“Fluid Fertilisers - After six years, where the heck are we? Where are we going?”

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We now have more than 100 comparisons of a range of fluid and granular fertilisers conducted by our group on Central and Upper Eyre Peninsula over the past six years. With all this data, can we now say whether fluids have a place in our South Australian Farming systems, or even in other States? The first step is to look at what we have from Eyre Peninsula, and then see what is now happening in other areas.

Results from EP are restricted to grain yields from replicated wheat trials and all comparisons are from trials where the rates of nutrients have been balanced to ensure valid results. Increases or decreases in yields are based on statistical significance. If there is no significant difference, the yields are considered to be the same. In some cases, more than one comparison was made in the same trial, e.g. between two different products.

To begin with “all fluids ain’t fluids”. The different kinds of fluids available often perform differently in different soils, even in different areas of the same paddock. We compared

- ammonium polyphosphates (APPs) (often mixed with urea ammonium nitrate UAN),
- phosphoric acid-based products (usually with urea and micronutrients),
- technical grade MAP or DAP dissolved in water (often with micronutrients and extra nitrogen), and
- suspension fertilisers - mixtures of fine granular fertiliser with water, clay, and micronutrients.

These were compared with granular fertilisers like TSP, TSPMn5, MAP, DAP, 13:15Mn6, 17:19Zn2.5, Urea, UreaZn5. We preferred to use the fertilisers containing micronutrients if possible. Generally, comparisons were made at rates of between 5 and 15 kg P/ha and 5 and 25 kg N/ha, according to the rainfall.

Trials were conducted on three soil types: Grey highly calcareous sandy loams with 15-70% calcium carbonate content; Red-brown calcareous sandy loams with 5-15% calcium carbonate and; Red-brown loamy sands with 1-5% carbonate and low nitrogen fertility. The results are shown with the number of comparisons on each soil type and are summarised below.

Grey highly calcareous sandy loams

APP – 21 comparisons with granular. 19 of these had a mean yield increase of 15%. In 2 comparisons there were no yield differences – no micronutrients were added in one of these and in the other, manganese precipitated out.

Phosphoric acid products – 11 comparisons in all with a mean yield increase due to fluid of 23% in 8 of these. There were no yield differences in 3.

Technical grade MAP/DAP - 11 comparisons with a mean yield increase of 20% with fluids. Micronutrients were mainly applied in the NP solution at sowing.

Suspensions – 7 comparisons with a mean yield increase of 19.6% with fluid. Micronutrients were applied in the suspension at sowing.

Overall, there were 50 comparisons, 45 showing a positive yield increase with fluid and 5 with no yield difference.

Red-brown calcareous sandy loams

APP – 10 comparisons. 7 of these had a mean yield increase of 14.3%. In 3 comparisons there were no yield differences. One of these was due to a low water rate – when the water rate was doubled, yield increased.

Phosphoric acid products – 16 comparisons. 9 had a mean yield increase of 11%. All of the 9 had micronutrients applied in solution with the phosphoric acid and urea. There were 7 comparisons with no yield differences. In these, either no micronutrients were applied, or they were applied pre-sowing to the soil surface or foliar, *i.e.* at a different time to the P solution.

Technical grade MAP/DAP - 9 comparisons. 3 had a mean yield increase of 15%, and in these micronutrients were applied in the solution at sowing. In 6 cases there were no yield differences. In these, micronutrients were applied pre-sowing to the soil surface or foliar.

Suspensions – 5 comparisons. 4 had a mean yield increase with fluids of 12.5%. In the 5th comparison there was no yield difference.

Overall, there were 40 comparisons, 23 with positive increases with fluids, 17 with no yield differences.

Red-brown loamy sand (low carbonate, low fertility)

APP- 6 comparisons. Two of these had a mean yield **decrease** with fluids of 10%. In 4 there were no yield differences.

Phosphoric acid products – 1 comparison had a yield **decrease** of 7% with fluid.

Technical grade MAP/DAP- 2 comparisons, no yield differences.

Suspensions – 2 comparisons. 1 yield **decrease** with fluids of 12%, 1 no yield difference.

Overall, there were 11 comparisons, with 4 yield decreases due to fluids and 7 with no yield differences.

There were 101 comparisons in all, with 68 yield increases due to fluids, 3 yield decreases (all on one soil) and 30 with no differences. In some of the "no difference" comparisons, there were early dry matter increases due to fluids but these had disappeared by harvest. For instance, on the red-brown sandy loam soil in 2003, a fluid mixture of APP with UAN and ammonium thiosulfate produced 31% more dry matter at mid tillering than MAP with UAN, but there were no grain yield differences.

