Improving Fertiliser Utilisation in No-till Systems

RESEARCH

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Almost ready

Location: Port Kenny
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Rainfall
Av. Annual: 375 mm
Av. GSR: 305 mm
2009 Total: 393 mm
2009 GSR: 354 mm

Yield
Potential: 4.9 t/ha
Actual: 3.2 t/ha

Paddock History
2008: Wheat
2007: Barley
2006: Wheat

Soil Type
Grey calcareous loam

Plot size
24 m x 1.5 m x 4 reps

Yield Limiting Factors
Nitrogen deficiency

Key message

- **No measured improvement in phosphorus uptake through low seed bed utilisation systems.**

Why do the trial?

The price of fertiliser over the past four seasons is not something which has escaped the attention of the farming industry. Necessity being the mother of invention, the concept of increasing fertiliser uptake within the cropping system is attractive to growers everywhere.

Seed Bed Utilisation (SBU) is the seed and fertiliser spread width within the crop row divided by the row spacing. It refers to the relative spread of the crop row and the width of the inter-row where no crop is sown. In high SBU systems, the seed and fertiliser are spread over a larger area and fertiliser toxicity is unlikely. Lower SBU systems, however, concentrate the seed and fertiliser into distinct rows which are subject to fertiliser toxicity constraints.

Generally as SBU increases, yield increases. A trend towards lower yield will be generally found when SBU is decreased in the absence of other agronomic constraints such as stubble handling, pre-emergence herbicides and sowing speed. As SBU increases, however, concentration of fertiliser granules in the crop row decreases.

As farmers have been reducing fertiliser inputs over the past few years, the risk of fertiliser toxicity has declined, providing an opportunity to use low SBU systems. The trial concept was to use the increased concentration of fertiliser granules in low SBU systems to measure any advantage of fertiliser uptake. Although the crop will uptake much of its nutrient requirements from historical phosphorus application, if the fertiliser concentration within the row is increased, then a greater opportunity for the crop to access the nutrition is possible.

How was it done?

The SBU combinations were accomplished by using three planting options with differing levels of seed spread. Seed spread of 40 mm and 65 mm was achieved using knife points and Agmaster boots. 5 mm seed spread was achieved using Yetter wavy coulters and K-Hart v-paired discs. The three sowing systems were each set on 203 mm, 254 mm and 304 mm row spacing to provide a range of SBU ratings from 3 to 32 %.

Triple super (0:20:0) was used to deliver 5 and 10 kg/ha of phosphorus. Triple super was chosen as the product for the trial to avoid confounding the results with nitrogen rates when fertiliser rates were increased to the 10 kg/ha P level. Wyalkatchem wheat was sown at 50 kg/ha for a target population of 150 plants/m^2.

Comparisons of 5 and 10 kg/ha were made for all seeding systems and row spacing combinations, however 0 kg/P was only compared at 254 mm row spacings.

A grey calcareous soil with high yield potential was chosen at Port Kenny for the trial. The soil test returned a value of 38 mg/kg of Colwell P. The trial was sown into adequate moisture conditions on 19-20 May.

Dry matter assessments were made on 18 August, to see if the SBU and P rates had an impact on early vegetative growth.

What happened?

Of the seeding systems, the K-Hart had the best early vigour and looked promising throughout the season, producing the most early dry matter/ha. The K-Hart system yielded more than the knife point systems, and the 40 mm closer plate system yielded more than the 65 mm closer plate system.

Row spacing had an influence on early dry matter results (Table 1). 304 mm and 254 mm row spacing resulted in more dry matter/ha than the 203 mm treatments (Table 2). Following through to final grain yield, the 254 mm treatments yielded more than the 202 and 304 mm treatments. The 304 mm treatments did not follow the early dry matter through to final grain yield and yielded less than the narrower row spacings.

A comparison between 0, 5 and 10 kg/ha P was only made on 254 mm row spacing. No differences were measured in early crop growth or final grain yield (Table 3).

Table 4 summarises the seeding system and row spacing interactions to final grain yield. No trends related to row spacing and seeding system (SBU) were observed. The 65 mm closer plate seeding system yielded less than most systems when used on 203 or 304 mm row spacing.

Table 1 Seeding system effect on grain yield and dry matter

	Early DM (t/ha)	**Grain Yield (t/ha)**
K-Hart	1.63	3.12
40 mm	1.12	2.99
65 mm	1.18	2.90
LSD (P=0.05)	*0.13*	*0.09*

Table 2 Row spacing impact on grain yield and dry matter

Row Spacing (mm)	**Early DM (t/ha)**	**Grain Yield (t/ha)**
203 mm	1.20 b	2.99 b
254 mm	1.35 a	3.11 a
304 mm	1.39 a	2.89 c
LSD (P=0.05)	*0.09*	*0.06*

Treatments followed by the same letter are not significantly different

Table 3 Seeding systems and P response on grain yield at 254 mm spacing

Sowing System	**Nil P (t/ha)**	**5 kg/ha (t/ha)**	**10 kg/ha P (t/ha)**
40 mm	3.03	2.93	3.15
65 mm	3.02	3.13	3.24
K-Hart	3.10	3.05	3.19

Table 4 Row spacing and seeding system effect on grain yield

Row Spacing (mm)	**Seeding System**	**Grain Yield (t/ha)**
254	65 mm	3.18 a
203	K-Hart	3.13 a
254	K-Hart	3.12 a
304	K-Hart	3.09 a
203	40 mm	3.04 a
254	40 mm	3.03 a
304	40 mm	2.88 b
203	65 mm	2.80 bc
304	65 mm	2.70 c
LSD (P=0.05)		*0.15*

Treatments followed by the same letter are not significantly different

What does this mean?

The yield differences measured between treatments was not due directly to increased P efficiency within the crop row, unlike the original hypothesis suggested. This may be due to various factors, the site did run out of nitrogen later in the season, as the low (9%) grain protein indicates. This may have made nitrogen the limiting factor and the crop was only able to utilise the P until it ran out of nitrogen.

The concept of reducing SBU may simply not add enough efficiency to make a discernable difference in final grain yield, however given the poor response to the three P rates across all treatments, it is difficult to draw conclusions yet. Like all good research, it requires further work!

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