# GRDC PODCAST TRANSCRIPT

**Managing green peach aphids and the emerging turnip yellows virus risk in canola**

**GRDC Turnip Yellows Virus and Green Peach Aphids 1.mp3**

[00:00:05] **Intro** This is a GRDC podcast.

[00:00:12] **Shannon Beattie** Green peach aphid and turnip yellows virus. You can't have one without the other. Hi, I'm Shannon Beattie. Back in 2014, a green bridge became infested with green peach aphids, which transmitted turnip yellows virus and caused infection in germinating canola seedlings, leading to significant damage. Flash forward to 2024, and we're looking at similar conditions across a wide portion of the country, particularly in Victoria and South Australia. There is enough soil moisture that self-sown canola will now survive until the sowing window, creating the perfect green bridge for aphids and virus. To help growers mitigate the risk over the upcoming sowing period, I'm joined by independent agronomist Craig Davis and research scientist Ben Congdon from WA's Department of Primary Industries and Regional Development, who starts us off by explaining how turnip yellows virus and green peach aphid correspond with each other.

[00:01:05] **Ben Congdon** Turnip yellows virus essentially cannot exist or spread without green peach aphid. So, it's an RNA virus. It exists as virions in infected plants. The aphid acquires the virus by feeding on an infected plant, and then transmits it to healthy plants by feeding on them. This virus in particular is not seed borne, although there are other, seed borne viruses. In the context of Australia, it is entirely originating from the grain bridge at the start of the year, so over summering plants and then gets spread into the crop. It's a virus that has had different names in the past. So, the 2014 epidemic, for example, it was probably better known as beet western yellow virus. There's an interesting history, with the advent of different technologies, we've figured out what's actually going on with this particular virus. It was first sort of found in 1950 or first described in 1950, infecting turnips. And then the Europeans thought that it was a strain of a virus called beet western yellow virus, which we now know is actually a completely different species we don't even have in Australia. They figured that out originally because it couldn't infect certain plants, so is based on host range. And then we started using genomics, so sequencing and molecular technology, to actually show that it was a different species here called turnip yellows virus and that was actually distinct from beet western yellows virus, and we have turned it yellow for us here in Australia.

[00:02:25] **Shannon Beattie** You did just mention the 2014 outbreak, epidemic, whatever we want to call it, of turnip yellows virus and green peach aphid. Craig, you were working as an agro back then, I believe. Can you tell us, I guess, where it is that you're actually based on what it is you witnessed back in 2014?

[00:02:44] **Craig Davis** Yeah, hi Shannon. I'm based in the Mid-North agricultural region in South Australia, and I cover the lower north and the Yorke Peninsula as well. In 2014, we had a bit of a perfect storm there with respect to green bridge prior to seeding, where we had not just volunteers, but also a range of broadleaf weed hosts of green peach aphid to carry through into the establishment phase of the canola crops. And that year, also we had a lower usage of seed dressing insecticides. So, coupling the presence of the aphid along with lack of seed dressing protection, we saw essentially an explosion of green peach aphid and subsequently the turnip yellows just moved through the district at a rapid rate. We had crops that were demonstrating almost 100 per cent infection rates and was certainly devastating at the time because there was a fairly large lack of understanding of what was going on. So steep learning curve at that point in time, and I think we probably struggled with the tools a little bit at that stage as well, in understanding what were the factors that really drove that to develop under those conditions. Obviously, we're a better armed and informed now, particularly with respect to, seed dressings and foliar insecticides.

[00:03:51] **Shannon Beattie** Ben, what can you tell us about 2014? I know it was a little bit before your time, before you were working in this space, but what do you know about why the outbreak in 2014 was so bad?

