# GRDC PODCAST TRANSCRIPT

**Why the long coleoptile?**

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

[00:00:12] **Dr Greg Rebetzke** The long coleoptile genetics have been delivered to the breeders, and the breeders are now developing high yielding, disease resistant long coleoptile wheats with a plan for commercial release in the next 3 to 4 years.

[00:00:25] **Hilary Sims** Hi there, I'm Hilary Sims and that's chief scientist at the CSIRO, Dr Greg Rebetzke, sharing the main outcomes from the first year of disease $12.7 million investment to support the integration of long coleoptile wheat into Australian farming systems. The four year project is reaching new heights and in this podcast we hear from research lead for the Soil Amelioration component, Dr Stephen Davies. He's got some promising findings to share on how long coleoptile wheat varieties can improve establishment in ameliorated soils. But first, back to Greg to share how this national project will benefit growers.

[00:01:06] **Dr Greg Rebetzke** There'll be learnings as we go. What we've been careful in doing, because it is a large investment, is bringing in the best teams nationally to ensure the successful testing and adoption - some of the captains pick of who are the best people out there in each state and each region to really ensure that the knowledge we get for those regions is widely deliverable. So we are looking at particular challenges in individual regions, and then those challenges are then being relayed and communicated across all the teams across Australia. That way it becomes a national project in the true sense of the word. So it is being fast tracked, and the only way we could really fast track it was by having all these different teams working together and ensuring that the knowledge is shared. And that knowledge will be communicated in time for the first release of the long coleoptile genetics from the breeding programs.

[00:02:00] **Hilary Sims** One of the research topics in this investment is how long coleoptile wheat varieties can help improve establishment in ameliorated soils. Principal research scientist, Dr Stephen Davies, works for the Western Australian Department of Primary Industries and Regional Development, DPIRD. He's leading trials in WA and reckons long coleoptile wheats are already proving to be a good insurance policy to ensure emergence in ameliorated soils. I caught up with Steven to learn more about these promising results, and we kicked things off by talking about the uptake of soil amelioration in WA. Here's Stephen.

[00:02:36] **Dr Stephen Davies** Growers in Western Australia have been in some ways undertaking aspects of soil amelioration in terms of deep ripping and applying lime for many decades now. But obviously over the past sort of decade, 15 years, there's been some new aspects of soil amelioration in terms of some new strategic deep tillage options which have allowed growers to address, I guess, more fully soil constraints like topsoil water repellents, getting lime actually into acidic sub-soils, and even deeper amelioration of compacted and hard soils. So these aspects have been quite well adopted by WA growers now, and in a survey that was actually just completed in April of this year, it revealed that nearly two thirds of West Australian grain growers are actually undertaking strategic deep tillage as part of their soil amelioration strategies. And then another group on top of that, more growers are actually still, you know, utilising lime and gypsum and other soil amendments to ameliorate their soils. So soil management is really a very active part of what grain growers do in Western Australia. And it's been incredibly well adopted and I think that's because the benefits to growers are quite clear.

[00:03:53] **Hilary Sims** And soil management is an aspect of the long coleoptile wheat research underway at the moment. Give me a bit of background to the soil amelioration component that you're working on as part of this research project?

[00:04:04] **Dr Stephen Davies** Yeah. So as with anything in agriculture, soil amelioration, you know, has a lot of benefits, but there's also some risks and struggles with it. And one of the things is with some of these strategic deep tillage, it is a one off thing. But when it's done the soil becomes very soft. And what we call unconsolidated - you sort of don't have much structure left. All the root systems and everything have been turned into the soil, and so the soil is not particularly well anchored or bound. And so there are issues with that. One is it's quite difficult to seed into those soils because the tractors and the seeding equipment tend to sink, and so it's hard to maintain good depth control when you try to seed as sort of a cereal cover crop onto those soils. Another issue is that the soil's bare, and it's exposed to wind erosion until we can actually grow a cereal cover crop, get those root systems and that plant material on the soil surface, which then sort of protects it from wind erosion and it will go back into a minimum till grain cropping system. And so it's really critical that first year that the amelioration is done. It's really critical that we get really good establishment of the cereal cover crop because it anchors the soil, it protects the soil, and then it also becomes the stubble residue that sits there. We have long, hot, dry summers here, and so that stubble residue needs to be sort of adequate to actually protect that soil right over through the next summer, where we do have some very high winds right into the next cropping season. And so it's a really important component. Where this fits into the long coleoptile wheat project is we're really just looking for ways to sort of help guarantee and make sure that we get that really good crop establishment. And because depth control can be really difficult, we can get a lot of soil throw from one foray into another because, again, the soils are loose - unconsolidated. So as the seeder goes through, the soil can move more than it usually does. We can get wind, or water, moving soil from ridges into furrows. There's a lot of reasons why seed might end up deep, and we're looking at how much can long coleoptile wheats help us ensure a good establishment, even if they end up deeper than we'd like.

