# Science to Practice Forum 2023

Day 1 Session 2 transcript

(Duration 65 mins 30 secs)

6 June 2023

## Introduction

This is the transcript of one of the Future Drought Fund’s Science to Practice Forum sessions, presented by the Department of Agriculture, Fisheries and Forestry. This transcript is for Day 1 of the Forum, session 2, Seeds & soil health: Innovating at scale.

Learn more about the [Science to Practice Forum](https://www.agriculture.gov.au/agriculture-land/farm-food-drought/drought/future-drought-fund/research-adoption-program/science-to-practice-forum).

## Transcript

[Recording begins]

Pip Courtney [00:00:10]:

The Noongar Land Enterprise Group is Australia's first Indigenous grower group. We'll now head to WA, where with support from the Southwest WA Drought Hub, they're looking to turn wattle seeds into branded products.

[Video voiceover begins]

Heidi Mippy [00:00:51]:

We are here today on Ballardong country at Boola Boornap, which is our native tree farm or nursery. One of the strategic initiatives for Noongar Land Enterprise Group has been our bush food production, and one of the projects that we have prioritized has been a wattle seed harvest.

Alan Beattie [00:01:06]:

So, the NLE is, as far as we are aware, the only Aboriginal grower group in Australia. We've worked on trying to develop culturally appropriate, commercially sustainable enterprises. So, we want to get to the point where through the nursery and other enterprises, we are actually self-funding.

Daniel Kidd [00:01:20]:

The funding provided by the Future Drought Fund was, was integral to these innovation projects occurring because the Southwest WA Drought Hub had to apply for the funding. This enterprise set up through NLE was really highlighted as, as something worth investing in. You know, just, just to help business enterprise bush foods, you know, seen as a real innovative area to, to expand into.

Alan Beattie [00:01:40]:

Funding we've received has covered things like wages for casual staff. Every single person involved in that process has been an Aboriginal person. We've engaged a marketing firm to work with us around branding and marketing.

Heidi Mippy [00:01:54]:

So, some of the products that we're looking at is raw wattle seed and also roasted and ground wattle seed. Ideally, we'd like to package that ourselves and take that out to market. As Noongar Land Enterprise Group. We're looking at some co-branded products, and so we're looking at a cold brew ice coffee with the wattle seed. Wattle seed is a staple food for Noongar people, so it's been a food that we've lived on for a long, long time. The challenge in contemporary time is how do we bring that to the market?

Daniel Kidd [00:02:25]:

I think this is really a springboard, proving that wattle seed is a viable business opportunity that Noongar Land Enterprise Group are really setting the framework for investment into other bush foods and other enterprises to jump on board.

Heidi Mippy [00:02:41]:

There's no doubt that people are struggling with drought across the wheat belt. There's a real opportunity here for us to recognise the value that native plants and the Noongar native plants play in keeping the country healthy, using less water than other plants, providing shade fodder for our, for the animals in agriculture. So there's some real opportunity there while we're talking climate change and looking at the value of traditional knowledge coming into that and building that resilience across the wheat belt and in fact, across the country.

[Video voiceover ends]

Pip Courtney [00:03:23]:

That was Heidi Mippy supporting Noongar landowners to bring native foods to market with support from the Southwest WA drought hub. Commercialising products takes time, money, and a specialised skillset. The Future Drought Fund recently put out a call seeking commercialisation services for Australian innovators and their drought resilience products and services. Here to tell you more is Blake Zur from the FDF. Take it away, Blake.

Blake Zur [00:03:51]:

Thanks, Pip. Hello all, and welcome. It's really exciting to be here today. I'm leading the branch responsible for the development of the Drought Resilience Commercialisation Initiative, and I'm here today to give you a quick update on what it is and how we are going, getting ideas to market.

Getting great innovative ideas into the hands of Australian farmers is so important and supports our primary industries as they prepare for dry conditions. We know that Australian farmers are innovative and willing to try new ways of farming. We know Australian farmers have been finding and using innovative new practices and technologies for a long time, and we know how important adaptation is to keep Australian agriculture moving in dry times. And there's lots of good ideas out there, but getting them into the hands of Australian farmers isn't always straightforward. It takes a lot of work and a lot of support to drive a great idea from early development to market availability. And we don't like seeing good ideas struggle to reach our farmers. We know Australian farmers rely on innovative tools. They need tools to adapt so they can be profitable in a landscape prone to drought.

So that's why we're delivering the Drought Resilience Commercialisation Initiative. It's to help drive those good ideas and fast track their availability to Australian farmers. So getting ideas to market in the research and development landscape. Some innovations might be really good ideas, but haven't been quite developed enough to be attractive for private investment or private assistance. There's too much risk, too much work to do before a viable pathway to market can be shown. This can often be the end for those innovations. Now sometimes that's because the innovations just weren't right for the market, but sometimes it's because they just need a helping hand from an expert to move forward on their journey to market. And that's the challenge we're looking to address.

This is a new approach for the Future Drought fund, and as such, we're going to run this initiative as a pilot. We're hoping to see impact we can have in this space and see some great ideas move closer to being available to Australian farmers. It will be a limited pilot tested over approximately 2 years with the first innovators due to come on board later this year. So, our delivery partner - the Future Drought Fund is far from an expert in this commercialisation space. We're passionate newcomers, and so we're looking for a partner with the right skills, the right expertise, and the right vision to help us drive the success of this program.