[00:04:03] **Ben Congdon** There's a few factors that would suggest an epidemic is possible. There's a lot we don't understand because there's a lot of dynamics at play here that are quite complicated, as with any kind of ecological system. With any epidemic that we have in Australia, especially in areas where we have a hot summer and no summer crops, even forage crops over summer, virus, and aphids when they come out of the spring canola, when it's drying off, they tend to seek refuges, usually isolated patches of plants, say, gardens and ditches and things like that. And the thing about green peach aphid and turnip yellows virus is they got pretty amazing host range. So, GPA or green peach aphid has a host range in 40 plant families or more. TuYV is 20 plant families or more, so that's an astonishing actual number of species within those families. Obviously with TuYV, as I mentioned, due to its genetic diversity, it's able to adapt to many different plant defence systems. With GPA, it's a generalist aphid species, as opposed to say oat aphid which is specific to grasses, and this actually is part of the reason which links into its astonishing insecticide resistance profile. Being a generalist, an ability to cope with different plant defence compounds, adaptability to some of the insecticides as well. With the epidemic, so it starts in these isolated patches. In a case where you do actually have forage brassicas, this could be an even greater reservoir. But then once we start getting the green bridge or the green ramp, these reservoirs can amplify as the aphids start to build up and move through. Volunteer canola radish, turnip weed, those brassicas just because of the how much that GPA and TuYV enjoy those particular species, but also how common they are. And then from there they'll move into the crop. So, because of our trend towards earlier sowing over the last decade or so with canola, the really important time we think for TuYV coming to the crop is the autumn. And so those autumn aphid flights in some regions will get two peaks of aphid flights in autumn and spring. Spring almost happens every year, autumn doesn't necessarily happen every year, but when it does happen, that's the period where we can get some risk. In season temperature is important too. So, whether the aphids are flying, it needs to be warm. So, the reason we get the peaks is because in winter it cools off and then they stop flying. Again, the temperature and other conditions will then also dictate how much they spread through a crop. So warmer conditions, they're able to actually reproduce quicker, and with GPA, as Craig would know, sometimes they're able to quickly colonise vast areas of the crop to a light colonisation level where they're very hard to spot, actually makes them a very potent virus vector. And in a case with TuYV, it has a high transmission efficiency, which means that one aphid has a 60 to 90 per cent chance of transmitting the virus. So, you can only have one or two aphids per plant, which can be incredibly hard to spot, and you can have virus spreading through the crop. So, in this particular epidemic, I would suggest a combination of factors created a perfect storm, and obviously the pre-season rainfall leading to the green bridge was the foundation for that. And then the green bridge dynamics are important. So, aphids will only move off those plants in the green bridge when they have cues. For example, if we get too much humidity or heat, if they're exposed to that, there's cues. But also, if populations build up, they send cues to each other to produce winged migrants, and then they move into the crop. So, I would say there's a lot going on, but it's a perfect storm in that particular situation.

[00:07:31] **Shannon Beattie** Let's move a whole decade forward to 2024. Craig, we are looking at some similar conditions at the moment in this current season to what we had back in 2014. Can you tell us what the state of play is at the moment for canola?

[00:07:49] **Craig Davis** Yeah, so we're still a little way off of farming canola. The earliest would normally see can all again on the ground would be early in April, but in reality, it may become late March if the opportunity exists. But we certainly have a broad spectrum of broadleaf weeds and volunteer canola across the district. We also have an increase in the amount of winter canola and also forage brassicas that are present across the landscape. We've had a very mild summer thus far, with only a few short bursts of heat, and we recognise temperature plays a very important role. And Ben certainly touched on that there in autumn, when we're getting more conditions through the establishment phase and we don't get a sharp cold spell, then the green peach aphid are able to persist in the crop. Like Ben mentioned, monitoring when you've got low density across the landscape can be quite challenging, it's only when you get large infestations causing direct feeding damage that sometimes you recognise that you've got the problem there in the first place. So we're going to have to be pretty vigilant there on those volunteers and weeds going into seeding, and as those crops establish, having a close look under the underside of the leaves for the presence. So, I think the other fact that, and Ben touched on this, and that is the triggers that get the GPA to move around the district and having weeds desiccated or dying down from the herbicide application definitely triggers them to move. So, in 2014, there was a lot of crops that didn't have a late autumn spray, they had a knock down prior to sowing, and those weeds were then dying down as the crop was establishing. I'd hope this year that people have done a better job with their volunteer management in paddocks, and the direct risk from within the paddock would be lower. But I recognise that doesn't stop the district wide presence of GPA and with forage brassicas, winter canola and maybe a volunteer canola that's gone on to become a pasture for some growers, there is still going to be a district wide risk in a lot of areas where soil moisture will carry those plants through and obviously carry the green aphid, which are likely to be carrying the turnip yellows virus.

[00:09:53] **Shannon Beattie** Craig, you said there's a risk at the moment, we've well established that in the past couple of minutes. But just how great is that risk and what could the damage be from both a crop perspective, a financial perspective, if we have a similar situation to what we did ten years ago?

