Stubble Project Field Day
Marrabel 2016

Intro Trent Potter

This is a 5 year project. We are just about into year two. The idea of the project is for farmers to have the confidence to retain their stubbles and get the same yields as if they hadn't retained them. Everyone does something different to their neighbors but the idea is everyone wants to retain stubbles but don't want to lose money doing it. We have had some research trials but a lot of this is that we will get the information from a whole lot of farmers and researchers and then package it up for everyone so they have a whole series of guidelines. Part of the idea of this spray workshop came in April last year. We did a bit of trial work further south with different treatments and used water sensitive paper and fluorescent dye and we had different nozzles and nozzle spacing and different speed. We thought it was worthwhile to have a couple of further workshops so one here today and one tomorrow on YP to just go through some of the real technical stuff in spraying given that some people are trying to spray high stubble and other people are spraying on the bare ground, so a whole lot of issues are involved. We got Bill Campbell over from WA. He will talk to you this morning and then out in the paddock with the sprayer.

Bill Campbell from FARMANCO

Everyone does something different so I'm aware of coming into a new environment and not fully understanding how you guys spray, etc. We got talking about drift yesterday. The majority of what I do is primarily around getting good efficacy. I aim to teach you guys so that when you go home you have a skill set where you have the tricks to work out whether you are doing a good spray job or a poor one. The main thing is actually managing drift. We can have you spray with no drift at all but you will do a really poor job. Likewise we can have you doing a really good job with heaps of drift so it's really about a happy balance we have to achieve.

We have been driving you guys to use bigger and bigger droplets because there is less drift. The thing to understand is that as we drive you from big droplets to smaller droplets, if we halve the diameter we actually produce eight smaller ones and double the surface area. That's why there has been a need to use more and more water. If you go back 15 years ago your water rates would probably have been 40-50L. Now our common water rates are around 70-75L give or take. We are trying to drive you bigger from a drift perspective and a droplet perspective Important to understand is that we have a useful range of droplets. The very, very small droplets we term not useful because they are too small, have no momentum, the wind can carry them away and they are liable to evaporation

and are driftable. The bigger droplets, the problem is that when they hit a target, they will generally bounce and run off, not retained. So we have this sweet spot in the middle where we try to operate about 200-350um.

The unique thing about air inducted droplets is that they can have air included within them. When we look at that useful range, because they have air in them when they hit a target they are actually quite elastic. When they hit something they have a bit of give in them and are actually retained on the target. So theoretically with big air inducted droplets we get more useful droplets on the bigger end of the spectrum so there's some benefits there.

Deposition and retention on the target

When we go to big droplets we actually have to slow them down for them to be retained. Too fast and they bounce off. With our smaller droplets we can retain them at higher speeds so there's a whole heap of factors that affect that retention on a target that become important.

1. Droplet Size and Speed
    1. Fine-medium are retained velocities up to 6m/s
    2. Med-coarse retained up to 4m/s
    3. Very coarse 3-4m/s (more affected by leaf surface and product formulation)
    4. Conventional vs air inducted
2. Height above the target
3. Number of droplets
4. Canopy penetration – interception
5. The target size, orientation, leaf surface
    1. Vertical target retain <150microns
    2. Flat target retains <350microns

What we are talking about when you guys are spraying into heavy stubbles is that you are trying to get it on the ground, we are not trying to retain it on the vertical target. That's scenario one. If we have little ryegrass in there too, the only way we can hit little ryegrass is with very small droplets and with small droplets comes drift.

When we use small droplets <150microns we can actually retain them on a vertical target. If we take you to a medium or coarse droplet we cant retain them on a small target. So when we start to talk about spray quality and understanding the target, it is very hard to kill a small ryegrass with a coarse or very coarse droplets. You just can't retain it on there. So if you are going into stubbles and spraying lots of fines and driftables and lots of fog and mist floating around it's not going to get on the ground. It's all going to get on the stubble above and it's all lost. Getting the spray quality right for the situation becomes critically important.

