

In brief

- 1200-1400 hectares of wheat beans and canola
- 7km west of Bordertown towards Cannawigara
- Average rainfall 475mm
- From loam over stone through to sand over clay, with a pH acid ranging to slightly alkaline
- Minimum or no-till farming system and direct drill, but conventional when renovating lucerne paddocks

Farmer profile > Michael and Roger Hunt

The desire to better manage trace elements in their crops motivated brothers Michael and Roger Hunt to make the switch to fluid fertilisers three years ago.

'In 2002 we had a dry year and our best wheat crops were the ones where we applied three doses of trace elements. We couldn't work out why but then we concluded that the crop was taking moisture from deep in the soil and not from the trace elements in the top 10cm,' Michael said.

This led the Hunt brothers to consider getting trace elements down into the 'moisture zone'. They approached the use of fluid fertilisers as an experiment and, trying to keep costs down, set up their own machine and equipment.

At first they found it difficult to find the information they required to get started. Attending a field day, they met Peter Burgess from Liquid Systems who provided them with technical information, advice and equipment.

'We use a modified Napier Scarifier and an old 2200L Shearer Computer Spray,' Michael said. 'We started with the computer spray pump but due to the corrosive nature of the fluids we had to change to a triple diaphragm pump.'

The brothers recommend spending the extra time with the plumbing to 'get it right' as the corrosive product can damage paint work and machinery if there are leaks.

Due to the stony conditions of their farm, they also needed to modify the equipment to protect the fluid delivery nozzle and hose. The sowing boots are spaced away from the tyne and the delivery tubes are positioned between the tyne and boot.

In the first year, Michael and Roger spent \$5500 to set up their system, which included the purchase of distribution manifolds and orifice plates from Liquid Systems. In the second season, they invested \$7000 in storage and cartage tanks.

The simple and cost-effective system has worked very well for the two farmers and the nozzles can accurately deliver 100L/ha for a range of sowing speeds from 6.5–11.5 km/hr, which equates to 2psi/km/hr. ► [p.2](#)



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From the editor **Jim Kelly**



There has been a lot of activity since the last edition of the Fluid News with farmers across the state commencing seeding. Generally, fair falls of rain have been received over the agricultural districts, however some farmers are now waiting for rain to finish seeding.

I would like to take this opportunity to recognise not only Bob Holloway's work with fluid fertiliser research, but the years of service he has provided to the Minnipa Agricultural Centre (MAC) and the farmers of Eyre Peninsula. There has been a lot of recognition of Bob's research internationally and it would be remiss of me not to pay tribute to his valuable contribution to low rainfall agricultural systems. Bob has been a pleasure to work with and a valuable resource when looking for articles for the Fluid News. Although Bob will finish at the MAC in July, his knowledge and experience will not be lost as he will be working in an affiliate role with the University of Adelaide.

On behalf of the Fluid News readers and myself, I wish Bob and Chrissie all the best in the future and hope they enjoy their time in Mintaro.

Contact Jim Kelly:
jkelly@arris.com.au
(08) 8303 6709 for feedback.

Farmer profile > Michael and Roger Hunt

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In the first year, Michael and Roger also conducted a series of trials to assess the efficacy of the fluids against granular fertiliser.

'We compared granular, our normal practice, to liquid and trace elements and there was a 6% yield increase. However, on a gross margin analysis there was no difference because the 6% covered the increased cost of the liquid fertilisers,' Michael said.

They have also experimented with different products.

'In the first year, we used APP (ammonium poly phosphate) products, but when we tried trace elements with those products we had problems with compatibility. We ended up going to the acid-base products because they handle trace elements beautifully,' Michael said.

Currently, they are applying 50L/ha of a 9:14 product supplied by Fertisol. Growing 4.2 t/ha wheat crops, there was the concern they were only applying approximately 50% of the crop's phosphate (P) removal with fluid product, so they have been supplementing the P budget with broadcasted single super. Last year, tissue tests showed that P levels where they have used just the liquid (without the top-up for two years) were in the adequate range.

To supplement the nitrogen (N) budget, in the first year they used urea but more recently they have been using urea ammonium nitrate (UAN). In comparative trials, they found the UAN to produce similar yields as urea. Although the UAN increased more protein, it also increased the level of screenings. The post sowing application of UAN was undertaken when soil conditions were good for root uptake and it was applied at 40-50L/ha total UAN and water.

The brothers are pleased to report they have not had major problems with supply of product.

'The first year was all shuttles and very expensive,' Michael said. 'Since then, we've operated in bulk from Fertisol. It's fantastic, you ring up and within a week it's there.'

Pricing has been a problem with the early adoption of fluid fertilisers. In the first year it was \$1.40/L and this year Michael and Roger expect to buy it at 75-80c/L. They said they would like to see the downward trend continue and the gap between fluid product and granular product close.

