Improved accuracy, efficiency, flow from liquid system

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Improving the uptake of nutrients through in-furrow fertiliser placement was the main driver for the adoption of liquid delivery on Mark Schilling's no-till farm.

Using liquid formulations has improved Mark Schilling's ability to deliver fertiliser – particularly trace elements – directly into the seeding furrows.

Trace elements are largely immobile in the soil, so being able to accurately place them within 25 mm of the seed improves the chance of seedling roots coming into contact with the nutrients.

Mark, who owns Copper Gone Farms, near Paskeville on Yorke Peninsula, also uses liquid delivery to apply fungicides, inoculants and nitrogen fertiliser.

An early adopter of new technology, Mark set up a liquid delivery system on both his seeders– a John Deere 1890 disc drill and a Bourgault 3310 Paralink tine with Atom-Jet points – five years ago and believes the benefits are evident in several areas of his cropping operation.

"It's hard to quantify dollars and cents, but I know my crop health is through the roof and my yields and protein levels have increased," said Mark. "That's largely due to better utilisation of our applied fertilisers.

It takes so much time to unlock all the nutrition in granules.

"Crop health is no different from you or me. If we have a wholesome diet, with good fibre and nutrition, we're going to be healthy. But as soon as we cut that out and maybe eat all fast food we get sick and feel lethargic.

"It's the same for our crops; we need to make sure they get the best nutrition."

Mark made the change to liquid delivery to improve zinc levels in the farm's brown loam soil. In the years leading up to the decision he was spraying zinc in heptahydrate form onto the soil in late summer/early autumn, before incorporating it with a tined implement then pre-drilling urea ahead of seeding.

MARK SCHILLING CHECKS THE QUALITY OF GRAIN IN ON-FARM STORAGE.

He now applies solutions or suspensions of zinc, copper and manganese, plus sulphur, UAN, Carbon Boost-S, pulse inoculants and fungicides such as Triad and Impact-in-furrow in the seeding pass.

The delivery systems, which were engineered by Copper Gone Farms using off-the-shelf parts, each cost about $10,000 for components.

Each system has dual tanks, a set-up that enables Mark to apply non-compatible chemicals at the same time. The main, 2,000-litre tank usually contains a mix of zinc, copper and manganese. The smaller tank holds 20 litres and is usually filled with a concentrated form of Carbon

THE DISTRIBUTION HEAD (ABOVE) IS THE HEART OF THE LIQUID FERTILISER DELIVERY SYSTEM MARK HAS FITTED TO HIS SEEDER (RIGHT).

Boost-S or an inoculant that is injected into the delivery stream through a Dosatron injection system.

The fertiliser is pumped from the tank into a distribution head similar to an air-seeder head. Hoses carry the liquid from the distribution head to a calibrated regulator – a tiny orifice in a plate – that controls the flow of liquid down a smaller hose into the plant row.

For the past five years Mark has applied his liquid fertilisers through the seeding boot, but is shifting the distribution point from the boot to just ahead of the press wheel so the fertiliser goes into the seeding furrow immediately before the wheel pushes the soil over the seed. "It's a bit less complicated and easier to fix when something goes wrong," he said.

Mark has replaced the centrifugal pump on one of the seeders with a diaphragm pump as part of a gradual upgrade of the systems, both of which have a double agitation system that rotates the water every two minutes. This is particularly important for trace elements, which tend to settle out of suspension if the mix is not continuously agitated.

The pumps are fitted with 80-micron mesh filters to keep the system clean. "Cleanliness is godliness, it's as simple as that," said Mark. "The liquid has to be filtered, but you need to be careful the screen isn't too fine or it could strip all of the nutrients out of the water."

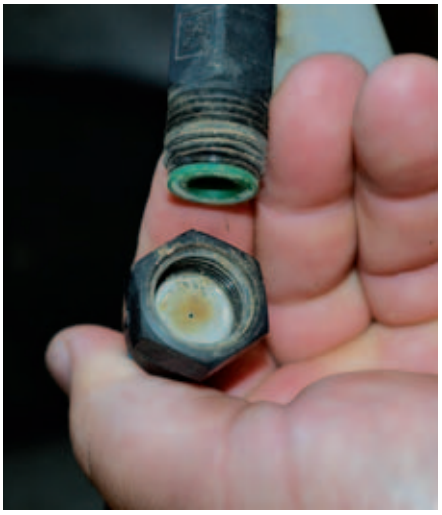
The fertiliser is applied at one and a half to two bar pressure, at a water rate of 80 litres a hectare. Quantities put in the tanks and seeder box at each fill are matched so water, fertiliser and seed refills are done at the same time; approximately every four hours. At Copper Gone Farms refilling is now done in the yard rather than in the paddock and generally takes half an hour, which allows tractor operators to take a break.

Mark uses a variety of approaches to achieve his crop nutrition targets. In addition to the liquid delivery system on the seeders he uses a stream bar to apply liquid fertilisers in crop and granular fertiliser formulations where they can provide the best outcome.

He aims to apply urea or sulphate of ammonia granules about six weeks after seeding, when there is a good chance of rain.

"We watch the season and look at the soil moisture profile. A month or so after seeding is a good time to spread granules because you've got the rainfall to match it."