This delivery partner is currently being selected following an open tender process we ran earlier this year. Now selection is a really big process and we are taking the time to get it right. So to start with, our delivery partner is going to help us to find the right innovators. They're going to help us develop the selection criteria and application process. I'll cover that in a little bit more detail later.

Now once the innovators have been selected, the delivery partner will provide an expert one-stop shop for commercialisation services to that selected group. This is going to include things such as facilitation services and other professional advice and support. This support and advice will help innovators to identify barriers that they are facing to come up with a plan to overcome those barriers and to take tangible steps towards market. Of course, the department's going to be there along the way to provide support and assistance where it's needed. We're excited to begin this work with the expert delivery partner. Now, as I mentioned earlier, the initiative will provide a one-stop shop commercialisation service to innovators. We gave the sector a wide scope to come to us with their best possible commercialisation service they could offer. But for all tenders, we asked that bids would provide tailored commercialisation, facilitation, and planning support along with allied professional advice and support.

We'll work closely with our delivery partner while they provide a valuable service to innovators. They will draw on their knowledge of the industry, particularly around innovator needs to deliver on this important program. Now, commercialisation facilitation and planning will be included, include the development of an individualised commercialisation plan. Each innovator's plan will be tailored to their unique needs. It will be developed by a commercialisation facilitator. We expect that one-on-one consultation with the innovator will take place during the development of the plan. The plan will identify things such as barriers to market and ways to overcome those barriers. It will include allied professional advice and support. It will vary considerably depending on the commercialisation model proposed by our delivery partner experts. But we do expect it could relate to the following factors. Developing a business model, legal considerations, including intellectual property, identifying potential partners, marketing and communications advice on raising capital or confirming market opportunities. These are just examples of the activities which will help an innovator overcome barriers to market. This approach is about walking with innovators on their journey to market. So facilitators will stay in contact with innovators as they participate and will encourage and coach innovators while they make their decisions about their drought resilience innovation.

So, who can apply innovators with a suitable drought resilience product or service will be able to apply to enter this program? It's likely we'll have a limited number of spots, noting that it's just a pilot. This will make sure tailored support is available for those who participate. The delivery partner will have the expertise to identify innovators who are most suitable, those who are likely to benefit the most from participation.

Of course, we do have some basic requirements for participation already. We broadly expect that a person will be able to apply for this program if they are an Australian citizen, resident or company, have a drought resilience idea, product or service. They want to commercialise own their own product, or at least can direct decisions relating to the project and are fully committed to participating, along with being reasonably likely to get positive benefits from participation in this exciting initiative. Of course, there's going to be a more specialised selection criteria. Our expert delivery partner will be tasked with determining what those parameters look like in close consultation with the Future Drought Fund.

So I hope after all of that, some of you are sitting there feeling pretty interested. So while the department is finalising the selection of the delivery partner, there are a couple of things you can do to stay in the loop if you're interested in keeping engaged. So if you or someone you know has a drought resilience innovation, which you think might be suitable, you can keep an eye on the Future Drought Fund webpages. It's up on the slide at the moment. You can scroll down to stay informed and sign up to the Have Your Say list, and that will make sure you receive any notifications about this program. The other key thing you can do is connect with your local Drought Resilience Adoption and Innovation Hub. So each of the hubs will have more details about this program once the successful delivery partner is announced. We're extremely excited to be bringing on an expert partner to deliver this really great program, and we're excited to be trialling new ways to fast track the availability of drought resilience tools for Australian farmers, because at the end of the day, this is all about getting Australian farmers the latest innovations, so they continue to get the job done. So thanks to all of you for attending today's update. I hope it's been interesting and I hope you stay tuned for more. Thanks.

Pip Courtney [00:13:12]:

Thanks, Blake. Australian farmers are so inventive. I'm sure you're going to be having a lot of people applying.

We now have two presenters sharing insights and experience on a new polymer technology being used as a sprayable biodegradable malt in farming systems based at CSIRO's Agriculture and Food Office in Werribee, Victoria. Dr. Stuart Gordon will discuss the development and properties of this technology. We'll then head to Bunbury in WA, where Richard Fennessy at the Department of Primary Industries and Regional Development will present findings from a number of trials established across multiple crop types.

Dr Stuart Gordon [00:13:53]:

First of all, I'd just like to express my, well, my gratitude to the Wadawurrung people down here in the southwest of Victoria for the privilege of reporting from their land, and pay my respects to their elders past and present and emerging. Today, I’d like to present a new product that CSIRO has developed which replaces plastic mulch films used in agriculture and avoids some of the problems they create. Essentially farmers are using plastic mulch to enhance the plant's transpiration process, you know, the process by which plants absorb water from the roots and circulated up through their branches to their leaves, where upon its released as water vapor to the atmosphere. This pump or this transport is really important for plant function and growth. And I'd just like to note that plants use much more water than animals and humans on a weight-for-weight basis. So it's very important that given the theme of this talk here today is around the Drought Hub, it's important that we preserve that water as much as we can.

So essentially you can see here from the graphic the plastic mulch film from CSIRO's sprayable biodegradable mulch enhances or reduces evaporation and enhances transpiration. Essentially, it's a plant pump, if you like. Now the issue with plastic mulch films is that, well, they're important. So we know that they've been around since the 50s. The Americans introduced them in the 50s to great success. They’re really important for crop productivity. And this is the other side to, you know, this is the yin and the yang of our problem here, is that, you know, we need to increase farm productivity because our arable land areas are finite and are [inaudible].