Spray Quality

Most of the spraying that we do is in the medium or coarse spray quality. Medium is now 240-340um, coarse is 340-400um and fine is 110-240um. So whilst we are saying we need small droplets to be retained on vertical targets there is a portion that sits in the medium range that does have that. Understand that we are now under a new standard when you get into the technical side of things and it is actually a lot coarser than the old standard.

We have international standards now. So we don't want to talk about droplet size or VMD, what is important is that we start to talk in terms of Medium, Coarse and Very Coarse. Everything is colour coded on the charts so everything that is yellow is medium and it doesn't relate to the colour of the nozzle. What is really important is that is has a driftable component, which is any droplet below 141um.

So the thing with Medium is that most of the mediums that you use would have 6-20% driftable component that sits in there. When we go to Coarse, the driftable component is about 3-6% so that is why we are pushing you to bigger droplets – less drift. There is some need to go to very coarse in certain circumstances where the drift component is very low. It is the law for some products. Read the label.

I live near Geraldton and we have a local 1976 act which means we can't spray phenoxy herbicides within 5 km of any hort crop and we have tomatoes everywhere. Can only be an amine and you have to get a permit from AgWA. We don't use fine spray quality anymore because the driftable component is just massive. We can use really low water volumes because we have lots of droplets but we don't want it because of the drift.

If we use very coarse spray qualities we have to use more and more water. There is still a driftable component with coarse but it's a lot less. I've spoken about the consequences of running from small to big and why we have to use more water so that is important.

Water Sensitive Paper – count the drops

What we are doing when we use water sensitive paper and it's something new, is we are actually counting droplets and measuring the area fraction and that becomes significant. Now if you are spraying summer weeds with coarse spray quality or greater for it to work you must have 10% area covered and you must have 20 drops per square cm.

So you can go and run your machine and if you are not achieving 10% area covered and 20 drops technically it wont work for those weeds. When we go to winter work where we need really good coverage, say paraquat on ryegrass or clethodim we must have 12-15% and 40 drops per square cm. When we do fungicide work we actually need at least 15% coverage and we need 60 drops per square cm so that is why you use 80-100L water with high pressure to get

more and smaller droplet because the way fungicides work is purely as a protectant.

Some things are translocated and move through the plant - glyphosate.=

SnapCard

When you look at water sensitive paper, every drop is a drop and it won't pick up the very, very small ones. If you can see it you count it. SnapCard is a tool that was funded by GRDC, CSIRO and UWA. Goes on ipad and phone. You take a photo of your water sensitive paper, drag the cursor over the top and it gives you an area fraction covered. Only created in the last three years. It is a little bit noisy and has a bit of variation but if you run it five or six time you will get an average and you will get and idea what is good or bad after a while. This is a fantastic tool that has revolutionised this quantifying and checking of the spray job.

When we count the drops on the water sensitive paper we have this little tool with a cut out and we just lay it over the top and count the droplets. This is the DaVinci code of applications! I find the ipad is better than the phone cause you get better clarity on the really small droplets.

Water Volume

Talking about water volume, if I say we are doing a lot of our common winter sprays at around 70-75L/ha is that about right around here? No, 70-110L/ha. The reason this has gone up over the years is that if we have a litre of fluid we actually know how many droplets per square cm we can produce. So when we are driving you to use 70L and you are using Medium spray quality if we get every droplet on the target in that size we know we can get 94 droplets per square cm. What was the coverage we needed for good coverage….one was 60 and one was 40 wasn't it? So that's why we know we can have that covered.
In some areas with aerial spraying we get 15 or 30L/ha from the plane and it can do just as good a job as an SP rig on the ground at 80L. When we put a plane in it's for other reason or for insects where they excel. Using lots of water is important.

In WA summer spraying is Coarse and at 50-60L. You go to very Coarse. With winter work we are at 70-75 Med and Fungicides are at about 90L with Med spray quality. The other thing I'm doing when configuring sprayers is when it gets windy and we have to keep going we use a lot more water but we go to bigger droplets with air nozzles to get a lower drift component. You might be quite inefficient but at least you are still turning a wheel and don't have to be stopped.

