Liquid fertiliser evaluation trial

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RESEARCH

Searching for Answers

Location: Tuckey
Jason & Julie Burton
Rainfall
Av. Annual: 330 mm
Av. GSR: 235 mm
2012 Total: 169 mm
2012 GSR: 289 mm
Yield
Potential: 1.95 t/ha (W)
Actual: 0.63 t/ha
Paddock History
2011: Angel medic pasture
2010: Stiletto wheat
2009: Wheat
Soil Type
Grey brown loam
Soil Test
C_{DGT} 36: Predicted Response (DGT) 81%
Plot Size
50 m x 2 m x 3 reps
Yield Limiting Factors
Early finish
Social/Practice
Time (hrs): uses less labour
Clash with other farming operations: more timely sowing operations
Labour requirements: Savings in terms of logistics and associated labour costs

Key messages

- **Liquid N gave the most significant response of all liquid treatments in terms of mid-season biomass production and final yield.**
- **A full liquid system including N, P, trace elements and fungicides provided the greatest yield response, significantly better than district practice granular treatments.**
- **Full liquid and liquid N treatments provided similar returns to that of traditional treatments, and greater returns than liquid P only treatments.**

Why do the trial?

The necessity to evaluate a decision to convert a grower's system to full liquid technology in 2011 prompted the establishment of split paddock trials in that season, resulting in a $100/ha gross margin benefit in the Liquid system over the traditional granule MAP + urea system on a farm at Tuckey. This gross margin increase prompted investigation into what components of this liquid system were responsible for such a benefit, thus the establishment of this trial site in 2012.

How was it done?

The trial was established on a uniform grey brown loam top soil over soft limestone subsoil, with a Colwell P of 36 mg/kg (sufficient) and nitrate N of 36 mg/kg (sufficient) (Figure 1), and chemical fallowed over summer. Sown with certified Mace wheat on 28 May, the replicated trials consisted of a number of liquid, granular, and liquid/granule combination treatments of nitrogen (N), phosphorous (P), trace elements (TE) and in furrow fungicide (fung) designed to establish which component has the greater effect on final yields. The treatments are summarised in Table 1.

What happened?

Visual differences in treatments were observed from crop emergence through to grain fill, with treatments containing liquid nitrogen, as well as the complete liquid treatment establishing quicker, with increased early vigour and maintaining a growth stage and biomass advantage. Emergence counts were variable, however it was noted that most complete liquid and liquid N treatments had greater emergence than the control (nil fert), while all complete granule and granule N treatments had a lower emergence than the control. It was also observed that higher P rates, regardless of P form, increased crop emergence.

Tissue analysis showed that treatments with liquid trace elements had healthier plants and liquid treatments had more favourable levels of N and P, although this was not validated. Tiller counts showed that higher rates of P (12 units) in the granule form supported increased tillering, but this did not translate into a significant yield benefit. Similarly, liquid flutriafol showed a tillering advantage over granule, but no yield benefit in 2012.

Nutrient (Depth 0.00 - 10.00)	Result	Low	Marginal	Sufficient	High	Excess	Sufficiency Range
pH (1:5 CaCl2)	7.6						4.7 - 7.7
pH (1:5 H2O)	8.3						5.5 - 8.5
EC (1:5 H2O) dS/m	0.21						0.00 - 0.80
EC (se) (dS/m)	1.7						0.0 - 6.0
EC (se) (dS/m) (Cladj)	0.9						0.0 - 6.0
Chloride (1:5 H2O) mg/kg	21						0 - 250
Electrochemical Stability Index	0.277						0.050 - 10.000
Organic carbon (Walkley Black) %	1.43						1.00 - 2.00
Nitrate nitrogen (KCl) mg/kg	36						25 - 50
Ammonium nitrogen (KCl) mg/kg	4						0 - 5
Phosphorus (Colwell) mg/kg	36						20 - 100
Phosphorus Buffer Index (PBI)	103.9						15.0 - 280.0
Potassium (Colwell) mg/kg	629						120 - 200
Sulfur (KCl-40) (mg/kg)	12.6						8.0 - 50.0
Exch. Ca (BaCl2/NH4Cl) meq/100g	15.15						10.00 - 100.00
Calcium Carbonate %	4.9						0.0 - 5.0
Exch. Mg (BaCl2/NH4Cl) meq/100g	1.76						5.00 - 200.00
Exch. K (BaCl2/NH4Cl) meq/100g	1.49						0.30 - 10.00
Exch. Na (BaCl2/NH4Cl) meq/100g	0.14						0.00 - 1.00
Aluminium (KCl) meq/100g	0.00						0.00 - 0.50
eCEC meq/100g	18.5						5.0 - 15.0
Exch. magnesium %	9.5						0.0 - 25.0
Exch. sodium %	0.8						0.0 - 6.0
Dispersion Index (Loveday/Pyle)	0						0 - 6
Copper (DTPA) mg/kg	0.4						1.0 - 5.0
Zinc (DTPA) mg/kg	1.3						0.8 - 5.0
Manganese (DTPA) mg/kg	4.0						6.0 - 50.0

