheat has been shown to be very frost susceptible and tends not to survive a frost. At the other extreme, phacelia can be challenging to destroy thoroughly.

Target to destroy cover crops in advance to provide a minimum of 5-6 weeks without green covers ahead of drilling sugar beet. Where possible, time cover crop destruction, particularly mechanical destruction and grazing to take advantage of any spells of cold weather, as this will help reduce aphid numbers even further. Cover crop growth has been strong in the warm autumn of 2022, so anticipate some challenges in destruction, possibly allowing a bit more time to kill all the green leaf material.

Beet Cyst Nematode (BCN) and cover crops

- Be aware of the risk of harbouring BCN on your cover crops which will then harm your future sugar beet crop.
- BCN is hosted by a wide range of Brassica species and can rapidly multiply on some cover crops, especially when planted early into warm soils.
- Recent BBRO research recommends the use of resistant brassica trap crops on infested fields which will prevent significant population build-up, but reliable population reductions were not found from all varieties tested over two years of trials. Make sure you know the variety is resistant.
- If you're concerned about BCN on your cover crops, gently pull up the roots and check for the characteristic white cysts. If found, destroy the cover crop immediately to prevent BCN numbers increasing.
- Target a 5-6 weed gap between destroying the cover crop and drilling sugar beet.
- Aim to grow a BCN tolerant variety in the following sugar beet crop if you are concerned about BCN.

Other host crops and weed hosts on farm

Understanding what other crops and weeds may act as hosts of virus, disease and pests is important. Whilst it may not be possible to eliminate all risks, managing rotations, and targeting the control of key host weed species at the right time could be important. Our next focus in this article is on aphid and virus hosts.

Aphid hosts

Myzus persicae has a large range of host plants including brassicas, potatoes, legumes, lettuce and sugar beet. However, brassica species appear to be their preferred overwinter host where they can survive as live adults and/or offspring. This puts beet crops neighbouring rape fields at particular risk of early infestation and potentially virus infection. *Myzus persicae* aphids can also overwinter as eggs on peach trees (hence the common name peach-potato aphid), although, in the UK, this is not a major source of aphids for the following spring crop.

Virus hosts

Infected sugar beet, either groundkeepers or leaf material on clamps, are one of the most important sources of virus. Some weed species can also be infected by beet viruses. Current known hosts of BYV and BMV are listed below (BBRO testing is ongoing to update this list).

BYV:

- Common chickweed (*Stellaria media*)
- Common orache (*Atriplex patula*)
- Common poppy (*Papaver rhoeas*)
- Common purslane (*Portulaca oleracea*)
- Corn spurry (*Spergula arvensis*)
- Garden orache (*Atriplex hortensis*)
- Red dead nettle (*Laminum purpureum*)

BMV

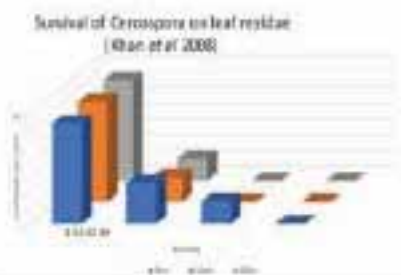
- Scarlet pimpernel (*Anagallis arvensis*)
- Shepherd's purse (*Capsella bursa-pastoris*)
- Corn marigold (*Chrysanthemum segetum*)
- Red dead nettle (*Laminum purpureum*)
- Common poppy (*Papaver rhoeas*)
- Groundsel (*Senecio vulgaris*)
- Corn spurry (*Spergula arvensis*)

- Common chickweed (*Stellaria media*)
- Field pansy (*Viola arvensis*)

Host crops of Cercospora and Beet moth

BBRO hasn't done a lot of work on the host range of these in the UK as they are both relatively new. However, there are scientific reports of these in other geographies:

- Cercospora – sea beet, spinach, swiss chard, celery, lettuce, wild mustard, and some dock species
- Beet moth – mainly the Chenopodiaceae family (including fat hen) and commonly found on sea beet. Incidence on beetroot and chard is also recorded.



- Cercospora survives on leaf residues
- Minimum 30 months to reduce risk (<20% in first 6 months)
- Survival rate lower at 10 & 20cm than on surface. Bury infected leaves
- Spread by wind from surviving infected leaf residue
- Leaf residue from adjacent previously infected fields (within 100m) will be a source

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Act now! Make biosecurity a higher priority

Green bridging of pests, diseases and viruses is clearly a challenge to sugar beet, as it is to other crops on the farm. As our climate changes and our pesticide armoury is reduced further, new and changing pest and disease portfolios and pressures can be expected in the UK.

Improving our biosecurity against pests, diseases and viruses, therefore, should become a higher priority and a core element of our integrated crop protection

strategies. Hopefully, this article provides a few facts on which you can act, but successful implementation on the farm requires attention to detail, training and great communication to ensure there can be a successful team approach.

References

*Hemming, et al. (2022) Likelihood of Extreme Early Flight of *Myzus persicae* (Hemiptera: Aphididae) Across the UK, *Journal of Economic Entomology*, 2022