

## It's all about the soil!

MIKE ROBERTS

Understanding how his soils are working, what constraints they may impose on his farming system and the potential they offer if those constraints are overcome are the keys to profitability for Jamestown farmer Pete Kitschke. Pete is also using a combination of liquid and granular fertilisers to provide his crop nutrients, after finding that liquid injection offers a flexible way to address some soil constraints.

A combination of a simple liquid injection system and getting his hands dirty learning about his soils has helped Mid North farmer Pete Kitschke improve his productivity.

Pete farms 2,100ha near Jamestown with his wife Mel and parents Peter and Mary. Pete and Mel's children Jordan, Tom, Maddi and Jack are also actively involved.

The homestead is in 550mm rainfall country near the Bundaleer Forest in the south and the property runs up to 400mm country near Hornsdale in the north. Soils vary from heavy clay to sandy loam, with red brown clay loam (red chromosol) the main soil type.

Historically, rotations on the property were typically wheat, barley, an occasional crop of peas and sometimes a pasture, but cropping is more intensive now, with a flexible rotation of canola, wheat, barley, peas and lentils depending on paddock conditions, weed burden and other factors.

The family also run limited numbers of sheep, mainly on non-arable ground.

Pete has been using no-till since 1997 and in that period has increased his row spacing from 225mm to 250mm and now to 300mm.

His seeding rig, which has just completed its third season, is a 17m John Deere 1870



JAMESTOWN GROWER PETE KITSCHKE.



SEEING IS BELIEVING. THIS 'SOIL PIT', DUG WITH A BACK HOE, REVEALED A COMPACTED DISPERSIVE HARD PAN THAT PREVENTED CROP ROOTS REACHING MOISTURE AND NUTRIENTS DEEPER IN THE SOIL.

Conserva Pak set up for granular and liquid fertiliser application, with a Bourgault airseeder cart supplying seed, granular fertiliser and specific liquid soil treatments.

The Conserva Pak is set up to deep band granular fertiliser at 100mm, with an offset sowing tine, aligned with a liquid delivery line, depositing seed at 25mm.

This new machinery represents a considerable investment but Pete is happy with the results achieved so far and is looking forward to more improvements in the future.

"Our oldest son Jordan is doing agriculture at Adelaide Uni. He is right into soil science and I'm sure it's due to his exposure to soil work we have done on our farm.

"Our soils are the absolute coal face of the operation. If you've got healthy soils you've got a healthy operation. It's pretty much that simple. The soil is where everything comes from so that's where it all starts. You've got to get that right to start with before you do anything else."

Pete has thought about a disc seeder but is yet to be convinced about the effectiveness of a disc on his heavy, highly dispersive clay soils. At this stage he has not tried to match machinery widths because he doesn't see compaction from wheel tracking as a major problem.

"If the soil is healthy and has good structure it tends to repair itself very quickly. Of course we take basic steps like keeping off paddocks when they are extremely wet.

"The dispersive layer in our soils, often referred to as the plough pan, is formed naturally and is exacerbated by tillage, not just the weight of traffic driving over it. I'm not saying that this country doesn't suffer from compaction but it's nowhere near as bad as, say, northern NSW."

### Seeking balance

About six years ago Pete was questioning whether the way his family had been farming for decades was actually the way to get the best productivity from the farm.



WHAT IS GOING ON DOWN THERE? THE SOIL PITS ON THE KITSCHKE PROPERTY HAVE ATTRACTED A LOT OF INTEREST (LEFT). MICHAEL EYRES (RIGHT) TAKES A MORE RETAILED LOOK AT WHAT IS HAPPENING DOWN THE SOIL PROFILE.

“Throughout our history we have been very nitrogen and phosphorus focused but I think plants are like people. We can live on beer and chocolate but it doesn’t make us healthy! We need a balanced diet to be healthy. We had been continuously cropping and feeding the plants the same things for a long time and I was looking for a more balanced approach.”

He wasn’t sure how that was going to come about until he was introduced to Michael Eyres, a soil advisor who had relocated from WA to work as Research Manager of Injekta Field Systems.

Michael and Ed Scott a fellow soil advisor from Injekta, a company helping farmers to better understand their soils, began to examine the soils on Pete’s farm and ran some trials using a liquid injection system to try to improve productivity.

Initially he was thinking in terms of substituting liquid for granular fertiliser and the costs looked scary, Pete said, and it took a while for him to realise that what Michael was trying to get him to understand was that any liquid system is designed to complement a granular fertiliser program.

Most good farmers know when to use qualified advisors and Pete is no exception. He had been employing Elders agronomist Darren Pech, someone he describes as ‘one of the best agronomists going around’ to manage crop health and weed issues and Michael was added to the team.