'This season (2006), acid-based clear product was not available and we used a product which is a suspension mix. We have experienced no end of grief when trying to mix trace elements with it and it has to be watered down to flow easily. We are told that supply of the clear product next year will not be a problem. We are really looking forward to next year!' Michael said. ▶ p.3

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Michael and Roger have found the benefits of using fluids are largely logistical.

'Our airseeder is now able to sow twice as much between fill-ups, as we can use both hoppers for grain. We've also found that on damp nights we don't have the problem of blockages due to moisture, like we had with DAP,' Michael said.

The Hunts have also been working with other concepts to increase the benefits and efficacy of the use of fluids.

'We've tried mixing Baytan® with the fertiliser. Growing soft wheat we often don't know how much seed to treat as it depends on when the season breaks. By not having the Baytan® on the seed, the crop emerged three days earlier and showed significant early growth,' Michael said.

On the renovation of their lucerne sites, the brothers have been growing wheat on wheat believing there would be adequate residual N fixed by the lucerne to meet the needs of two crops. Sowing Janz wheat in the second year and concerned that rust could be an issue, they added 1L/ha of Turret fungicide.

'We were very pleased with the results. We did end up having to spray for rust but not until four weeks later than the wheat we didn't treat with Turret. And we only had three black tips per 100 grains, whereas our other paddocks nearby were down graded to GP1 for black tipping,' Michael said.

Michael and Roger also trialed a lower rate, ½L/ha, with less pleasing results, as they still had to come in at the same time with rust spray and also had the black tipping problem.

Another benefit identified on the property was where the use of Glean® highlighted a zinc deficiency. The brothers applied copper and zinc with the fluid fertiliser and, after watching it carefully, didn't have to add further zinc. However, where they used only fluid N and P they had to apply trace elements as a post emergence spray.

In the future, they want to look at using insecticides with the fertiliser rather than having to spray the whole paddock post sowing.

The Hunt brothers believe that if farmers want to use trace elements then there are significant benefits with fluid fertiliser technology.

'You don't need a \$25,000 hydraulic adjustable machine to get consistent output,' Michael said. 'Obviously it would be nice, but with a little time calibrating the system it works well.'



What have we learnt? What can we say? What do farmers need to know?

Almost a decade of fertiliser research in cereals has shown that clear liquid multi-nutrient fertilisers banded at sowing offer an improved fertiliser option 90% of the time on grey highly calcareous soils and 60% of the time on red calcareous soils in the low rainfall (<400mm) area of Upper Eyre Peninsula.

Take-home messages for farmers on alkaline calcareous soils:

- Fluid containing P, N and micronutrients has a reliably increased yield. With a fluid containing P at a compatible price to that in granular fertiliser, extra profit can be expected.

Mean yield improvements of about 20% from fluids compared with granular fertilisers were recorded on grey highly calcareous soils at rates of 10kg P/ha, with mean increases of about 13% on red brown calcareous soils.

Often, as higher rates of P were applied, yield differences between the two forms of fertiliser increased. The fertilisers were applied as a band below the seed. In most of the experiments where fluid increased grain yield, P, N and micronutrients were applied together at sowing rather than as separate applications.

- Fluids are more efficient sources of P for cereals on calcareous soil and result in more rapid early growth.

If P demands are met by fluid fertiliser, marginal sources of N and micronutrients may no longer be sufficient to maintain the demands of increased growth and it is often necessary to include them in the fertiliser to meet increased crop requirements.

- The conversion of sowing equipment to fluid-capability is straightforward with modern adaptor kits now readily available on the market.

Recent developments with application technology mean that fluid fertilisers are ideally suited to 'on the go' blending and variable rate application, and farmers are reporting that there are significant logistical benefits.

- As a rule of thumb, fluid P tends to be at least as effective as granular at 50% of the granular rate on these soils.

The price of fluid fertiliser will be the main factor determining choice of product rather than the formulation chosen, provided that all of the essential nutrients are supplied in a compatible form. The form of fertiliser (fluid or granular) that is most profitable depends on the price differential between the different forms and the substitution rate, eg at a 40% substitution rate, 4kg P/ha would be applied as fluid to replace 10kg P/ha as granular.

The amount of P applied as fertiliser should at least replace P lost through exports from the property in grain, wool, meat and other produce.

Suspension fertilisers have attracted attention as a cheap alternative to clear liquids with similar agronomic benefits, but there have been some recent problems with adding micronutrients. Suspensions also have special requirements for storage and regular mixing. The problems with micronutrient additions have been overcome and work with suspensions continues. An example of what can be done with suspensions is the 'mix and go' facility set up by Cronin Bros. of Streaky Bay where large batches of DAP, water, urea and zinc sulphate are mixed and applied under constant agitation within a few hours (see the Stock Journal, 9/3/06).