Figure 1 Soil test results for Rudall trial site, 2012

Yield data (Table 1) shows the full liquid treatment (treatment 8) yielded significantly more than the district practice of granule MAP + Urea (treatment 1). This is consistent with observations in the 2011 split paddock trial, however the liquid treatment assessed in 2011 (Burton Brew treatment 21), which has less liquid P and N than other liquid treatments, did not have a significant yield advantage over granules this season. Trace elements, or the addition of fungicide, had no impact on final yields, but rather differences were driven by N and P. Despite these trials being planted on medic pasture stubble, liquid N had a far greater impact on yield than P when fertiliser form was analysed as a factor (Figure 2). Treatments containing liquid N yielded significantly more than traditional granule treatments, as well as those containing granule N and liquid P.

Grain test weight was the only quality measure to show any significant difference between treatments, however not enough to affect the grain quality grade, therefore having no impact on gross margin return (data not shown). Improved yields did not translate into higher profits, with no difference in gross margin return between full liquid, liquid N and granule treatments (Figure 2). Liquid P had the poorest return, returning up to $70/ha less than Liquid N or granule treatments and $35/ha less than the higher costing complete liquid treatments.

Table 1 Wheat emergence, tiller count, grain yield (t/ha), test weight (kg/hL) and gross margins ($/ha) in response to fertiliser treatments. *Note all treatments contain 20 units of N and 8 units of P unless specified otherwise in the description. Trace elements (TE) consists of Zn and Mn @480 gms/ha and Cu @ 193 gms/ha as sulphate, except for treatment 13 which is EDTA chelate. Fungicide consists of flutriafol @ 100 gm/ha active ingredient as a liquid, except for treatment 18 which has a coating on granule fertiliser. Furthermore, the Burton Blend contains N-(6liquid+14granule), P-(6liquid+2 granule), Zn Mn 480 gms, Cu 193 gms, and Burton Double N-12liquid, 14granule, P-12liquid+2granule, Zn Mn 1000 gms, Cu 42 gms.*

Treatment	Treatment Description	Emergence (plants/m²)	Tiller Count (/m²)	Grain Yield (t/ha)	Test Wt (kg/hL)	Gross Margin ($/ha)
1	granN granP (T1)	144	172	2.38	84.8	666
2	ganN granP +fung -TE (T2)	146	226	2.37	84.6	660
3	granN granP -fung +TE (T3)	151	234	2.41	84.4	664
4	granN granP +fung +TE (T4)	133	232	2.40	84.8	658
5	liqN liqP -fung -TE (T5)	172	233	2.53	84.9	636
6	liqN liqP +fung -TE (T6)	175	235	2.49	84.8	619
7	liqN liqP -fung +TE (T7)	162	231	2.55	84.7	638
8	liqN liqP +fung +TE (T8)	181	232	2.64	84.6	658
9	liqN granP -fung -TE (T9)	178	245	2.55	85.0	675
10	granN liqP (T10)	134	231	2.38	84.4	593
11	liqN granP -fung +TE (T11)	160	242	2.56	84.6	673
12	ganN liqP -fung +TE (T12)	137	205	2.44	84.5	600
13	liqNliqP +fung +TE (T13)	160	221	2.51	84.9	598
14	granN (20) granP (12) -fung -TE (T14)	154	235	2.42	84.2	668
15	Burton Double (T15)	140	242	2.55	84.4	630
16	liqNliqP (6) +fung +TE (T16)	170	243	2.57	84.5	650
17	granNgranP (12) +fung +TE (T17)	149	258	2.46	84.6	671
18	granNgranP +granfung +H20 +TE (T18)	135	206	2.51	84.4	683
19	nil fert (T19)	160	219	2.43	84.7	728
20	nil fert +fung (T20)	165	228	2.44	84.9	729
21	Burton Brew (T21)	142	*	2.43	84.3	655
LSD (P=0.05)		*23*	*35*	*0.15*	*0.5*	*47*