“We all did a lot of learning in those early

days and dug a lot of holes!”, Pete said. As many as 15 deep pits have been dug with a backhoe in different soil types on the property and many samples from different depths have been sent to a laboratory for analysis.

“Some pits were dug in crops to find out where the roots were growing. The first holes showed us that the roots were going down then moving sideways as they hit the dispersive layer.”

Michael Eyres says one of the problems with Pete’s soil was the high potassium value in the soil solution when it was wet, which limited nutrient uptake and reduced the length of the growing season

by limiting the amount of moisture crop plants could access at depth.

“The first thing we picked up was the surface sealing in his soils; the compaction if you like. They were topsoil rather than subsoil constraints so they were easier to work with but we needed the liquid delivery systems to be able to deal with the chemical deficiencies and soil inefficiencies.”

Before they initiated a treatment regime there was only limited root growth through the compacted clay dispersion layer, so in a dry spring crops would hay off early, even though there was moisture below the compacted layer.



THIS BARLEY CROP ON PETE KITSCHKE’S PROPERTY YIELDED 5T/HA.

“The trouble with this dispersive layer is that it meant we tended to farm only the top few inches of soil. When it rained the surface wet up really quickly and the water couldn't get through very fast. That meant wet country with poor trafficability. Then, of course, the sun comes out and a lot of that water is trapped in the top few inches so it starts to evaporate and you lose it.”

Leaf tissue tests were also conducted to work out trends in nutrition. That was particularly useful in canola.

“We found that at the break of the season there were good levels of soil nitrogen but once we got to colder weather in July there was a big dip in nitrogen availability. That's why crops were going yellow and really suffering. Traditionally we would apply urea but as the soil warms in spring and mineralisation increases you get a sudden increase in nitrogen anyway, so you go from one extreme to the other. Now we make sure that we get enough nitrogen on early to fill that dip out.”

## Liquid injection

It was decided to use liquid injection to break down the dispersive layer under the root zone and Michael recommended the use of Infiltrax™ containing flocculating agents, emulsifiers, soil stabilisers and electrolytes to aid in the aggregation and stabilisation of soil aggregates.

“Using soil conditioners in furrow to keep the clay flocculated and open means you are always water harvesting in the Kitchke's dryland environment,” Michael said. “Most of the moisture that will keep the crops alive at the end of a season comes from depth. We need more soil to

take more moisture in and that's how we get more soil use efficiency.

“One thing we have learnt is that, when using liquids, the amount of granular fertiliser can be adjusted up or down with more confidence. You know you can, for example, extend your spring value by using more subsoil moisture, so you can apply more fertiliser knowing you will get benefit from it.”

Another benefit of liquid injection is that liquids can be used to adjust in-furrow pH and electro conductivity so you get a better response from the granular fertiliser applied; an approach Pete has used on his more calcareous ground to control the bicarbonate effect in the furrow when the soil is wet.

Trace elements identified by tissue tests as being of use, or added to enhance uptake of other compounds, can also be added by liquid injection, and Pete has used zinc, sulphur, copper, manganese, molybdenum and boron to boost crop performance.

The boron is used in canola crops to ensure good seed initiation.

Fungicides such as Impact in Furrow for canola and barley are also easily applied by liquid injection and legume seed no longer has to be inoculated prior to sowing because small amounts of freeze dried inoculant is injected into the soil near the seed.

“It gives us huge flexibility to be able to put all these things in the furrow and I couldn't do that with a granular system,” Pete said. “As long as it is physically compatible in the tank we can put it in.”

When he started out with liquids Pete wanted to keep things simple and costs down so he built his own system with a single delivery system fed from a single tank mounted on the A-frame of his old seeder. That cost him about \$20,000 for tanks, pumps and distribution hoses; plus his time and labour.

“The more tanks and separate systems you run the more complex it gets. You have to have multiple storage tanks and multiple tanks on the nurse truck bringing the products out to the paddock. Because we are not over-endowed with staff we just try to keep it as simple as possible and at the end of the day you don't want it holding you up and delaying seeding.”

**“If the soil is healthy and has good structure it tends to repair itself very quickly.”**

The materials Pete uses are relatively non-hazardous to handle. Initially he used some blended UAN but the price of granular urea has come down and he has now replaced the UAN with urea.

“Once we could see that we wanted to continue on with liquids I was prepared to spend a few more dollars. On the new Bourgault seed box we have gone to a tank that is integrated into the hopper, which is a much more professional outfit.”

The manifold and distribution system he is using is from Liquid Systems in South Australia, a company Michael Eyres says manufactures the best systems available.