The Fluid Fertiliser Research Group in CSIRO, SARDI, the University of Adelaide, the Department of Primary Industries in Victoria and Arris are currently preparing a Fluid Fertiliser Manual, which will summarise research and technical information to the present time. The manual should be released in the second half of 2006.



Fluid researchers visit US Great Plains



Australian fluid researchers attending the 2006 Fluid Forum in Scottsdale, Arizona (AZ) extended the fact gathering portion of the trip by an extensive tour of the southern Great Plains. Dr Bob Holloway and Leigh Davis of the Minnipa Agricultural Research Centre and Therese McBeath of the University of Adelaide travelled from Phoenix, AZ to Dallas, Texas (TX) then to Vernon, TX, to Amarillo, TX, then to Lubbock, TX and eventually back to Dallas before heading home.

This portion of their travels took them to the High Plains region and to the Rolling Hills region of Texas. The objective of this portion of their trip was to discuss variety testing procedures used in the Land Grant University system of the area and to discuss wheat production procedures with researchers and growers.

This region of Texas encompasses the north central and north western parts of the state. The Vernon Research and Extension Center of Texas A&M University headed by Dr. Don Robinson, is located in a wheat-cattle area of the state where wheat is an important part of the beef production system. Grazing wheat is standard practice in a huge area of Texas, Oklahoma, Kansas, New Mexico and Colorado, and wheat varieties suitable to both forage and grain production are a focus of variety testing in the region. Cattle on wheat pasture may include both cows and stockers, mainly stockers, which then go to the region's feedlots. Feedlots are a major industry of the High Plains from the Texas Panhandle (Amarillo) north into Kansas and Colorado. This region is also a major producer of feed grains (corn and grain sorghum) under both dryland and irrigated cropping systems.

Nitrogen, phosphorus and sulfur fertilisation are primary nutrient needs of wheat for both forage and grain. Wheat is seeded in September with a good supply of N, P and S for plenty of early growth and grazing. The Fluid Fertilizer Foundation and the fertiliser industry have supported an extensive P fertilisation-wheat grazing program at Vernon which has demonstrated to wheat producers and cattle producers the profitability of supplying more than just N for the crop. Weather permitting, cattle are kept on the wheat until about the first of March and taken off prior to jointing if the producer is planning to harvest a grain crop. After the cattle are removed, the wheat is topdressed with more N to make up for that removed in the beef gains. In many cases, wheat is simply grazed out with no grain harvest. Wheat is frequently leased by growers to cattle producers who supply the cattle and pay on the basis of gain which spreads the risk to both wheat grower and cattle producer. ▶ p.6



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Bloat and wheat tetany are two problems for cattle producers in this system. Adequate P fertilisation has been demonstrated to be a key factor in improved magnesium (Mg) concentrations in the forage. Grass tetany is a condition related to low blood serum Mg which can send the animals into shock and eventual death. Bloat, another common problem, is being addressed from the standpoint of N management in the area in another Fluid Fertilizer Foundation project at Texas A&M Vernon headed by Dr John Sij. Excessive N rates apparently contribute to the problem and timing of N applications is an important management factor.

From Amarillo to Lubbock is considered the southern portion of the High Plains, an area of wheat, corn, sorghum and cotton production. Actually, the Texas southern High Plains has the largest acreage of cotton production in the US with both dryland and irrigated production. The past two years (2004 and 2005) have seen the largest crops of cotton and the highest yields ever in the region. However, irrigation water taken from the vast Ogallala aquifer is becoming seriously depleted in this area, and areas formerly irrigated are reverting to dryland.

Texas A&M University and Texas Tech University both have strong research programs in this area. The Australian researchers visited with Dr Kevin Bronson and his colleagues at the Texas A&M Research and Extension Center at Lubbock regarding crop production and variety/hybrid testing procedures that are being studied and utilised.

Dryland feed grain production in the region is turning heavily to reduced or no-till systems ideally suited to the use of fluid fertilisers. New crop genetics are turning out varieties and hybrids which have better drought tolerance. Better production practices with better moisture conservation features, new genetics and proper fertilisation provide growers with much improved yields and profit potential. But, if it doesn't rain, and for the past six years much of the area has been in a serious moisture deficit, even the best practices have limited effects!

Fortunately or unfortunately, depending on one's point of view, the trip was a huge success with the fearless travellers covering some 1,300km at the tail end of winter. There was hoping to see snow for the first time but that was not to be, which probably wasn't all bad with Leigh negotiating a vehicle at 110+ km/hour on the wrong side of the road!