Other soils

In 2003, a pot experiment was conducted at DPI Horsham to assess the early growth response of wheat to APP, phosphoric acid and granular triple superphosphate (TSP). There were growth increases with both APP and phosphoric acid compared with TSP on 5 acid soils from SA and Vic, 4 soils from the Northern Mallee (Vic), 3 soils from the Birchip area and 7 heavy clay soils from the Wimmera. In 2003, field trials were conducted at Kalkee near Horsham, at Walpeup in the northern Mallee and at Birchip (Fig. 1). DAP (18:20) was also included in these trials. There were improvements in early shoot production with a phosphoric acid solution at Kalkee and with both phosphoric acid and APP at Birchip, but not at Walpeup. Grain yields were higher at Birchip with the fluid fertilisers at rates up to 12 kg P/ha.

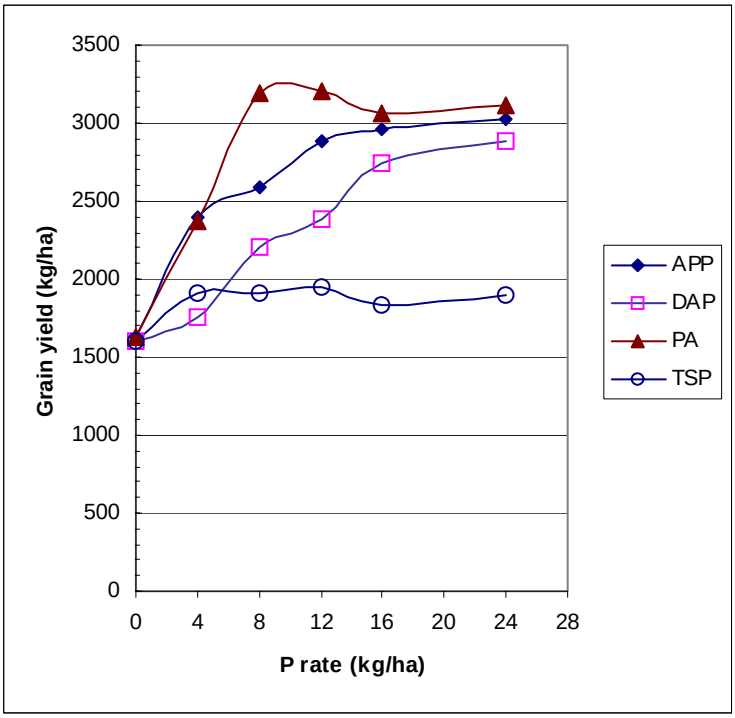

Fig. 1 Effect of P fertiliser form and rate on the grain yield of wheat at Birchip 2003. l.s.d. (5%) Fertiliser form x rate = 210.2.

Trials conducted by Dr Nigel Wilhelm in 2002 showed positive responses to fluid fertiliser (Tech grade MAP cf MAP) at Warooka and at Orroroo, with no response at Minlaton.

Other points

- In a long-term residual P trial at Warramboo (grey highly calcareous soil), wheat yields in 2003, the year after application of APP (and N plus micronutrients) or 13:15 Mn 6/ Urea Zn5% were higher after the APP. This is the first indication of higher residual value of P from a fluid fertiliser.
- On a red-brown sandy soil low in N, fluid UAN was less available to plants than granular urea, particularly with wet soil at sowing. The use of ammonium thiosulphate (ATS) with UAN may reduce ammonia volatilisation and reduce nitrate leaching. There is some evidence of improved UAN performance with ATS in our trials this year.
- Suspension or "liquid granular"(copyright J Lamb) fertilisers can be made in SA. They could be manufactured at competitive prices given a sufficient market. They are more difficult to handle and store than clear liquids. In 14 comparisons with MAP/DAP-based products, they increased grain yields in 12. There was one instance of no difference in yield and one of a yield reduction. This occurred on the red-brown loamy sand soil and it is likely due to poor utilisation of N in fluid form.
- According to "a reliable source" prices of fluid P in WA this year may be close to equivalent to granular.

Conclusions

- Fluid fertilisers are likely to give positive yield increases compared with granular on highly calcareous grey soils in low rainfall areas.
- Non- or low-calcareous sandy soils may have problems with loss of N from fluid UAN. More research is needed in the use of ATS to help prevent this.
- Best results with phosphoric acid solutions came from applying N (as urea) and micronutrients in the same solution at sowing.
- When there is a likelihood of deficiency of more than one nutrient they are best applied together in a single solution if possible. If not, they should be applied at the same time to the same soil via a separate system, e.g. zinc and manganese solution and APP will precipitate but they work well if applied in separate systems.
- Suspension fertilisers are likely to be a cost effective way of using fluid technology in SA.