GRDC has a Fact Sheet for In-Crop Herbicide Use.

Dilution

The other thing that comes up is dilution. We get this argument to say that if I'm spraying with 40L then my droplet is more concentrated than if I'm spraying with 80L. With the water volume ranges that we work within, that is a furphy. We are working in the range where that extra 40L of water is actually just getting us to our coverage requirements. So we can have 32 droplets at 45L and when we go to 70L we actually get 66 droplets so we are actually retaining more droplets. Where the argument for dilution comes in is for tree crops where they are doing say 2000L/ha and they come back to a concentrate of 500L/ha and that is a massive difference. Also in the US or Europe where they normally do 200L/ha and they come back to 100L/ha then there is a dilution factor there but not for the water volume range that we work in. For us, using a little big more water means we get more on the target

Leaf Area Index

The other really important factor that comes along especially with fungicides sprays where we are using more and more water is leaf area index. That's the area of leaf of the plant over a square meter on the ground. When we have big bulky cereal crops and you can have 2-3 times the leaf area on that one square meter on the ground therefore you actually need more droplets because the area isn't just the ground area but maybe three times that. So when we talk about water rates in high production wheat in NZ where they are growing ten and twelve tonne crops with big canopies that's why they are doing fungicide work at 150-200L/ha.

Looking at this water sensitive paper at 60L when we start to look at the area covered, it's a bit skinny. By adding another 20L/ha you can see the improvement in coverage.

Nozzles

We will talk mainly about hydraulic nozzles and there are some others out there on the market but the principles are similar.

Out of the nozzle a sheet is formed and the droplets are actually formed from when that sheet breaks up. When you are watering the roses with a hose and you put your finger on the end and squash it down it makes the sheet bigger and bigger and gives you finer droplets as you squash it in. When the sheet is bigger it takes the droplets longer to form with finer types than with coarser types.

When it comes to nozzles most of you spray with 110-degree nozzles and we also have 80-degree nozzles. If we have an 80-degree nozzle forming droplets from that sheet breakup, how do we turn an 80-degree into a 110-degree nozzle? Drops out of an 80-degree nozzle will always be bigger than out of a 110-degree nozzle. 110 has a wider fan and operates at 50cm above the target. An 80 deg would operate at 75cm above the target. If you have excessive boom movement and narrow 80 deg nozzles then you might not get the coverage you want.

With the **XR or the Flat Fan nozzles** we used to use the orifice (if it's 02, say) does the metering, nothing else there. The driftable component comes from the edge of the sheet which is the fastest part. Where that sheet breaks up it is generally doing 15-16m/s (45mph) when those droplets form and the driftable component is about 25%.

When we go to a **low drift nozzle** what we do is put a pre-orifice measuring plate above it. That becomes 02, so the actual nozzle becomes 04. That ratio is 2:1 and that's important. Top bit does the metering, still some restriction so the pressure drops inside so what happens is the sheet is a lot smaller and is only doing 7-8m/s when the droplets are formed. That's why the driftabe component in here might only be 9%. There is a direct relationship between the speed the droplets are formed and the amount of drift that is there. So when we move you to low drift nozzles the XRFFs are probably fine and the Low Drifts are probably medium. That's why we don't use the XRFF anymore. Just that subtle pressure drop inside the nozzle makes all the difference.

When we go to **air induction nozzles**, the top opening might be 02, the nozzle itself might be 04 or 045 or 035. The manufacturers change that and then introduce air in from the side between the openings. When you choose an air inducted nozzle the choice is massive and that's where all the confusion comes from. The sheet is smaller again and actually doing only 3-4m/s and that is why the driftable component might only be 3-4%. By restricting the sheet and adding air the driftable component gets less and less. It is all about speed of that sheet. Play with the hose at home to understand what is happening!