So that's a really big, high-end sort of proposition. So basic mulch films will be around for a while, but there's a problem They don't biodegrade, there's a high cost to their retrieval and disposal and they generate a high volume of waste. And the foundation will be in the future that there'll be legislation to phase their use, and this is already, you know, legislative action has already been initiated in the EU. I'd just like to note a point here that, you know, when we talk about plastic mulch films for broadacre, we think, oh, in Australia, maybe that's not done. But I'd like to give you the example of China where it's estimated that 18% of their arable land is covered in plastic polyethylene mulch films. So 18% of their arable land covered in plastic, essentially.

And that equates to you know, more than 200,000 square kilometres of area covered in plastic mulch films. So CSIRO very keen on these sort of big motivators, and as such, about 10 years ago, some of my compatriots here at CSIRO Manufacturing came up with the idea that they could spray an aqueous emulsion of polyurethane a little bit like a paint, but fully biodegradable polyurethanes sort of have an easy sort of, they're easily sort of metabolised by the soil microbiome. So what we have here is we have, we have some pictures of our mulch being applied to some tomato crops out at Rochester just in Northeast Victoria. And what we noted here in these trials that we get soil moisture preservation, we get weed suppression just for that period until the crop canopy gets up and we get improved germination temperature.

Our product's patented, and it's easy to apply using sort of standardized farm spray systems, and it's, I will say, and this is a little bit this is up for debate, but it's close to cost parity with sort of current biodegradable plastic mulches when you include the waste and disposal of those plastic mulches. You know, there is no waste, no collection after cropping and there are no disposal issues. So on that happy to take questions after this but I'd just like to acknowledge my compatriots here. So Raju Adhikari and Keith Bristow there, they are the actual inventors, and their co-workers there are the inventors of this sprayable biodegradable mulch. I'd like also to acknowledge Boron Molecular, they're based out in Noble Park in Victoria for batching up. They have some polyurethane reactors there and to Richard Fennessy who will start the next presentation for his application of it and his interest in our product. So thank you.

Richard Fennessy [00:19:46]:

Thanks, Stuart. Very pleased to be with you today, and I like to pay my respects to the [inaudible] people here in in Bunbury in Western Australia. It was a great opportunity to be aligned with the work that CSIRO and Stuart and his team have been working on, and an opportunity to evaluate this innovative product in some horticultural farming systems. So let me just give you a bit of a, a brief overview of our objectives of our work. So, the work's currently yet to be completed. So, we're still three quarters of the way through it. So, we're just going to be sharing preliminary insights with you today. But essentially what we wanted to do is see if this innovative technology can be used to address climate change challenges across a broad range of horticultural farming systems. And as Stuart highlighted single use plastic mulch provides some pretty weighty challenges in terms of environmental costs. So, we wanted to find a sustainable alternative to that, and also just to help Stuart and his team and further develop this technology.

So, we applied the spray on mulch. I'll just refer to it as, as mulch, for the rest of the presentation. We applied the mulch to 2 table grape vineyards in the Swan Valley and wine grape vineyards in the Franklin and Margaret River wine regions. The picture on the left is the table grape vineyard in the Swan Valley, and on the right is the wine grape vineyard in Margaret River. While I've got these images up, I just want you to sort of take notes of the exposure of the ground. There, you can see that the canopies of those two systems are very different. The table grape canopy covers the soil. So it is shaded for, for most of the growing season. There is in the, the wine grape vineyard, the trellises are quite open, and sun is directed upon the, the ground there. So the underground, the under divine treatments very similar across those 2 sites. So, essentially we had the spray on mulch, we had remnant weeds after a herbicide application, and this is representing the conventional practice. And we also had a bare earth covering. We installed sensors 25 centimetres from the surface in depth, and they measured soil moisture and soil temperature. And we also captured weed emergence and mulch degradation. Again, if you can see on, on the right, there is a time lapse camera there affixed to the post.

Now, again, reiterating this project is still underway. So just sharing some, some brief data with you today. But the full data set is yet to be fully interrogated. So this graph is showing soil moisture content from the Franklin Wine grape vineyard. And you can see that there is quite a clear separation between the treatment. So, the mulch is represented in the green line at the top remnant weeds after herbicide, the blue and down the bottom there, bare surface. So the bare surface is obviously quite separated from the other two treatments. And what we can sort of take away from this is that the mulch was very similar if not a little bit higher than the conventional practice in terms of retaining soil moisture throughout that growing season. Now soil temperature was quite an interesting observation.

So the top graph there is from the table grape vineyards. Again, we're using the same colours to represent those same 3 treatments and it may be a little bit difficult to see the scale there, but essentially what we're seeing in that top graph, not a huge difference between those three treatments. In terms of soil temperature, we're seeing about a 1.5 to 2 degree separation between the highest and the lowest. We attribute that to the, the shading effect of the table grape vineyard system. But in contrast, if you see down the, the below graph, there is quite a significant separation in that green line, which represents the, the mulch application. So there's about 30 to 40 degrees difference across those treatments. And what we believe is attributed to that is the direct sunlight heating up the, the, the mulch film, which is which is black in colour and consequently is heating the soil. But although it might not be entirely desirable in this sort of farming system, we believe that heating the soil to these sort of temperatures might be beneficial in some horticultural farming systems where we apply soil fumigation to treat pathogens and also that elevated heat could be used to mitigate weed seed emergence.