[00:06:18] **Hilary Sims** And to help us paint this picture, can you please describe the trials that you've had in the ground so far?

[00:06:23] **Dr Stephen Davies** So we've been doing experiments for several years now, and last year we did two experiments with the long coleoptile wheat, the national project. And they were looking really at combinations of sort of where we had soil treatments, so we were looking at nil deep ripping or what's called deep ripping with rotary spading. So a deep mixing sort of treatment. We basically had a number of lines, including a long coleoptile wheat and its partner sort of short coleoptile version of the same wheat. And we basically sowed those at several different depths. So we had the target depth that we would like to have, a 2 to 3 centimetre sort of depth, but we also did sow some down as deep as 10 to 12cm. And the idea is to simulate, well, what would happen if the seed does end up really quite deep in these soils? And how effective is the long coleoptile trait at sort of emerging in those circumstances? And we were comparing that on nil soils just loosened soils with deep ripping, and these deep mixed soils. So, you know, some different sort of soil environments and different impacts on the soil. Really interested in that early establishment, really interesting sort of ground cover early and, then obviously but still just following things through to yield and that as well.

[00:07:39] **Hilary Sims** And what sort of season did you end up having for these 2023 trials, and how did the long coleoptile wheats perform?

[00:07:46] **Dr Stephen Davies** It was generally very challenging season. So we had one site right in the very northern part of the grain belt of WA, and that was a very dry season for there so yields were low. But what was interesting, I guess, was that there was still an advantage of that long coleoptile trait in improving establishment early despite it sort of being a difficult season and difficult to say much about sort of yield in the end. That long coleoptile trait still did improve establishment, not necessary by a massive amount, but it was still a significant increase in establishment compared to the short coleoptile wheat sown deep. And then our other site was in what we call our eastern wheat belt, so near town called Merredin, East of Perth, and it had a slightly better season and probably an even bigger sort of benefit of that long coleoptile wheat improving crop establishment over short coleoptile wheat when sown deep. So when these things are so sown shallow the different wheat lines I guess established really well. But when they sown deep, that's when that long coleoptile trait is of benefit.

[00:08:51] **Hilary Sims** And Steve, was there anything that surprised you in this research or did it all go along as expected?

[00:08:56] **Dr Stephen Davies** As far as that long coleoptile wheat trait goes, there weren't really any surprises there. They really did express that - they were often a good 10 to 15mm longer coleoptile in that actual field environment, like expressed in the field and measured from the field. So that was, I think, really positive just to see that actual difference, I guess, in the actual expression of that trait in the field. So I think this definitely gives us a bit of confidence about the value of it about being expressed in our soils and our environment. I think a couple of things that probably have surprised us is that we have a lot of deep, sandy soils, I guess, in Western Australia, and they're often the ones that are ameliorated in this way. And as we've gone from site to site, we do notice that some sites, the soil after amelioration that actually seems a bit more of a challenge for the wheat plants to get through than other sandy soil. So ostensibly you would look at these sands and say, well they're both kind of deep yellow sands, they're both similar, but there are actually more subtle differences between them. And so some once you've sort of ameliorated them and I've had time to settle, some of them can form crusts that are actually quite difficult on the soil surface, difficult for wheat plants to emerge through. Whereas other sandy soil that look quite similar aren't forming those. So it just goes to show, I guess, that there can be these quite subtle differences that can impact on things. But in either case, the long coleoptile wheat was showing a benefit at emerging from depths. And I probably should just say that, look, we're not necessarily trying to sow deep on purpose, we're not necessarily trying to chase moisture in these scenarios generally, but this is really about ensuring a good establishment if our seed does end up deep for all the reasons of soft soils and soil moving into the furrows.