Pressure

The Flat Fan nozzles operate from 2-3Bar, the low pressure air induction nozzles operate from 2.5-5.5Bar and what is important is that at about 4 Bar they go Medium. Below 4 Bar they go Coarse. The big mistake we made in the early days was that we tried to run them too low. We had big droplets and we couldn't achieve the coverage that we needed to for our targets so there were lots of poor results by using the wrong pressure for the wrong nozzles. One of my key take home messages is that it doesn't matter what nozzle you have on your machine, if you operate it at the right pressure range they will do exactly the same job but the AI nozzles will have a lower driftable component. That's why there are lots of benefits to running air nozzles if you can run them at the right pressure.

What does 02 mean?

Everyone says it is a diameter but it is actually a flow rate. 02 means .2 US gallons per minute at 40psi. This is really handy because when we look at the charts it's an actual flow rate.

So if you are using 03 plus 02 in alternate you are using .3US gallons plus .2USG, actually .5USG together so we can actually add sizes together. That means if we have that nozzle at the recommended 3Bar it will give a consistent flow rate.

As nozzles get bigger the orifice and flow rate get bigger but the spray quality also gets bigger generally but you need to check this on the chart because they are not all the same. When we pick a nozzle we have to find out where the machine will operate and then we find the right nozzle to suit.

Remember I said that at the high pressures we get medium spray quality? Here's an example where we have an Agritop airmix 02 at 5.2Bar which is running medium and at the low pressure, it is running coarse. So when we look at the coverage on that water sensitive paper it is only giving us about 7% but when we drive that pressure up we get an average of 10%. So when you come back to the coverage requirements, if we know the area fraction that we need…..if it's at the wrong pressure we don't get the coverage but if we drive the pressure up we do. Try to always run them in the optimal range for the particular nozzle where it wants to work. Or you could run more water but would have to slow down.

Nozzle / Spray Chart

You can download this onto your ipad and it's an awesome resource. You will use it consistently. The way it's set out is that there's a block of flat fans, a block of low drift, the big block in the middle is the low pressure AI nozzles and then we have the high pressure AI. Be careful what you read in the charts and use common sense and observation of what is coming out of your boom so you are not led astray.

Spray Application Formula

This is the number one formula for spray application:

$$\text{Flow rate} = \frac{\text{Water rate} \times \text{Speed} \times \text{Nozzle spacing}}{600}$$

So it is a really good way on the run to check what your flow rate it. If you've got a Weedseeker or a WeedIt machine or you're going to spray your firebreaks or use a mister, that formula does the whole lot, it's the number one formula for application.

$$\text{Litres/min per nozzle} = \frac{\text{L/ha} \times \text{km/hr} \times \text{W(m)}}{600}$$

Total flow rate = Number of nozzles x Litres/min per nozzle

Conventional vs Air-Induced

1. Air induction had relatively minor effects for both grasses and broadleaves
2. AI may provide a benefit on weeds which are difficult to 'wet' as they appear to retain coarser drops than conventional nozzles
3. Grass weeds are more sensitive to application method than broad leaf weeds
4. Summary: if AI used correctly then no difference in efficacy

So if you have small targets – back to the coverage requirements – if you have small grasses, small targets – 12-15% and 40 drops whereas with your summer work in those broadleaf weeds you only need 20 drops.

Tom Wolf and his team in the US spent 3 years trying to work out if an AI droplet is better than a Conventional droplet and their conclusion was in the sizes that we use there is no difference. Except that the air included droplet because of the way it works on the speed of the sheet has less drift. Don't get caught up in the argument that one gives better efficacy or control than another one. It's how you use it.

Use the chart to work on the flow rate, the pressure the nozzle operates at then substitute the right nozzle. I don't get caught up in if it's a T-Jet or an Agritop or a Hardi or whatever. I want to fit the nozzle that suits the pressures for what I want to do. I dislike the little anvil shaped Turbo-Ts in the small sizes because they block up.

Labels

Labels are being revised. AVPMA is responsible for pesticide us in Australia. The community regards spray drift as a significant issue.