We've recently established pumpkin and tomato trial sites in Carnarvon, which is approximately 900 kilometres north of Perth. Again, these treatments were applied as you can see visually on the left photo spray on mulch which is in that sort of that front left of the image. And we also compared that to the conventional practice of using black plastic mulch and also a biodegradable plastic mulch taking very similar measurements on those sites as what we are taking in the vineyards in addition to measuring yield. So, the data is still being collected. We expect to harvest those plots in the coming weeks, however, what we have observed to date is really, really interesting in that top right top right image is cracking. So, when we applied the film and it dries, and then through the irrigation cycles, the, the clay-based soil does expand and contract. Consequently, cracks do occur in the film, and again, in the image to the right there with the tomatoes, you can see the weeds have emerged from, from those cracks.

So in summary, our preliminary observations that soil moisture retention was comparable to conventional under vine treatments, that soil temperature under the mulch was elevated in direct sunlight, level of weed suppression was observed, but influenced by coverage and soil type, the viscosity of the product in ability to form a film does present some challenges on application. We did find that nozzles do get blocked up and you need to be aware of that when making those applications and that the current formulation and suggested application rates require large volume of product leading to cost and logistical challenges. And we hope to we really look forward to completing this work in the next 2 or 3 months. And then continuing our collaboration with CSIRO to help develop this product. Further, I'd like to finish by acknowledging my colleague Truyen Vo, who was involved in establishing these trial sites, our partnering vineyards, CSIRO, and our funding providers. So, I appreciate and thank them for their involvement in this project. Thank you very much.

Pip Courtney [00:29:11]:

Thank you, Richard. That's fascinating. We've got a couple of questions from Slido. First up, where is the sprayable mulch tech at in terms of commercialisation?

Dr Stuart Gordon [00:29:24]:

That's a, that's always a leading question Pip, thank you. So at the moment, CSIRO’s been through an attempt to create a company out of the new tech. So it's at a technical readiness of 7, maybe 8. You know, we can batch it up into big lots. Some of the constraint, well, some of the issues around commercialising it are, as Richard has presented around the volume of water. It's an aqueous emulsion so you're carrying a little bit of water. But we are just about to start a another, well, a big project with, the broad acre industry to devise a new formulation of it so that we are using something that's, a more ubiquitous polymer. And we'll be using, you know, the formulation technologies that we have at hand to sort of adulterate cellulose so that it becomes the material that covers most of the space. It's a tricky one. It probably needs, it's not a short answer either. So happy to have, happy to take names and, you know, establish the conversation further after this.

Pip Courtney [00:30:48]:

Do you see farmers just buying this off the shelf, or would it have to be custom batched for a particular farmer who's got different soil types to even the man up the road, let alone the woman in another state?

Dr Stuart Gordon [00:31:05]:

Yeah, that's a good question. So as Richard pointed out, it does depend a bit on soil type you know, it doesn't, you know, if you have a higher degree of ped in the cultivation, then you will get cracks if you've got a clay will swell and crack and things like that. It depends a little bit on the application, as Richard alluded to. So that's a work in progress. I think at this point in time, if it was to go on the current formulation, we'd be looking at having it batched to the farm from regional centres you know, there would be, I guess there would be you know, a manufacturing plant in a capital city it would be batched in a concentrate form out to farms, and then the farmer would determine, the application rate and the number of applications to build a nice fill over that, over that crop. So again, they, the farmer then would have to look at their cost inputs and things like that. So that, that's another good question.

Pip Courtney [00:32:19]:

Are there risks? And either one of you can answer this, are there risks to the soil biology? Another question from Slido, when the product breaks down?

Dr Stuart Gordon [00:32:30]:

I don’t know what you've observed, Richard, and I'll, I'll let perhaps Richard respond after this, but we have subjected material to fairly stringent or fairly strict biodegradability tests, and we do know that it's, it essentially biodegrades down to CO2 and nothing else really. So it is very biodegradable this particular polyurethane formulation that we have. So that said, I would not be applying it, or expecting it to disappear that quickly on some of the red sands, you know, out in the, out in the Mallee or east of Perth perhaps. Richard, what did you find when you saw it in terms of biodegradability?

Richard Fennessy [00:33:24]:

So, yeah, we haven't observed the, the product long enough to make any conclusions. We will be taking samples of the, the mulch from those vineyards again in the next coming weeks after about 7 months post application. So, we'll collect those findings at the end of the project, but unfortunately, we just haven't got to that point in time where we can make some commentary. It's a point that the farmers that we've engaged with in our project here have you know have presented those sort of similar questions to us. And there's a real eagerness to learn to what degree and what rate of breakdown the mulch will incur in those different soil types.

Dr Stuart Gordon [00:34:27]:

Pip, I'd note the, you know, the stronger the microbiome population, the quicker the breakdown essentially. So yeah, if you've got fertile soils, then it disappears relatively quickly.

Pip Courtney [00:34:45]:

Oh, well, that's a good way for a farmer to find out how good his soils are. Thank you so much to both of you. It's going to be a fascinating project, and I think a lot of farmers will be keeping an eye on it, particularly on the farm waste issue. So thank you very much. Now to WA to hear about a project testing soil moisture probes and making horticulturalists in three states less vulnerable to drought.

[Video voiceover begins]

Tanya Kilminster [00:35:34]:

The Southwest WA Drought Hub has assisted numerous grant rounds that have been funded through Future Drought Fund. The Modern Soil Moisture Monitoring Program is a, a national collaboration. The Southwest WA Hub leads it, we're working in with the Northern Australia Hub and the Victorian Hub. We work really closely with the Future Drought Fund. And the need that we are trying to address is the fact that there's many horticultural producers that are either under allocating or over allocating their water or their irrigation allocations.