In August, September and October, when the rainfall is less reliable, Mark uses the stream bar to apply UAN when he needs to provide crops with more nitrogen. The stream bar, much like a spray boom with very large-orifice nozzles, streams the



THE DOSATRON INJECTOR (LEFT) THAT ENABLES DELIVERY OF AN ADDITIONAL NUTRIENT OR INOCULANT STREAM AND ONE OF THE REGULATORS (ABOVE) THAT CONTROLS THE FLOW OF NUTRIENT DOWN THE DELIVERY TUBE.

THE UHP 'TINE' CREATES A SIZEABLE SLOT, EVEN IN ESTABLISHED TURF.

THE ULTRA HIGH PRESSURE (UHP) PROTOTYPE IN ACTION SHOWING THE 'TINES' SET JUST ABOVE THE SOIL SURFACE.

liquid onto the crop so that, rather than remaining on the leaves, it forms large droplets that fall to the ground, which minimises the risk of leaf burn.

"We've used stream bars for 10 years and I love them," said Mark. "Some people say, 'you're wasting your money', because it's more expensive, but I believe I get more bang for my buck with liquid nitrogen than I do with granules."

He also believes liquid fertilisers deliver greater flexibility for 'just-in-time' farmers looking to adapt their farming systems to the season.

"I'm one of those guys that farm to the season because I've had too many failures where we've put it all out there and then it doesn't rain. That's false economy.

"It takes so much time to unlock all the nutrition in granules. They help you fix a problem over the long term. Liquids are immediate. That's where liquids have found their niche. They're going to help that crop straight away.

"A lot of nutrients are relatively cheap to apply – less than $10 a hectare in some cases – so we can afford to apply them to be sure we've got the nutrition right and have all of the elements there."

However, he cautions, it's important to take care with nitrogen inputs because too much nitrogen can affect grain quality.

"The big element that tends to fail a crop

'SO MANY USES ... IT'S SCARY'

"I think there are so many uses for it, it's scary to think about," is Mark Schilling's view of the ultra high pressure (UHP) water jet technology SANTFA is exploring.

A progressive farmer who is not afraid to take a 'suck-it-and-see' approach with new concepts, Mark is excited by the potential of this innovative technology.

Showcased at the recent SANTFA conference in Tanunda, the ultra high pressure water jets are able to cut through soil or stubble to enable seed and fertiliser placement.

Mark believes the jets will allow more accurate placement of liquid fertilisers and fungicides. Many chemicals – particularly fungicides – work best when placed in a band below the seed so roots are protected or access the nutrient as they grow through the band on down through the soil profile.

"That's why I'm so excited about this technology, because you're going to be able to get the nutrients or fungicides under the seed," he said.

"Placement is so important, but I don't want to rip to go under the seed. As soon as you rip it, you're wasting diesel.

"Hypothetically, you could use a disc machine to sow your seeds and use a water jet on one side to add a layer of UAN, so when the root system gets to a certain stage it can take up the nutrient.

"And on the other side of the trench you could lay a zinc, copper and manganese mix.

"You could also inter-row sow and not have any problems with crop burn, and apply all of your nitrogen at seeding, which would be fantastic.

"The water jet could also be used in front of a tine machine to prevent stubble hair-pinning as the water jets cut the stubble like a coulter."

is if you put too much nitrogen on. If you don't get the balance of the trace elements and the nitrogen right you're not going to get a decent crop.

"If the season prevails and we think it's going to be a five-tonne wheat crop we revisit our inputs and maybe apply some more trace elements or nitrogen in crop.

"But it's important not to overdo it. We've all cooked our crops before because we've gone in too heavy with nitrogen and come harvest time we haven't got quality anymore, we've got chook feed."

In addition to liquid fertilisers, Mark has successfully used his liquid delivery systems to apply liquid fungicides, such as Impact-in-Furrow, to combat rust.

"We apply Impact-in-furrow at seeding time to give us that 12-week armour or grace time and apply a rust spray in the first two weeks of August," said Mark.

"With that combination the infection hasn't been as great. If there is infection there, it isn't as rampant as it used to be years ago.

"And the nutrition is better because we're feeding the crop and making the nutrients available in the right place."

Mark now uses the liquid system to apply fungicide instead of treating the seed with fungicide before seeding. Mark was dissatisfied with seed treatment because the amount of fungicide covering the seed was variable and unreliable.

He has also used the system to apply Carbon Boost-S for the past four years, which he believes helps plants develop healthier root systems.

"I have seen proof that where we use Carbon Boost-S there is at least a 30% better root system," said Mark.

He applies the supplement at seeding, at a rate of 250 mL/ha. This is achieved by setting the Dosatron injection unit incorporated in the liquid delivery system to feed the Carbon Boost-S into the main delivery line at a rate that gives a concentration of 0.05%.

Liquid inoculants for his legumes are also dispensed via the Dosatron because they cannot be mixed with zinc, copper or manganese. Mark previously applied inoculants directly onto the seed as it was augered into the seeder box but the process was messy and time-consuming.

"Some people say, 'you're wasting your money', because it's more expensive, but I believe I get more bang for my buck with liquid nitrogen than I do with granules."

He believes liquid application is the way of the future.

"One day I'd love it that all I was putting in my seeder box was clean seed.

"If I want to put fungicides or fertilisers on it all goes through a liquid tube. That way, if we don't use all the grain, at least we haven't got pickled grain sitting around the farm.

"It's a quality assurance issue, more than anything. It means we can sell any seed that is left over, so there's no wastage."