Key priorities

1. Human Health
2. Health of the Environment
3. Protection of Australian Trade

15th July 2008 – Spray Drift Initiative Launched
Now Mandatory No-spray Downwind Buffer Zones – as products are registered or re-registered

They also give you spray quality requirements on new labels eg:

1. Spray quality
    1. Boom set-up ie nozzle type, pressure
2. Meteorological considerations
    1. Avoiding risky drift conditions ie wind speed, inversions

Labels are becoming much better. Eg – gives you wind speed max and also a lower min speed so you avoid inversions and still conditions. It talks about inversions and actually give you the spray quality and also gives the boom height. So if ever in doubt look at the label and show staff who you may be employing.

A lot of labels have mandatory record keeping. Controllers in the machines can sometimes capture the info. The key thing is that if anything goes wrong and you have records it can protect you in a court of law. If something goes wrong and you drift something you shouldn't have and you have no records you have no support at all. So they are really valuable. It's also useful from the point of view of day-to-day agronomy to figure out why something worked or didn't work.

Wind Speed

The max wind speed should not be above 20km/h and preferably around 15km/h.

Higher wind speed can be managed

- With a canopy to catch the droplets
- With droplet size ie – Boom set-up
- Buffers (no spray zones) provided gusts are not too strong

During the day, a minimum of about 3-4km/h is essential to ensure the air moves and mixes

At night this should be above 12 km/hr for the whole time between sunset and sunrise.

As far as legislation goes I think we have gone to one extreme and now we are coming back and allowing you to make some judgment. So if you have the wind going in the right direction and you know what is happening I think we can actually apply a lot of products with smaller droplets.

We are always going to be caught in that grey area and that's why I used the example of the little ryegrass when we have phenoxys in the mix – we do get caught out.

Mick – our hardest one is probably this time of the year when we use glyphosate, for example, to knock off summer weeds and then we see what else is there and we throw the Group I in and we don't change anything. It's the group I that is so dangerous in this environment. We had an example of this kind of drift this morning and there's not a broadacre property within 5km of it. It's come from 10-20km away. So we have to get our there and say have we got ryegrass or have we not? We are knocking them off because we use lots of glyphosate.

Bill Campbell

Windspeed on all the labels, generally, shuts off at 20km/hr. Wind would be one of the hardest factors to manage with spraying because it is not always perfect. With my work in the field I often measure it. The other day we were out and the wind was 18km/hr but gusting to 25km/hr. When we were observing our machine at 25km/hr we were having all sorts of trouble trying to get our spray on the ground. 20km/hr is not that strong but that's what the label is.

The wind speed for **night spraying** is 12km/hr. The problem with night spraying is that conditions get calm and we generally get no wind at night so becomes an issue.

Delta T

You guys talk about **Delta T** mainly for summer spraying. What about in winter time? The issue is that we have probably over focused on Delta T for summer spraying. This is an old chart that we drew up when we had the old Kestrel meters that gave us relative humidity and temp so we used to reference this chart. We used to say don't spray above 10 for summer spraying. But we now say that when we go to bigger and bigger droplets that we can actually squeeze it out to 12-14. So going along, it's about 9-9:30am and the day is 'going off' and it's starting to get really hot. So we slow down, pull some pressure out and get bigger droplets and we can keep going. Especially with our summer type mixtures we are doing.

The only index we don't have is the **stress index**. Say it's 45 C yesterday, potentially the weeds could still be stressed today. How do you determine how stressed they are? If you have a full profile of moisture down below then you are probably going to be alright. But we are probably better off to wait for a day because then you are going to get a better kill and we can 'abuse' Delta T a bit more than we have been. So we are learning a bit more about that.

The other thing with Delta T is that the low Delta T's is the problem where we get excessive droplet survivability. In wintertime we actually should be checking it. In a Delta of 0 what is the air? Delta T is the wet bulb and dry bulb….so the drier the air then you get more evaporation and a greater difference. As the air is more and more saturated there is less difference. So what happens with a Delta T of 0 or 1? You get excessive survival. That's the problem. If we put any droplets into a Delta T of 0 or 1 – If we put 100um drops in there they can last 125 seconds. So if it's a morning and there's fog, they survive and they move and that is also the issue that we have at night. They will travel a long way.
When it gets hot we look at the survivability of these droplets and we are down to just seconds. As we get bigger, they survive longer so that is why we use bigger drops in summertime.