Bill Bateman [00:36:09]:

Not a lot of growers definitely monitor their moisture at the moment, only 10 to 20% in Australia. You can't control what you're not monitoring in the soil, and if we can't budget for our water resources, which then we are making ourselves vulnerable. The Modern Moisture Monitoring Project, funded by the Future Drought Fund, is designed to assist growers in becoming more resilient in times of drought or low rainfall. 15 growers that are participating in the project are apple, avocado, and tomato growers. In this project, each grower gets probes from different manufacturers to be able to see which probe suits them the best.

Paul Chapman [00:36:58]:

We're in Brunswick, an area in the southwest of Western Australia. So the orchard here is about 20 acres, and it has about 1,820 trees on there. So we're just new to this probably about 2 years into it. Did a little bit of research before we started on the rainfalls here and looked over the last 10 or so years, and clearly, it's declining. I was conscious of that because there's limited water source and avocados are quite thirsty plants.

Maurie Lyster [00:37:24]:

Here at Lyster Orchards, the apples we grow are the Gala strains, Pink Lady strains, and of course, the Bravo, where we're standing at the moment. I think the role of the probes is extremely important because your soil moisture movement in different soil types varies quite considerably in this area. So, on our property here, we have deep loam over clay. Further up on the hillside, it is more a gravelly loam. And then we have a patch of fairly sandy loam. So, the water requirements in those 3 areas are totally different. With the increase in fertiliser costs, which is almost trebled in the last 12 months, you can't afford to be wasting your fertilisers.

Paul Chapman [00:38:13]:

I generally access it on my phone to see how saturated soil has been with the water, whether we need to start backing off on the water. We were just watering once a day. Since this we've been watering twice a day a month or so ago, I got a text message from Bill asking if my water had stopped. And actual fact what had happened one of the solenoids had broken, and so we weren't actually getting water, so that was great.

Maurie Lyster [00:38:35]:

On that, the importance of monitoring the, the moisture in the soil is to make sure that you're not over irrigating, which is pushing your fertiliser below the root zone of the tree. Or if you are under irrigating, you're causing a little bit of dry stress in the trees if you have a major wet stress or a major dry stress that relates to a drop of about 25% in production.

Tanya Kilminster [00:39:06]:

The strength of this collaboration is that we've got growers learning from other growers. We've got researchers learning nationally from other researchers. We also are very much encouraging and excited by the fact that within the project, there'll be workshops and field days where we can bring other growers that perhaps haven't been exposed to the modern technology, and bringing that knowledge and the sharing of the learnings to others.

Paul Chapman [00:39:31]:

The more information you have, the more informed decisions you can make.

Maurie Lyster [00:39:33]:

This has given me a huge amount of confidence because yes, having this technology available to me at the drop of a phone, I can travel off anywhere and still keep an eye on the moisture levels in the orchard.

[Video voiceover ends]

Pip Courtney [00:40:02]:

That was Maurie Lyster from Lyster Orchards explaining how soil moisture monitoring is improving business confidence and resilience in a change in climate. Thanks to the Southwest WA Hub. Now we are crossing to Adelaide to speak to Neil Lantzke from the Western Australian Department of Primary Industries and Regional Development, or DPIRD. Neil will be expanding on the FDF Soil Moisture Monitoring Project we just saw a teaser of in the last video. This project is being conducted in Western Australia, the Northern Territory and Victoria, with assistance of DPIRD, NT Farmers and Food and Fibre Gippsland. The project is assisting fruit and vegetable growers to better schedule their irrigation by using soil moisture monitoring. Neil is a senior research scientist who leads the DPRID vegetable team. He's previously established and managed a large orchard and worked as a horticultural consultant in fruit and vegetable marketing. Over to you.

Neil Lantzke [00:41:05]:

I'm going to discuss some of the findings of this soil moisture monitoring project, which was funded by the Future Drought Fund. The goals of the project, firstly, was to assist the participating growers use soil moisture monitoring to better manage their irrigation. In total, we've got over 25 growers in the 2 states and the NT. And, and secondly, we want to provide practical recommendations to the wider horticultural industry, to assist them to adopt soil moisture monitoring. And we also want to understand that the barriers to adoption of soil moisture monitoring equipment, so soil moisture monitoring, it can increase water use efficiency drought resilience and increase yield and profitability as well as bring about environmental outcomes. Most horticultural producers don't use soil moisture sensors or evapo-transformation data to schedule their irrigations. They generally make decisions based on, or more subjective observations, such as the appearance of the crop, the feel of the soil, past experience, and they look at daily weather forecasts.

But in my experience, growers may not accurately or always accurately predict their water requirements. And I'll put up some data here from a benchmarking study that I was involved with, with stone fruit growers in the Perth Hills. So, we looked at their water use and, and these guys were all growing similar crops, similar climate, similar soil types and irrigation type. And you can see that, that some of the guys were, were applying, say, 5 or 6 megalitres a hectare a year, and, and others were applying double that. And on top of that, you know, I've done a lot of sore moisture monitoring over the years, and I've seen that, that that you know, that some people are under irrigating, some people are over irrigating, and in fact, some people in within the same crop or the same year, both under and over irrigate.