## Cost:benefit

It's important to realise that to deliver the base load of nitrogen and phosphorus fertiliser you will never compete dollar for dollar, liquid versus granular, Pete said. It always needs to be a combination of liquid and granular.

“The actual cost of the liquids we use is around \$25/ha, which is a small outlay if you can get better use of the granular fertiliser you are putting down and better crop health.

“When you put liquids in the row you are really affecting just the row beneath the plant in that cropping year. You're not trying to change the whole paddock; that's too expensive.

“If you spread gypsum and lime, for



THE CONSERVA PAK IS SET UP TO DEEP BAND GRANULAR FERTILISER AT 100MM, WITH AN OFFSET SOWING TINE, ALIGNED WITH A LIQUID DELIVERY LINE, DEPOSITING SEED AT 25MM.



THIS CANOLA, INTER-ROW SOWN INTO STANDING CEREAL STUBBLE, IS OFF TO A GREAT START.

example, you are trying to change the whole paddock and it's less cost effective. It's better to drip feed in dryland cropping systems and incorporate longer-term lime and gypsum spreading programs to complement the whole system."

Michael Eyres tries to structure farm programs to get responses to every dollar farmers spend in the year they spend it. "There is an exponential increase over time but it's about cash flow in precision agriculture. You have to get a response. However, it might take two or three years to work out how a soil operates because of the differences in seasonal conditions."

## Results

After six years using a combination of liquid and granular fertilisers Pete says they "now know well enough what does and doesn't work. Generally, I can see obvious improvement over the whole system. I feel we are getting a lot better use of granular fertiliser because of the trace elements and soil conditioners we are putting into the furrow at planting and have seen a general increase in yield across the board.

"We are growing better crops on less rain because we are using more of our soil, and in years with dry springs our crops are hanging on and doing better.

"Six years is not a long time in terms of a soil perspective, it's only a split second, but we are definitely heading in the right direction. Last year we had a fairly wet

winter but very little spring rain and we probably had close to our best year ever. Without these changes we wouldn't have gone anywhere near that. It's all about soil use efficiency."

Pete and Michael do not use a moisture probe but always dig soil pits in spring and are now seeing water penetrating much further down the profile than it used to; something Pete has observed on a block he bought recently after leasing it for some years.

"When we started farming this property - in lower rainfall country south of Hornsdale - it had this really dispersive, high potassium clay layer, but last spring we had water right down at depth. It's got two metres of soil but it just had this dispersive layer locking up its potential."

"The soil is definitely improving," Michael Eyres says. "The key indicator is what he can grow in a lesser season. Pete knows he can grow more than he could historically.

"What you have to look at is yield and quality and obviously your profitability per hectare. We can put 350kg of urea out and get a 5t/ha crop of barley and have no margin or we can engineer a response from the soil and understand the whole system far differently. That way we might get the same yield but maybe 2.5 times the margin. To get that gross margin you need yield and quality but you also need to manage the cost."

## Weeds

Weeds such as ryegrass seem to be less of an issue for Pete now than they were in the past; something he attributes in part to less disturbance in the inter-row because of the wider row spacing he is now using. "We are also very fortunate to work with Darren Pech, who has helped us manage chemical resistance by using techniques such as crop topping our legumes and rotating chemical groups."

Michael thinks that another contributing factor has been the improvement in surface soil condition making it more hospitable for crops and less so for certain weed species.

Pete is 'pretty happy' with the way things are going and will continue to fine tune the system into the future. "I guess we are still learning!"

At this stage he is not considering adding an additional tank and line to the liquid delivery system but does not rule that out to avoid compatibility issues if he decides to include liquid phosphorus in the program. "A small amount of extra P in liquid form distributed evenly along the furrow at sowing makes a big difference to canola in higher pH soils. This is where granular and liquid P can complement each other well."

A second line might also give him the ability to deliver soil-conditioning agents at a greater depth in the soil.

"A lot of blokes want to know whether, if they go to liquids, they'll see big yield increases straight away. It doesn't matter what you do in this game, it takes time.

"When we went to no-till it felt like we went backwards before we went forwards. We didn't lose ground when we started using liquids but I think it took a while for the system to start to tick."

Pete suggests that anyone interested in liquid injection try it in a small way to see how it goes, and advocates that be done with the support of advisors like Injekta Field Systems, whose fees he considers quite modest, 'unless you are soil scientist yourself'.

Michael advises interested farmers to choose a site that is not performing, dig a hole to expose the soil profile and get knowledgeable people to determine the potential of the different soil horizons. "Get accurate laboratory soil testing done so you have one site as your template. Learn to understand it then move from there to other parts of the farm." 