# GRDC PODCAST TRANSCRIPT

**Getting grain storage right**

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Chris Warrick: G'day, I'm Chris Warrick, I'm here with Alex Conway. We're part of the GRDC's grain storage extension team. Our task is to help growers with their on-farm storage and also undertake some development activities to try and understand tools and equipment that we can use to better store our grain on farm, in particularly how to monitor and do fumigation. Today we're talking about three topics on grain storage. They are fumigating and venting in grain bags, recirculation systems for large storage when we're fumigating with phosphine. And lastly monitoring grain temperature in storage. Alex, we know we can do fumigation in grain bags. What are the challenges and how might we go about it?

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Alex Conway: There are a few challenges that come with the bags, and as we know, they're a great resource for harvest logistics. Bags are great, but we often don't have the same benefits in terms of aeration with the bags, so fumigation does become really important. Some of the challenges that we see is how to get the gas to distribute evenly along the bag when we're doing a fumigation, and then how do we go about venting the bag is often another one of the big tricks.

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Chris Warrick: Yeah. So colleague of ours, Philip Burrell, who's been in the industry for a long time, recently retired, did some research on this years ago and found you can vent the gas out of a bag in about two days with a fan drawing the gas out, but we often get asked about is there a way to passively vent the gas out?

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Alex Conway: And the reason being they are usually in pretty remote locations, a lot of these bags, they're in the corner of the paddock or something along those lines. So it's really important to try and come up with what are the options available when we're looking at doing it without power? And some recent research that has been done in terms of doing the fumigation correctly, found that we're using 50ml PVC tube inserted into the bag at seven metre increments. So these tubes were placed on alternating sides of the bag seven metres apart. And that really helped us get that distribution of gas during the fumigation. So we had a tray that would slide into these PVC tubes to get the gas inside the storage. We do a conventional ten day fumigation. And then venting was obviously the next part after that trial.

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Chris Warrick: Yeah, that was the main thing we're trying to test is can we use those same tubes once we take the phosphine out, replace the cap on that tube with an elbow just to keep the weather out and really testing whether that tube could become a vent port. And look, research found in a couple of instances that it could, but it takes quite a while, up to 35 days to vent. If 0.3 parts per million is our target venting. So 35 days. But compared to the sulfuric fluoride, Alex.

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Alex Conway: So we know we can use commercial fumigators for trying to fumigate bags as well. As Chris said, using sulfuric fluoride, we could actually get that venting time back to 11 days if using that gas. So it was a great alternative that we actually picked up through the trial was that using different gases can actually give us the ability to shorten our venting time. And at the end of the day, I guess the big thing is really planning. It's making sure that we're prepared for the venting time that comes with fumigating bags.

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Chris Warrick: Absolutely. And I have seen a few people now opting to rather than muck around fumigating in a bag, actually transfer the grain into gas tight storage, fumigate in there and then outturn. So do a batch fumigation. We talked about monitoring equipment earlier in the day today is really the surest way to make sure a bag is vented with a low range metre to test our clearance level.

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Alex Conway: The other important part as well, during the fumigation is again having that feedback from the bag or the silo when we're doing a fumigation. So using a high-level metre we found is extremely beneficial in getting that feedback on what is our gas concentration inside the storage. And as Chris said, then once we get to the venting period, using a clearance meter to ensure that we're happy that we're down at a receivable concentration.

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Chris Warrick: Speaking of fumigation, Alex, we're seeing more larger storages go in on-farm and finding the importance and the value of having a recirculation system to enable phosphine to be distributed through the silo a lot more efficiently.

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Alex Conway: Absolutely. The recirculation systems are really opening up the door to trying to distribute gas in larger storages, able to get that uniform gas concentration inside the silo in a shorter time frame and try and hold that lethal level of concentration for a longer period is really the idea behind it. But it does come in a few different format screws.

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Chris Warrick: Yeah. So we start with the passive option, or the ground level application system really allows us to apply the phosphine without leaving the ground into a chamber at the base of the silo. That chamber is connected to the head space with the pipe, and also into the base of the silo, so that phosphine can liberate throughout the storage. And of course, with any recirculation system, it must be a sealed gas tight sealable storage. So versus a powered system, Alex?

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Alex Conway: Yeah. As we get into the larger storages, it's where we often go to a powered recirculation system. So it's really the same principle applies. We're still drawing air from the head space and introducing at the bottom to try and circulate the gas through the silo. But in this scenario, we're actually using a powered fan of some sort to try and get that air movement happening. And again, just distribute that gas nice and evenly.