There's a whole lot of different types of sore moisture monitoring equipment out there. And generally, it's reliable and low maintenance, particularly compared to, to years gone by. And these days, generally most of it's logging, so you get a continual stream of data like it's shown on the graph there on the right. And, and that data can be viewed by the grower on their mobile phone or on a laptop soil moisture monitoring. It tells you to what soil depth the irrigation or rainfall has reached and whether the entire root zone has been filled. So, you get an idea of whether you filled up the root zone and you, and you can see by looking at a deeper sensor, whether you pushed a lot of water past the root zone, it's a bit harder to work out the refill point. So that's the critical level of when you should recommend irrigation. But by looking at the graphs and studying them closely and with a bit of experience, you can work out the refill point, but I'll say that sore moisture monitoring, it's not, it's not as easy as just putting the sensors in the ground and looking at the results. And there's 3 criteria here that, that I'll talk about in the next 3 slides. The first one is proper site selection and then proper installation technique, and then correctly interpreting the data.

So, when you, when we're installing soil moisture sensors, we need to make sure that they go into a representative soil type within that irrigation block. And soil types vary a lot. So, you need to make sure you're not putting it in a small sandy patch. It's in a soil that's representative of the whole block. And, and the sensors need to go under a representative. If it's an orchard tree size, you can't put it on a small tree on the edge of the block where it's got different environmental conditions. And then you need to understand the irrigation uniformity. In some cases, growers, irrigation systems don't put on water uniformly. There may be different sprinklers within, in a block or at the end of the line where there's, there's pressure loss along the lateral. There'll be less water coming out there.

So, you need to understand that. And if you've got sprinklers, you need to under, well, sprinklers don't put on water uniformly. Uh, there's circular wedding patterns overlap in many cases. So, you need to work out where you're going to put the sensors within the wedding pattern. So, we put out catch cans to measure the application rate you know, both this, both directions from a sprinkler to work out where we're going to put the soil moisture sensor, so we know whether that's in an average application rate spot. And lastly, you need to know the depth or the location of the root zone. So, we, we dig down and just see where the roots are, the sensors need to be going and where the roots are. The, the installation technique is really critical for soil moisture monitoring. And if you don't install them correctly, you'll get results, don't, you'll get misleading results.

And the main thing is that you need to have good soil sensor contact. You can't have air pockets next to the sensor, because of the way the sensors work it'll give misleading results. So, there's a whole lot around the ordering technique, whether you use slurries of clay, the soil material or bentonite, and what do you do if you've got a gravelly soil? And I won't go into them now, but you just need to make sure that the things are installed as recommended by the supplier. And there's other tips as well. And the last thing is interpreting the data. And I think a major constraint to growers using soil moisture sensors has been interpreting the data. And, in fact, I've looked at a lot of soil moisture data and sometimes it baffles me, and it takes a while to work out what's actually going on.

And assistance from an experienced agronomist in the first season is really important for many growers to try and work out exactly what's going on. So, from this study, and we're only halfway through it, but what we've found is the largest barrier to adoption is lack of support. And I mentioned that about interpreting the data, but it's also in troubleshooting with the equipment, etcetera. And often aftermarket service is not provided by the suppliers. And in, in our case, we had an agronomist, you know, we employed agronomists in Western Australia to help, to help out and the other 2 locations did too. But sometimes agronomists, they can lack the knowledge and expertise and soil moisture monitoring. And there's also the grower's lack of willingness to pay for the service, to buy the equipment and to pay for the service. And part of that might be that they don't trust the data. And, I think, to overcome that, we need to demonstrate the issues, you know, with the data.

What have the participating growers learnt so far? As I said we're just 6 months into a year-long project, but the growers involved have gained a better understanding of how to interpret the trends in the data and understand the benefits and limitations of soil moisture monitoring. The vast majority of the growers involved in the study now view the data every day, and that helps them. That helps them schedule their irrigations. In WA, 13 of the 15 growers we've got look at the data, there's 2 that don't, and we need to go back and, and have a closer chat with them to find out exactly why they're not using the data and why they don't see it as being a benefit. But the overall response of the project's been positive and, and I know some of the growers have already bought additional equipment to put in other irrigation blocks.

So the outputs of the project, it was mentioned earlier in the video, we are holding field days, so we'll be holding 3 in Western Australia for the 3 crops that we're looking at, so we can showcase the project and you know, demonstrate the case studies to other growers to try and bring them on board so they adopt the technology. We'll be writing a publication on the practical use of soil moisture monitoring, and there's a lot that can go into that. And lastly, we'll be doing a benefit-cost analysis, on some of the properties. So, we'll look at, well, what's the cost of the equipment, and to have assistance and compare that to savings and water and increased in yield and quality. Lastly, I'd like to thank all of the partners involved in the project. So, the people on the ground with the NT Farmers and Food and Fibre Gippsland and also the 3 Drought Hubs and the Australian government and the Future Drought Fund. Thank you.

Pip Courtney [00:50:08]:

Thank you, Neil. We have a question here on Slido. Why do you think soil moisture monitoring has not been widely adopted as a tool to improve irrigation management?

Neil Lantzke [00:50:19]:

Well, there's the cost of buying the equipment and do farmers want to pay that? So some of the smaller farmers may be a bit hesitant to do that, but I think, you know, it's largely to do with, if you put the equipment in, and it's particularly, you know, I would say that this equipment is more useful for fruit tree crops where you put it in and leave it there and not so useful for short-term vegetable crops where there's a lot of installation. But you know, I was an orchardist and I felt like without soil moisture monitoring, I was driving blind. You know, I didn't really know. I thought I knew what I was doing, but when I put in the equipment, I had a much better understanding. And there were times when I was under irrigating, and it really alerted me to those facts and I irrigated better.