Inversions

The key thing with inversions is that any droplets we put into an inversion are trapped and they are very concentrated. When we get inversions generally the air is very cold and very saturated so we get a lot of survivability. That becomes the problem.

Droplets may drift and concentrate toward the top of the inversion layer and be carried far off target by light wind. If today there is an inversion at 5 or 6000 feet but it cycles the whole time. What happens at sunrise…….well in the afternoon the ground is warm and as you go higher and higher the temp drops. What happens is that as the sun goes down the earth cools very quickly so you produce a layer of this cool air very close to the ground so that is when if you put anything in it, it gets trapped. And as the night goes on the ground cools even further but that inversion lifts higher and higher. The reason we start to see the inversions in the morning when the sun comes up is that the ground warms up and gets this tight layer of air that stops the mixing. We have to get to later in the day for the inversion to get high enough to get out of the way. That cycle happens the whole time.

So what time of the year do we get inversions? We need warm ground but cold air – in the autumn when we are sowing. When we get really high differences in max and min temps that is when we get these inversions.

Mick – average every 5 or 6 of every summer day has an inversion here.
When it comes to the sort of conditions where you see that dust hanging you really need to pull up. The difficulty is that say you are trying to get out trifluralin or get a spray out and you want some sunlight on it but you have a seeder going into a paddock, what do you do? You do get trapped phasing your sprayer and your seeder but you just have to be careful.

GRDC have this fact sheet on Surface Temp Inversions and Spraying. It's really good.

Mick – There's going to be some more work done on alerting people to just when an inversion layer is happening. Many are not sure or are going on hearsay. Smoke pots are totally impractical. No one is ever going to do it. *There actually is a Tips and Tactics thing that has just been released from the GRDC. Take no notice of it. If an inversion layer doesn't exist, GO SPRAYING!* It actually says to you 'an hour and a half after inversion' you cant spray. No, you can only not spray if an inversion layer is still there. *If the inversion layer is gone, you've had good mixing and there's a breeze there GO SPRAYING.* Don't stop when you should be able to go spraying. It's really the afternoon going into the nighttime that is the major problem and then in the morning only if the inversion layer is still there.

Night Spraying

Night spraying is where the greatest potential for moving product off target can happen.

Air stability index. At night, the wind drops and we get very stable conditions so whatever you put into it will stop in there for a long time. Then if you have any topography effects like drainage or inversions you can move product a long way away. In this study they set up collection towers and actually look at the amount of product you lose away from the field around droplet drift and the proportion of that spray volume. Real science that you can actually use to measure what is going on.

The other thing we are starting to find out about night spraying, when we have been really pursuing this with Delta Ts is that we can have a loss of product efficacy. An example from the north of WA on button grass – hard to kill. We had really been pushing Delta Ts hard and you can see half the paddock has been sprayed at 3am and the other half of the paddock had been sprayed during the morning when the Delta T was still pretty good. Gly/Ester/Ally mix . February, very dry. The glyphosate is the component that kills the grasses. It takes about 5-6 minutes to dry out on the plants. Because it was dry and still dark in the 3am treatment the plants never take it up and that explains the poor result.

Glyphosate has to be in sunlight and in solution on the leaf for the plants to take it up in an active process. So if we spray glypho at night and we don't get a dewy morning in the days following it is unlikely to work.

Rainfast period – another example from WA – capeweed and radish sprayed up until just on dark. Guy was going to the pub. When he was gone at the pub there was a big downpour of rain. He came back the next day and sprayed and then seeded it. The plants sprayed close to dark – no light so it's still sitting on the leaf in solution but the plant isnt photosynthesizing and hasn't taken it up. The rain then washed it off. That is why on the glypho labels they talk about the product needing to be in adequate light conditions. Be aware of the spray to sow intervals if light is needed to activate the glyphosate and the seeder follows too quickly for that to happen.