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Chris Warrick: So you talked about the larger silos. The label actually says for storage is greater than 300 tonnes for surface only application. The fumigation time is 20 days. If we have that powered recirculation we can shorten that exposure time down to 10 days.

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Alex Conway: And the other really important thing to note is, as we know with that surface level application, that the gas does actually move through the storage relatively slowly without any assistance. So it moves at approximately about six metres per day, previous research has shown. So that is really the big benefit of having powered recirculation is speeding up that distribution of the gas quite quickly.

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Chris Warrick: Components of that recirculation box. So we're talking about a box that you'd put the phosphine in at ground level. It's connected to that sealable silo with a powered fan. Other components of that box.

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Alex Conway: So the fan is obviously the biggest component. Just having a fan of sufficient volume to be able to circulate the gas. We also really need a vessel that's of sufficient size to try and get the amount of tablets. Or if we're using blankets in the box to try and get that distribution happening nice and evenly. We don't want all of our tablets stacked up in a small vessel, so making sure it's of sufficient size, but also ensuring that there's an explosion-proof door is really important as well.

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Chris Warrick: Yeah, so if that fan happens to stop or someone turns it off in the first few days of the fumigation, gas concentration in that box can reach explosive levels. So having a panel that will let go before the box explodes is really important. The other option alternative is to rather than use a box, just use a small fan plumbed into the head space and the ground level of the silo and still put the phosphine in up the top. So using a fan to do your recirculation. That way if the fan happens to stop, the phosphine can keep liberating in the head space.

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Alex Conway: Yep. And I guess in that scenario we avoid that explosive level if it's got enough room to disperse. The other key part of it, then, I guess, is we've probably spoken a lot about portable systems, and that's what's commonly used on our flat bottom storages. But there's also a lot of systems on cone bottom silos. Now, isn't that Chris? They're sort of doing the same box mounted underneath the cone, but the same principle applies. We're still typically using an aeration fan in that scenario, because on our cone bottom silos they're a bit smaller fans, which is perfect for distributing gas. So in a lot of cases where sealing up the remaining fans and just using one aeration fan to distribute that gas through the recirculation system. So a massively handy tool that we're seeing really, really good results in all forms of storage. It really is a good step, and I think the economics come into it a lot as well. Obviously, it is an extra cost at the point of purchasing a storage, but one that we're definitely seeing the benefits of. So we want to keep front of mind I think.

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Chris Warrick: You mentioned planning, and I guess any good fumigation requires planning, but if we can shorten that exposure period from 20 back to 10 days and still get a really good result, that certainly plays into having flexibility. Obviously, we always follow the label directions with any fumigation. Make sure we do that well. The last topic we were going to talk about today, Alex, is monitoring grain temperature during storage. We do so well at monitoring a crop during the growing phase, but we often then forget about it when it gets to in the silo. What are the reasons we tend to look at grain temperature?

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Alex Conway: The first one typically is it's a really good feedback mechanism from what's happening inside the silo. So things like if our aeration system stripped or a fan still has a cover plate on it or something along those lines, it's a really good indicator of if our storage and our aeration system isn't performing the way it should. The other one is also, it really gives us an early indication of what might be happening inside the silo as well at different points. So if we do have hotspots generating all the like, it's a very handy tool. But there's a few other things regarding fumigation as well, Chris.

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Chris Warrick: Yeah. The label tells us if we're fumigating grain below 25 degrees between 15 and 25 degrees, we need the exposure period to be 10 days. If the grain is below 15, it's too cold to fumigate, and if the grain is warmer above 25 degrees, the exposure period is seven days. So we really need to know the grain temperature before we do a fumigation, to know how long to leave the phosphine in for.

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Alex Conway: I think a really big part of it. Also, just tacking onto that is the quality mechanism as well. We know that temperature is a really good indication of how well we're going to maintain our germination of any seed that we're storing. And in terms of general grain quality as well, we know that we're pulling a lot of this grain off in the warmest part of the year. It's going into storage at quite high temperatures. So actually, understanding that if we can get that grind nice and cool, we can limit insect activity, we can really maintain germination. And that grain quality really well. So having that feedback from the silo, I think is a really key feedback mechanism from the storage. But there are a few ways in which we can actually get those readings.