[00:10:48] **Hilary Sims** And we've certainly touched on a lot of good messages already through this discussion. But what would you like growers to take away from the research findings that you have at this stage?

[00:10:58] **Dr Stephen Davies** From our sort of perspective, we've sort of done other work, I guess, around crop establishment as well. And so I guess when more long coleoptile wheats that are well adapted to different environments become available for growers, we're really keen that they sort of consider using those wheats when they are establishing that cereal cover crop on ameliorated soils. Any improvement in crop establishment really helps gain soil cover more quickly, it protects the soil, and as I say, it ends up providing stubble there for the following summer as well. And it's really important to protect that stubble and maintain it, and to sort of go back into that minimum till cropping practice. We just want to give growers confidence that these are a useful tool when you're undergoing that amelioration process. And in a way it's a fairly simple story, but we should not estimate the value of all these improvements. Some of our other work obviously shows that maintaining a really good seeding rate is really helpful as well. And then ultimately, you know, to be good if in the future we have some quite high vigour wheat varieties that we can combine with a long coleoptile trait, and then that'll really kind of help us get that soil cover. And so I think the focus on soil covers is just important just because you've done all this excellent work, made a big investment in soil amelioration so make sure you sort of protect the soil. And we really sort of get the maximum benefit out of all that effort that's been put in and all that costs that's been put in. So it's really about avoiding pitfalls and protecting that really precious soil resource.

[00:12:27] **Hilary Sims** Absolutely, there are some good messages there. And speaking of the future, where is the research heading? Do you have any trials in the ground this year?

[00:12:35] **Dr Stephen Davies** Yes, we do plan to have trials in the ground this year - it's already getting towards the end of May, and it's been so incredibly dry here that whilst our sites are sort of prepared and ready to go, we're still waiting on at least some rain. I'm based in Geraldton in that northern region, as I said, and we've had very little rain since September last year, so we actually don't even have some sort of moisture of any significance. So yes, the plan is still to go ahead. We're running a little bit late, later than we'd like, but I guess one of the advantages of this research, I guess, is we're really interested in that early stage of crop establishment and crop development, and so we'll still go for it and get some measurements and get some details of the use of these tools. We still have some work that we want to do in controlled environments too. And one of the things we typically want to look at is does that long coleoptile wheat trait provide you any advantage if you do have those surface crusts. So will a long coleoptile wheat coming from various depths, you know, perform better than a short coleoptile wheat when it's trying to penetrate this surface crust? And, you know, to us, we put our fingers on these sandy surface crusts and we think, oh, it's not very strong. But for a small wheat seedling trying to emerge, it is actually quite a challenge. I guess our hypothesis is, is that if the emerging leaf is still protected by that coleoptile sheath, in the case of a long coleoptile wheat, that it will be able to penetrate and have more strength to get through those crusts. But that's something that we're really keen to test in the field. So it'll be another handy piece of knowledge for us to understand, and to know about.

[00:14:10] **Hilary Sims** Well, yes, if it gives growers the confidence to use the varieties when the time comes, that can only be a good thing. We'll leave it there Stephen, thank you very much for speaking with us today.

[00:14:20] **Dr Stephen Davies** Oh thank you. Thanks for the opportunity. Appreciate it.

[00:14:28] **Hilary Sims** And that was DPIRD Principal Research Scientist, Dr Stephen Davies. And before him was chief scientist at the CSIRO, Dr Greg Rebetzke. This four year long coleoptile wheat project, made possible with GRDC investment, is being led by CSIRO along with research partners including the University of Melbourne, New South Wales Department of Primary Industries, Queensland Department of Agriculture and Fisheries, SLR Agriculture, DPIRD, the University of South Australia, and EPAG research. More information on this topic can be found in the description box of this podcast or online at GRDC.com.au. I'm Hilary Sims and you've been listening to a GRDC podcast.

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