[00:10:10] **Craig Davis** Yeah, so ten years ago, where the infestation was allowed to persist and have direct feeding damage, plus higher levels of viral infection, there were certainly reports of highlight was a huge loss, I think in the order of 50 per cent, and there was other factors involved there in terms of that yield loss. But I think there is still that if it's unrecognised, unchecked and people don't pull the trigger on a foliar insecticide, they could be dealing with the same sort of levels of your loss. I would like to think though, that the level of awareness across the industry would mean that we wouldn't get a district wide epidemic. I suppose we've also got temperature and volunteer management, and we're still a little way off seeding, so I'm hoping that we can mitigate that risk somewhat by reducing the load of broadleaf hosts in the environment. In reality, there will be those localised paddocks that are going to be at a similar sort of yield loss risk.

[00:11:04] **Shannon Beattie** Ben, it's not like it's been ten years since we've had any turnip yellows virus or any green patch aphid in Australia, but it has been ten years since we had a really bad outbreak that affected a vast region at the same time. Why is that?

[00:11:20] **Ben Congdon** So, virus infestations, epidemics, they are sporadic by nature because of the disease triangle that we think of for fungal pathogens is you have the fungus, the host, the environment. Whilst with virus you've got the added thing of the vector, the added element of the vector. And so, all these things have to come together for there to be an epidemic. We also don't know whether there's any actual patterns to where the virus goes in the off season, where it refuges, and that also has to coincide with the aphid as well. You can get an infected plant in a roadside ditch, but if it's not infested with aphids, it's not going to be a reservoir host, because the only method of it to spread is aphids. So, for example, I think it was 2018, in Esperance region, we had a massive epidemic. Every year we pretty much say turnip yellows virus spreading to some degree. We can talk about the timing of infection and why that matters in the context of management. The sporadic nature just comes down to how complicated the system is, and there must be a bit of randomness in it too, in terms of whether an infected reservoir plant happens to also get colonised and then move. But the thing is, at the same time, as you saw in 2014, once an epidemic does get going, it does seem to cover quite a vast area and doesn't seem to just be isolated to single paddocks, and this is just because of the mobility of the aphids. So, the aphids can move hundreds of kilometres in the wind and once they're producing a heap of young, they can actually control their flight and move around quite quickly. So, there's a lot we don't know too, these things are so complex, it's hard to get a real quantified handle on all the factors at play.

[00:12:57] **Shannon Beattie** Alright, we're looking at a perfect storm again this season. Craig, you touched on it beforehand, but can you give growers listening a nice little snapshot of what they need to do to try and limit the impact this season?

[00:13:11] **Craig Davis** Yeah. Shannon, I suppose there's a few things the growers can do. And the first thing is controlling volunteers and broadleaf weeds well in advance of timing a crop, recognising that volunteers alone aren't a cause, it's obviously the presence of GPA with the virus within the host plant. But firstly, get rid of any broadleaf weeds and volunteers well in advance. Secondly is use an effective seed dressing insecticide. Thirdly, is monitor upon establishment of that crop for the presence of green peach aphid and the success of your volunteer control and broadleaf weed control. And thirdly, if the presence of GPA is there, the conditions are right for the population to continue to expand, then growers should be considering the diligent use of an insecticide foliar to pull those populations down. Admittedly, environmental conditions do play a significant role and so that needs to be considered as well. So, a few key messages there I suppose where growers can improve their chance of a successful crop.

[00:14:14] **Shannon Beattie** And anything from you Ben? You've been researching this space for a fair few years now, is there anything we know now that we didn't know in 2014 that might help growers mitigate some of the risk?