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Chris Warrick: Yeah, there's sort of four mechanisms to monitor temperature in grain storage. The first one being the most basic. And that's a thermometer or a digital thermometer taped to a bit of dowel or conduit pushed in the top of the silo. It can sit in there alongside of our probe trap tied off inside the silo, in case we forget it's there and out load. But then when we do our fortnightly or monthly monitoring, we can actually just check for insects, check the grain temperature and start keeping a record of it.

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Alex Conway: It sounds a bit silly really Chris, but I think eBay and places of the like are a really great place to go for that sort of equipment. I know in a lot of cases growers sort of say it's an extra expense, but there are lots of ways that we can go about it very affordably and nice and simply. So I think it's really important to try and get it out of the two hard basket, but obviously we can then take it to the next level. So there are devices out there. A lot of them are stainless steel probes or thermocouples are still manually operated, have a handheld reader in most cases, or a little LCD display, and we can insert them into the storage. They typically give us the ability to get a bit further into the grain depth. We can buy them in one and two-metre spears, so we're getting a reading from nice and deep inside that storage. And we can do it at multiple locations around the silo. But what's the next step up from there, Chris?

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Chris Warrick: We have seen people use rev nuts or nut certs, or alternatively a water tank outlet in the sidewall of a silo where the ladder platform is to be able to get a temperature reading not just at the top of the storage, but also at multiple levels up the side of the silo. One of the newer technologies available now in Australia is real time speeds for monitoring grind temperature and moisture. They can go into silos either through the wall, through a custom-made port, or also really handy for bags or bunkers to give you temperature that's read back to your phone remotely, or back to a website that you can access. So another good option for people that really want to keep on top of grind temperature.

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Alex Conway: Even a few other options around that remote monitoring. There's systems like canisters. There are also cable systems which are really good as well. So the cables are mounted from the roof and extend vertically down to the ground in most cases where they're tied off. And they actually give us a lot of clarity around what's happening at different levels in the silos on a lot of those systems will say they have multiple sensors up the height of the grain stack and can give us some really informative information around temperature and humidity at different heights. And that is really critical in those applications where there's a little bit of risk involved, like when we're dealing with high moisture grain or we're trying to do drying in the silo, it's actually a really good way of trying to map a drawing front as it's moving through, in terms.

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Chris Warrick: Of how often we might want to monitor grain temperature, as you said, Alex, if we're trying to store something a bit higher moisture, we may want to check temperature every day, initially. Once we're satisfied that the grain storage temperature and moisture is safer, we can go down to fortnightly. Then, when grain temperatures down to the 20 degrees monthly, monitoring is adequate. But we need to make sure that equipment is actually suitable for Australian conditions.

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Alex Conway: Yeah. Really important to note because we do rely quite heavily on phosphine for our fumigation to try and control insects in storage. Really important to note that a lot of this equipment is in the storage in a lot of cases when we're fumigating, and phosphine is really corrosive on copper components. So we need to understand when looking at this technology, talk to the manufacturer and see if you can get confirmation that the devices are phosphine resistant, or get a format where it's able to be removed species and the like where we can pull them out if we're doing a fumigation. So really important, and I think it's just really important to understand that there's different levels in this technology. Quite often we see monitoring ends up in the too hard basket. But understanding that there's some really affordable options, there's other options that take the hassle out of it. There's a whole variety of options to try and get feedback from the silo. So really, really important.

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Chris Warrick: That's right Alex, I don't think we need to overcomplicate monitoring grain storage temperature, but really valuable to do. And when you think about the dollars tied up, not only in the storage itself, but the value of the grain in the silo. Why wouldn't we want to keep an eye on that and check it, make sure we're doing a good job of it?

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Alex Conway: Yeah, absolutely. Farm storage is really erupting Australia wide, it appears. And as we're just saying, storage is getting larger and larger, more and more grain being stored on-farm. I think it's just only working in the direction of trying to get practices and processes in place that really allow us to do a good job of managing grain on-farm. But there's so much information out there regarding grain storage, so where are a few handy places to go?

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Chris Warrick: So if people want more information about grain storage, they can go to storedgrain.com.au or give one of the GRDC grain storage extension team. That's us. Give us a call on 1800 Weevil and we'll do our best to help you out. From the GRDCs Grain storage extension team, I'm Chris Warrick.

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Alex Conway: And I'm Alex Conway.

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Chris Warrick: And this has been a GRDC podcast. Thanks for joining us.