Pip Courtney [00:51:06]:

You said that you sometimes even with your expertise struggle to look at the data and understand it. Are there apps out there that can help farmers or does looking at it every day mean they become more familiar, and they start to see the patterns that they maybe didn't at the start? Because if you got all that data, don't think it's a bit of a waste, isn't it?

Neil Lantzke [00:51:27]:

Yeah, yeah. I don't think that there's any apps out there. You know, after you've looked at the data for a season, you start getting a better understanding of what's going on. I think that's the main thing is you know, just to start looking at the data and you know, looking at different irrigations and rainfalls and see what's happening. And you'll get a feel by, by tying that in with how you think the crop's going to see whether you are, you are under irrigating or over irrigating.

Pip Courtney [00:51:59]:

Well, thank you very much Neil, and particularly great to hear that some of the participants went out and bought more equipment. Obviously you're doing something right, so thank you very much for being involved today.

Neil Lantzke [00:52:11]:

Cheers.

Pip Courtney [00:52:14]:

Now it's to Horsham in Victoria's Wimmera. The Wimmera has a long and proud history of producing quality broad acre crops as well as wool and lamb. In fact, agriculture is the Wimmera’s largest source of employment and contributes almost a quarter of Victoria's grains. And about 16% of the state's sheep meat and wool drought is a regular feature in the Wimmera. And farmers have a proven capacity to adapt and manage climate variability. However, its predicted drought conditions will intensify beyond the lived experience of Wimmera farmers, becoming more frequent and longer, with more pronounced impacts. These climate forecasts compound the complexity of farm decision making and risk management. We're being joined by Bronwyn Bant, the Regional Agriculture Landcare Facilitator with the Wimmera Catchment Management Authority. Bronwyn will provide us with an overview of their recent project, which is using soil moisture probe technology to increase drought resilience on farms in the Wimmera. Thank you, Bronwyn.

Bronwyn Bant [00:53:24]:

Thanks so much, Pip for the introduction. It's great to be able to share our project with you all today. Today, I'll take you through Wimmera farming systems, drought and climate forecasts, how soil moisture probes can be used to support drought resilience, provide you with some details about the Wimmera soil moisture probe project, including some farmer case studies and next steps for our project. Just to give you some context for our project, we've got a map there of the Wimmera region within Victoria, we sit just below the Mallee region. In the southern Wimmera areas, we might have an annual average rainfall, about 550 mills in the northern regions, it can be around 300 and 340 to 400 or 450 mills a year. Our wettest months tend to be June to August, and broad acre cropping form is the largest agricultural enterprise followed by sheep per meat and wool.

As, as Pip's already mentioned, the Wimmera is no stranger to droughts. And because of this, Wimmera farmers have already adapted their farming practices from a land health perspective. Farmers are retaining and accruing as much moisture as possible in order to continue growing crops and livestock.

So, some examples of that, I've got photos there. There's stubble retention, no-till cropping and rotational grazing in stock containment areas all being used to keep that ground cover and ensure that soil moisture is preserved. However, the Wimmera is forecast to experience lower spring and winter rainfall and warmer temperatures by 2050. The Wimmera will be more like the current climate of Deniliquin or Central Eyre Peninsula with more frequent and severe periods of drought. And this is likely to lead to more marginal growing conditions for Wimmera farmers.

We all know that soil moisture is a key regulator of productivity in agricultural systems and that greater knowledge of soil moisture conditions at the paddock and catchment scale is needed for farm and agribusiness decision making and drought resilience. So, to address this need, data-driven drought resilience project was created as a measure to reduce that farm business risk. For those of you unfamiliar with this technology, you’re probably not, after all the sessions we've had today. I have got a photo there of a soil of a of weather station. You can see some of the data it can collect there on rain wind speed, wind direction, and the likes. You can also see that there's been a trench dug behind that weather station that can give us some details on soil moisture as well at depth.

I've also included in there a little risk assessment table that we developed with Dale Boyd from Agriculture Victoria. This is developed specifically for cropping enterprises that can be used throughout the growing season, whether it's sowing, early tillering pre-harvest, and it gives you an idea of what you could do in your particular paddock given the soil moisture levels. So now that I've given you a little bit of the theory on why the network was needed, I’ll now briefly explain how we went about establishing the network. We had funding to deliver 72 soil moisture probes and weather stations across the memory catchment, which spans near over around 3 million hectares. Our aim was to establish a spatial spread of soil moisture probes with representation across soil types, farm mixes, rainfall zones. And to achieve this, we used a grid system, you can see there on the screen.

We divided the catchment into 72 squares. They're about 22 and a 22 kilometres squared each. Our aim was to install a soil moisture probe where the station and each of those squares, we use an expression of interest process to select locations and the proximity to other installations, the soil type. All of those parameters are listed above or were considered in selecting the sites. The CMA contributed two thirds of the cost of the soil moisture program weather stations, and the farmers who were participating agreed to share the data from their station and probe on a publicly accessible data portal for 5 years.

So, with the technology installed, and ironically there was some delays due to some really wet paddocks. We weren't able to access them to get the installations in. We then shifted to the next phase of creating the data portal. It's free to access via our website and just requires you to set up your own username and password. The image on the left is showing you the soil moisture summary across the catchment. It's colour coded, so the red sites have got fuller soil moisture profiles, the blue are lower, and you can use that screen to toggle between different views. So, you can have a look at air temperature, rain, humidity any of the measurements that the weather stations or soil moisture probes are collecting. You can also switch view to look at an individual site. So, I've pulled up the dashboard there for the rainbow soil moisture probe. And there you can see a stack summary of soil moisture at 10-centimeter intervals along with the rainfall bar graph.