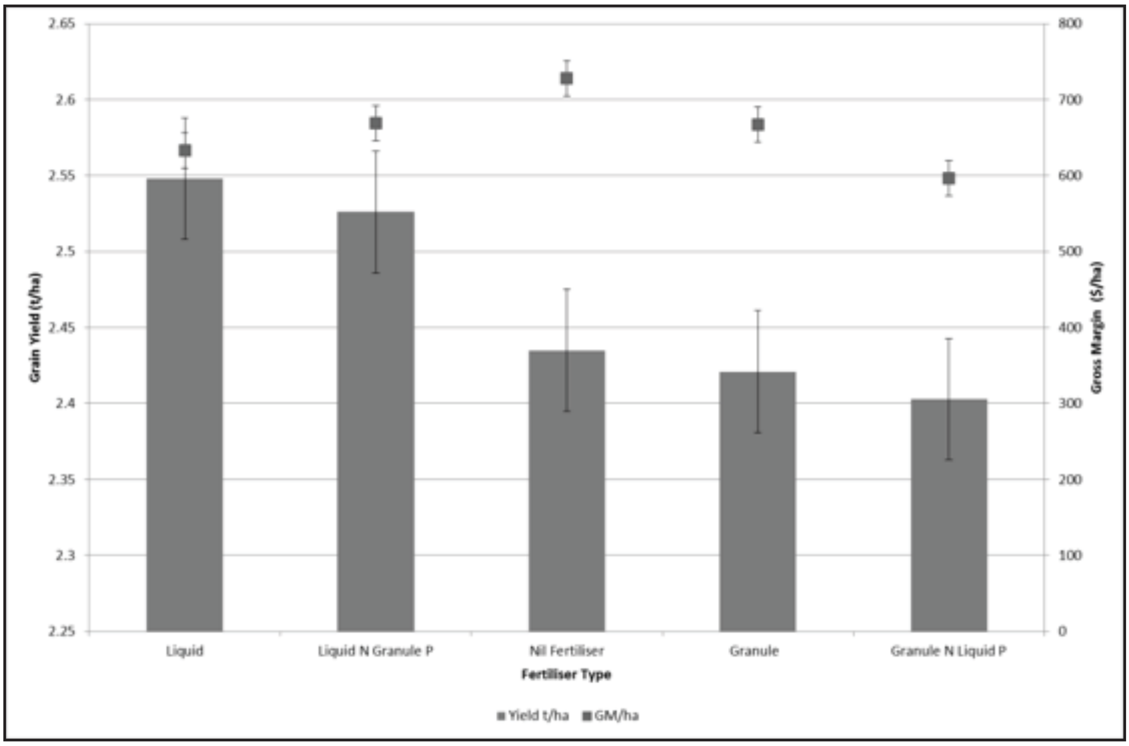

Figure 2 Wheat yield (t/ha) and gross margins ($/ha) of liquid treatments compared to nil fertiliser, granule treatments and granule N + liquid P

What does this mean?

Results from previous split paddock trials near this site suggest potential for large gross margin improvements in a full liquid system over a traditional granule fertiliser system at sowing. This study supports some of these observations, showing improvements in crop establishment and early vigour resulting in significant improvements in yield under a liquid system compared with granules, although there is no increase in profitability in this instance. This is however a significant outcome in a season where water was the limiting factor, not nutritional inputs.

This study also suggests that liquid N has had a greater impact on yields than P on this farm, which has given greater financial returns. Trace elements had no impact on final yield, although they did have an impact on crop establishment and tillering, indicating possible benefits in a more favourable spring. Likewise, the presence of flutriafol, whether as a liquid stream or as a coating on granule fertiliser, had no impact on final yield in a season where no disease pressure was observed.

This study has captured one year of split paddock trials and one year of replicated plot trials, which has encompassed two very different sets of seasonal conditions. While similar results and trends have been observed both years, further research is required to validate the results and learn more about the impacts of liquids under varying seasonal conditions. At this point there appears to be an advantage in liquid technology outside of P response with possible benefits in returns when liquid N is considered in the system.

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