[00:14:25] **Ben Congdon** Yeah, I think there is. So just trying to focus growers in on the emergence to about flowering or stem elongation and early flowering, that is the danger zone, so that is where all your control mechanisms need to be activated. After flowering, either the horses bolted - viruses cannot be sprayed out there like a fungus can be. But also, if you haven't had any spread by then, then any spread that happens after that point is likely not going to have any impact on yield. So, if you do get that infection prior to flowering, you can get losses anywhere between 10 to 50 per cent, as shown in multiple studies, and also impact on the seed quality. And as Craig alluded to, the magnitude is going to vary. You know, that 10 to 50. per cent range is going to depend on things that we know now is time of infection. So, the earlier crop is infected, the more impact it's likely to have on yield. There's going to be a spectrum of tolerances within the varieties that we grow in Australia, so some varieties are going to be able to cope with infection better than others. As you see in any population, the virus genotypes of some strains are more severe than others. We don't know what happens when you get more than one strain, because we do find that quite a lot, especially in the Eastern States. Also, presence of other stresses, abiotic and biotic stresses, and just the environment, so we know temperature has an impact on the aphid, but it also impacts the amount the virus builds up in an individual plant and then impacts it. So, with that in mind, I definitely would reiterate, as Craig said, that the use of neonicotinoid seed treatments, we still consider them still effective, but we are finding that in our latest trials they are not performing as well as they have in previous studies. This could be because the rates are different than used in previous studies, they're a bit more liberal with the active ingredient. We're using the commercial seed, but there's also an increase in metabolic resistance to neonicotinoids in the green peach aphid population, so that's being slowly developing and spreading over the last seven or so years. This is another factor that we've shown in with our collaborator, Cesar, that can reduce the effectiveness of seed dressing. And with the foliar application, we've shown as well in our trials that these work well, but the timing, as Craig alluded to, is absolutely crucial. So again, you can't spray once the horse has bolted, once the spread has occurred and you're at a higher level, 70 to 100 per cent, spray is not going to do anything except maybe make you feel a little bit better. But it can be highly effective if you can get it just as they're starting to colonise and spread. If you actually come in before you get a bit of systemic control but hitting that early colonisation we've shown actually can have a quite a marked influence on the infection. And same thing, green bridge control, sowing into stubble has been shown to have effects. I think I've seen photos from the 2014 epidemic where there was a patch of the paddock which had been cleared of the stubble residue, and another patch with the stubble residue, and you can see the differences in the symptoms and the infection rate. But also last year, 2023, in WA it was the later sown crops that actually copped it because we got a big dry spell and it got really cold, they were maturing later and as I said, that early growth stage is the critical time. The spring aphid flights coming in are actually the ones that started causing problems in that crop. So not only had that delayed maturity, there also got some infection. The host resistance is the other thing I really need to mention, because this is an evolving space, and this is hopefully something that we're going to have soon in our commercial varieties. We know there's one variety that we know of that has resistance, that is Stingray by Nuseed. However, we know that that resistance may break down under certain conditions, so higher temperatures and different strains of the virus. We've got a bunch of different resistant germplasm from, for example, Europe, who are far ahead of us in this game, they have commercially available resistant varieties and a few that are developing breeding markets for others. And we're testing some of these, plus our own ones that we've identified in Australia to see how they might hold up in our conditions. So, looking at specificity against different virus genotypes, how they would cope under warm temperatures that we experience in Australia, and sort of long term durability. And I need to sort of link back to the current GRDC investment. We're doing a lot of work in this space, looking at the biology of TuYV and how that impacts its management, especially around resistance, but we're also doing aphid trapping. So, we've done this for last few years in WA and releasing our findings on PestFacts, as soon as we kind of get our data back and we're testing the aphids we catch on the traps for the presence of TuYV. We've shown that this can provide a bit of an early warning for risk, and so we're going to be rolling this out across all the canola growing states. It won't be in all areas; it'll be in certain areas. So, I would just say keep an eye out for those alerts, and hopefully we can get a near-real-time kind of indication of what's happening. This is on top of doing your crop inspections like Craig talked about. And just know who your local diagnostic laboratory is, so if you find GPA and you worried about it, you can send plants in to be tested as well. And you can do this early in the season when you're wanting to make a management decision, but you can also do this at the end of the season if you're looking at your crop, because the symptoms don't necessarily appear. Quite often, it's symptomless, and when I say symptomless, I mean obvious symptoms, and it's just a reduction in seeds per pod and pod number. And if you see that your crop is not looking fantastic, but there's no obvious symptoms, yield was less than what you expected. I would actually recommend getting some plants tested later in the season through your diagnostic laboratory that is closest to you in your state, because then you can actually account for potentially some unexpected losses. So that's pretty much my key messages, those last few points.

[00:19:57] **Shannon Beattie** Craig, Ben, thank you so much for joining me on the podcast and sharing your wisdom with everyone.

[00:20:03] **Craig Davis** Thanks, Shannon.

[00:20:03] **Ben Congdon** Thanks Shannon, cheers.

[00:20:04] **Craig Davis** Thanks, Ben.

[00:20:05] **Ben Congdon** Cheers, Craig.

[00:20:12] **Shannon Beattie** That was Ben Congdon and independent agronomist Craig Davis speaking about green peach aphid and turnip yellows virus. More information on this topic can be found in the description box of this podcast or online at GRDC.com.au. I'm Shannon Beattie. This has been a GRDC podcast. Thanks for listening.