I'll now share with you a couple of examples of how farmers are using the soil moisture probes to build their drought resilience. This is Tony, who farms at Glenlofty in the Pyrenees Ranges. Tony uses the soil moisture and temperature data alongside weather forecasts to monitor feed availability if soil moisture reserves are dwindling and temperatures are rising, particularly in spring. Tony uses his to inform when to sell stock well before the feed and low ground cover become an issue. When our livestock farmers are often faced with the feed gap over the summer months when rainfall typically decreases. If there's enough soil moisture from late spring rain, Tony can make a decision to sow perennial pastures or a summer forage crop knowing that the financial outlay is low risk.

This is Tim. Tim is a broad acre farmer in the Horsham region. Tim and his brother Luke have both worked off farm as engineers and have played to their strengths using technology and data to inform farm decision making and obtain a better understanding of plant available water. This is just one of Tim's graphs which tracks when profiles fill and dry and the amount of water available to plants at the paddock scale. Tim is tracking soil moisture across several paddocks with this really sophisticated approach. So, in this final slide, I'll briefly talk about next steps. Our highest priority is to continue to promote the network and continue extension around data interpretation so that more farmers and agronomists are using the network to increase drought resilience. There's also been some interest in the addition of inversion towers. They can be used to reduce spray drift and provide greater pesticide efficiency and reduce off-target use.

There's also potential for a range of research uses. For example, the movement of slugs when rainfall events happen, there might be plant disease likelihood capabilities. And there's also the opportunity to look at land management practices and how that affects soil moisture correlations. And finally for the network to have a lasting legacy. Beyond the 5 years of our timeframe that we've set, we would like to work with Wimmera farming communities to develop a sustainable and a viable approach to make sure that the network continues beyond that 5-year timeframe. And we'll be looking to some of the more experienced networks across the country to provide us with some advice on that. I'll leave it there. Thanks for the opportunity to share our project with you today. Thank you.

Pip Courtney [01:01:40]:

Thanks so much, Bronwyn. We've got a couple of questions coming through on Slido. One is, how do you plan to measure the impact of the network?

Bronwyn Bant [01:01:50]:

Good question. One of the ways we can do that is by looking at who's using the data portal. So, everyone who uses it needs to, to set up a username and password, partially because you can then adjust the settings to see just what you want to see within the network. So, we're able to track how many people are using it and how frequently they're using it. So that's our, I guess, our biggest test to make sure it's being used and it's helping with drought resilience.

Pip Courtney [01:02:18]:

Are you getting any feedback yet as to how useful farmers are finding this information? Because it's the sort of system you see with fruit and veggie growers, not broad acre croppers and wool growers.

Bronwyn Bant [01:02:33]:

There's been some really positive feedback. It’s been an interesting few seasons. Obviously, it's been quite wet here last sowing season, so there's it's good. Yeah, the feedback has been fabulous because farmers can see that the soil moisture in the sort of, the top 30 centimetres might be a little bit dry, but underneath there's quite good reserves of soil moisture. So that's giving them a bit of confidence that as the season continues, they should be able to produce some really good crops. Another really useful bit of feedback has been so many farms in the Wimmera at the moment are located in isolated pockets. So, they can check the weather at a different farm before heading across, knowing that it's a good day to say spray or fertilize a particular paddock. So yeah, the feedback's been fantastic.

Pip Courtney [01:03:26]:

So, 72 squares do you need more, does the system get more accurate and more useful for the farmers if you've doubled it and then triple it?

Bronwyn Bant [01:03:37]:

Yeah, so we exhausted our funding by getting the 72 soil moisture probes in, but having said that, there are some gaps in the system that we would like to see covered. And yeah, completely agree, the more soil moisture probes and data we can collect, the greater accuracy we can give farmers.

Pip Courtney [01:03:55]:

Oh, well, you've just announced a funding request there. We're happy to help Bronwyn. And we've got another one here. Can you see something like this network being used in other regions or states, which I think is a cracking question?

Bronwyn Bant [01:04:12]:

Yes, absolutely. This could be definitely rolled out and scaled out to other regions. There’s definitely landholder support for this, you know, there's many farmers that have said, I'll even pay entirely for my own soil moisture probe and included in your network. So, I think as some rainfall gets more marginal or more variable soil moisture is becoming more and more important and having this kind of data to back your decision making and reduce your risk. It'll be incredibly important to farms in the future.

Pip Courtney [01:04:49]:

I think I'd be pretty on the money if the Mallee was the next. It seems an obvious extension.

Bronwyn Bant [01:04:57]:

It does. I reckon there'd be plenty of broadacre dry land farmers in the region. Well, there'll be some already using soil moisture probes and I think there'd be plenty who'd benefit from a network.

Pip Courtney [01:05:07]:

Okay. Bronwyn, thank you so much for your time. It's a fascinating project. It's time now to break for a bite to eat. Thanks Bronwyn. Thanks everyone. See you back here after lunch where you'll be learning about an exciting innovation recently tested in Queensland to detect pregnancy and cattle using breath testing technology. Yes, you heard that right. That's at a quarter past one. See you then.

[Recording ends]

**Acknowledgement of Country**

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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