Dew – we have a certain amount of humidity in the air. If we keep cooling it down we get to the point where the air gets saturated and that is where we start to get drops forming at the dew point. Have a look at what the dew point in any particular night and where that minimum temp is. If that min temp goes below the dew point then you will get dew. In winter time when you are trying to do your post em spraying you have wet crops, what do you do? In the evenings we don't want to spray because we have potential inversions and in the mornings you might have dew. So you end up with a time in the middle of the day and often not enough hours to complete the job.

We don't have an index for managing dew so generally what our guys do is fill up and do a bit of a run and if that dew runs off those plants then it's still too wet and they stop. Where we are having some wins with glypho with dews, say we

are spraying at night and the product drys out on the leaf but we get a dewy morning that is enough to wet that product up for the plants to take it up in sunlight.

Weather Essentials for Pesticide Application – Graeme Tepper

Product label – Mandadory Requirements
Wind Speed (depends on label) and Wind Direction
Delta T (temp and reliative humidity)
Release Height and Speed (depending on spray quality)
Local weather effects (especially night spraying)

Adjuvants

When selecting your nozzles and products, especially adjuvants….think about the impact that may have on the droplet size and drift potential.
If you are trying to manage drift, the product in the tank can be really critical. Certain products just drift like mad – certain glyphos, paraquat, dry Roundup forms

Work done at Gatton with LI700. What you find is that the nozzles that drift badly like our XR and FF nozzles, you will get the biggest reduction in drift with LI700. You still get a reduction with the AI nozzles. As the nozzle becomes less prone to drift then the effect from the adjuvant becomes less. If you treat LI700 as an oil for minimising drift, it will change the VMD to some degree. While we talk about these charts saying to spray at Medium, if you put some of these adjuvants in, eg a grass selective with an oil, you can move the spray from a Med to a Coarse. Same thing with paraquat, you might think you are spraying with Med spray quality but certain adjuvants can push that to Fine.

LI700 can reduce the driftable component but you need to be careful because some additives can affect nozzle performance. **Nufarm vid from Jorg Kitt.**

Different formulations of products (eg Glyphosate) have different additives and amounts of additives, which can all affect spray quality. Some will drift more than others.

Some problems with glypho and oil on small grasses in WA. Oil coats the leaf and glypho must be in aqueous solution to be absorbed into the leaf. Impedes the uptake of the glypho on small grasses. We use LI700 as it seems to fit as somewhere between and oil and a wetter.

Foamex to cut froth in tank – effect on spray quality?? Can increase drift. Methylated spirits added to tank will reduce foam but it will reappear with agitation. DF granules – have surfactants that causes dispersion and that causes the foam.

Activator – unique wetter that is drift neutral and does not create the driftable component that BS1000 does.

I have a grower down at Franklin near the grapes. In his shed is either Activator, LI700 or oil. He doesn't use BS1000. He uses air inducted droplets, big water rates, low pressures, low speeds, wind in the right direction, right speed, no inversions.

Sprayer Air Flow Dynamics

We are starting to learn that there are lots of machine effects on the spray pattern. So much pipework, and steel there that it is starting to have quite a big effect on what we are doing. With smaller tow behind booms we see lots of dust and swirling behind them. As we go to bigger sprayers with a lot more clearance, these effects that we used to see at slower speed are starting to show up at 18-20kph. On SP machines with the boom behind it is also happening at around 20kph where we are starting to get interference from the machine. Nitros where the boom is out the front and there is very little interference then those effects are happening at higher speeds. Every machine has some effects that happen around it.

We are getting better coverage in the interrow now that we are going up and back compared to when we used to go around and around. How do we get more droplets into the interrow is the challenge.

Speed – first thing that happens with an SP machine is speed increases. 5-7kph faster than tow behind

When we form droplets from a plane, which obviously travels vERY fast – they are created very differently from the hydraulic nozzles used on a ground rig. The plane nozzles rely on windshear and they produce a more uniform droplet without a tail of small or big droplets. They are dropping in clean air with no machine interference except for a bit around centre and tip vortices.