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2006 Fluid Forum

*Dr Bob Holloway
Principal Research Scientist, MAC*

The 2006 Fluid Forum was held 12–14 February at the Scottsdale Plaza Resort in Scottsdale, Arizona, US. Three of us attended the Forum: Leigh Davis, who operates the variety testing program for cereals on Upper Eyre Peninsula, based at SARDI's Minnipa Agricultural Centre; Therese McBeath, a final-year PhD student with Prof Mike McLaughlin's group at the University of Adelaide-CSIRO; and myself, Bob Holloway. Therese and I were invited speakers at the Forum.

The Forum was the best I have attended, with an excellent list of speakers and topics. Sunday evening was a time for networking and we met and spoke to Drs Martin Kucke and Viola Richter from the Institute of Crop and Grassland Science, part of the Federal Agricultural Research Centre at Braunschweig in Germany. Dr Kucke has been following our work in deep placement of fluid nutrients and had planned to attend the Fluid Forum to meet with us and discuss our work. He also gave a presentation of his own work in Germany as part of the Forum.

Also present from Australia were Wayne Crofts, Marketing Manager for CSBP limited in WA, and Matthew Evans, Fluid Fertiliser Development Manager. They brought us up-to-date on the current fluid fertiliser situation in WA, which is vastly different to SA.

In WA, CSBP took an active role in developing and marketing fluid fertilisers. CSBP were able to make the fluid nitrogen fertiliser urea ammonium nitrate (UAN) at a very competitive price and became involved in on-farm storage and transport to the farm, so that the expansion of the UAN market in WA has been meteoric.

The major reason for adoption of fluid fertiliser in WA is the range of logistical advantages rather than any yield improvements. The WA industry is now turning to fluid NP fertilisers, which are also readily available at a competitive price.

In SA, the main purpose for the continuing research program with NP fluids is greatly improved fertiliser effectiveness and increased yields on calcareous soils.

Even though the major initial research work with fluids was done in SA, the adoption of fluids has been slow. The pioneering soil chemistry work done by Prof Mike McLaughlin's CSIRO group, which has provided conclusive soil chemistry evidence for the greater efficiency and effectiveness of fluid fertilisers on calcareous and other soils, has been recognised worldwide. It is possible that the major adoption of fluid fertilisers in SA may eventually come via WA or Victoria. A small SA company, Fertisol, has battled to establish itself in the SA market but requires major infrastructure inputs to gain economies of scale.

On the international scale, Al Mulhall, Director of Market Research for Potash Corp, stated that the world's food production would have to increase by 50% in the next 20 years to feed a 33% higher population. We have been hearing predictions like this for many decades but, in the last 20 years, wheat prices in Australia have remained static while virtually every other farm input cost has increased.

Mulhall also pointed out that arable land available per person has fallen from 0.5ha in 1950 to an estimated 0.2ha in 2010 and is continuing to decline because of urbanisation, population growth, development of [p.8](#)



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infrastructure and industry and land degradation. Also, the world grain stocks to grain use ratio is the lowest it has been for 30 years. Grain stocks have fallen rapidly over the past 10 years while the rate of grain consumption has continued to increase. Mulhall forecasts an increasing gap between China's grain consumption and production, with consumption growing at a faster rate than production. Consequently, the demand for grain is expected to increase strongly over the next 15 years.

In a presentation on the future needs for agronomic research in the world, former Potash and Phosphate Institute Director David Dibb referred to the claim of some critics of the 'green revolution' and how it did not work' in Africa. Dibb's comment on this was that 'the green revolution never arrived in Africa ... lack of availability of improved varieties, lack of access to nutrient inputs, lack of infrastructure, corrupt governments, and lack of political will are simply examples of what can result from the lack of already available technology rather than the result of technology'.

Dibb also suggested that, throughout the world, a lack of adequate nutrients for plants is a much bigger environmental problem than excessive nutrients. He believes that our focus should now be on using nutrients more effectively and efficiently.

He also suggested that we must continually evaluate and advance the genetic yield potential of crops and pointed out that potential yields have not continued to advance in the past 25 years, making above-average yields more difficult to realise. He also noted that USA energy bills call for a doubling of ethanol use by 2012.

Finally, a quotation from Max Planck, a world-renowned physicist, is still pertinent today in the field of adoption of agricultural innovations:

An important scientific innovation rarely makes its way by gradually winning over and converting its opponents: What does happen is its opponents gradually die out and the growing generation is familiarized with the (new) idea from the beginning.

The Fluid Forum is held each year in February at Scottsdale, near Phoenix, Arizona, which provides an ideal climate and venue at that time of year. The Forum is highly recommended to scientists, industry personnel and farmers wishing to develop contacts with research and industry contacts and learn about fluid fertiliser research throughout the US, Canada, Europe and Australia.



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