As we go faster the coverage and droplets retained reduces. You need higher water rates to compensate for those effects. The consequence of going to fast is that you have more drift and then you get wind tunnel effects around the wheels.

If you want to get more efficient what can you do?

Lower water rate
Drive faster
Fill up quicker
Minimise ferrying time to paddock

With big paddocks it take around 8-12 seconds to turn around at the end of the run. The smaller your paddocks the higher the number of turns relative to the total distance covered.

Is there any point going to 30kph if you are compromising coverage but you can make a change in efficiency somewhere else? Just minutes in a day can make a big difference. Trying to justify not going too fast!

Dust can cause loss of glyph efficacy behind machine.

Be aware of AI nozzle getting air hole blocked with dust

GRDC Improving weed control in wheel tracks fact sheet

Improving deposition in stubble rows and around front wheels

1. Higher clearance sprayers
2. Front mounted booms (up to 22km/hr)
3. Wheel track nozzles (for knockdowns)
4. Narrower nozzle spacing (25cm vs 50cm), at least adjacent to the wheels
5. Higher application volumes
6. Slower travel speeds
7. Mud guards that interrupt air flow

Coarse-med 'ish' spray quality appears to be best as it allows for some droplet 'movement'

Improving droplet penetration into standing stubble

1. Minimise stubble interception
2. A cross wind (wind direction is a big factor)
3. Nozzles at the smaller end of the Coarse spectrum
4. Narrower nozzle spacing (25cm vs 50cm)
5. Higher product and water rates generally better (.60L/ha, 80L/ha better!)
6. Optimising boom height (but must be at least double overlap)
7. Slower travel speeds
8. Dry sowing vs controlling small weeds techniqes

Well made formulations are made to work in water quality parameters of:

Hardness	1000ppm (3WHO)
Salt	2000ppm
TDS	3000ppm
pH	ideally 5-6
Bicarbonates	<250

- Must avoid high levels of combined Salt and Hardness
- High hardness (+500ppm) affects aqueous concentrate formulations
- High Salt affects emulsifiable concentrates formulations
- High TDS affects dry flowables

Hardness – products most affected are glyphosate and amine. Ammonium sulfate only fixes calcium and magnesium hardness. Determining what is causing the hardness is important. If it's caused by iron or something else then AS wont fix it. If you have high pH water then most probably the hardness is caused by calcium. When it comes to salt, most products will handle a fair bit of it. Simazine doesn't however like salty water. In high pH water then bicarbonates can become an issue. Bicarbonates affect clethodim severely, should be using AS as a matter of course.

Some people believe that in the high load glyphosates you don't need ammonium sulfate but if you have hard water you still have to use it.

Fact Sheet – Spray Water Quality – available on net

pH
Hardness (Ca, Mg, Bicarb)
Turbidity (suspended solids)
Salt (EC)
Temperature

Spraying in a range of speeds and pressures

If we are spraying at 70L with particular nozzle we get a 'sweet spot' of say, 22-24 k/hr to operate in. If we want to go to 80L then technically we should slow down to maintain same spray quality. (19-21kph). If we maintain the same speed then the pressure will go to high. The other thing we could do is go to a bigger nozzle, bigger orifice, coarser spray quality. If you have gone from 50cm spacing to 25cm you can say put 2 x 02 nozzles together to make an 04. That helps maintain spray quality. Mix and match your nozzles to suit the conditions if you are on 25cm spacing, twin lines.

Multi-step sprayers – two and three tier machines. (A) nozzles runs to capacity, then (B) nozzle fits requirements and comes into play. The beauty is that it gives you a massive range of working speeds say 15-28km/ha. Similar to having a 25-50cm dual line spacing. Systems can now be fitted to any machine. We have solenoids that turn the nozzles on and off and we have them working in pairs and we can dial up what we need.

Can run A nozzle, B nozzle or A+B, wide range. If just in flat broadacre situation might not be necessary. Useful in hilly variable country