Calibrations of soil tests for N, P, K or S

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RESEARCH

Location
Minnipa - Gareth Scholz
Minnipa Ag Bureau
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2018 Total: 208 mm
2018 GSR: 155 mm
Yield
Potential yield: 2.0 t/ha (W)
Actual: 1.0 t/ha
Paddock History
2017: Pasture
2016: Pasture
2015: Pasture
Soil Type
Red sandy clay loam
Soil Test
$pH_{(water)}$ 8.4, PBI 79, K 523 mg/kg
Plot Size
20 m x 2 m x 4 reps
Trial Design
Completely randomised design, 2 bays x 44 plots x crop type (wheat or canola)
Yield Limiting Factors
Dry conditions at start of the season - moderate impact

Key messages

- **With low rainfall and poor growth at many sites, crops required little P to maximise grain yield, even though P fertiliser was quite inefficient early in the season due to soils often being dry.**
- **On a Minnipa red sandy clay loam, poorly performing wheat only needed a Colwell P value of 10 mg/kg to achieve maximum grain yield.**

Why do the trial?

Soil testing for N, P, K and S is a key strategy for monitoring soil fertility of cropping soils as well as for refining fertiliser application strategies for future crops. For this to be successful, the relationship between the soil test and likely response to applied nutrients needs to be well calibrated. Many of these calibrations were developed from fertiliser trials conducted over 20 years ago and have provided robust guidelines on many soil types, but mostly for cereals. Since these trials were conducted cropping systems have changed significantly and altered the face of soil fertility in the Australian grains industry. A detailed re-examination of those existing guidelines is needed to ensure they are still relevant in current farming systems.

As part of the GRDC funded MPCN2 (More Profit from Crop Nutrition) program, a review of data in the Better Fertilizer Decisions for Cropping (BFDC) database showed gaps exist for key crops, soils and regions. Most of these gaps relate to crops that are (i) new to cropping regions or are a low proportion of cropped area, i.e. break crops, (ii) emerging nutrient constraints that had previously been adequate in specific soil types and (iii) issues associated with changing nutrient profile distribution. This project (UQ00082) is closing gaps in the BFDC database using replicated trials. Trials are being established on sites selected for nutrient responses and run over multiple years to develop soil test-crop response relationships. By using wheat as a benchmark alongside a break crop, we should be able to extend the relevance of the guidelines beyond the conditions at the trial site.

How was it done?

A P deficient site on a red sandy clay loam was selected near Pildappa on upper Eyre Peninsula. Soil P status was very low at < 6 ppm Colwell P. On 7 May 2018, P fertiliser treatments were applied at 11 rates from 0-200 kg P/ha to create a range of soil P reserves. Every plot was sampled from 0-10 cm for Colwell P immediately prior to seeding.

Two identical trials were sown at the site on 21 June 2018, one with Mace wheat @ 60 kg/ha as the benchmarking crop and Stingray canola @ 5 kg/ha. The canola failed to establish with the initial seeding so the trial was re-seeded in August. However, this crop failed in spring and no data was captured for canola.

What happened?

Adding P fertiliser successfully created a range of soil P values in both the wheat and canola trials (Figure 1) despite the generally dry conditions from application to sampling 6 weeks later.

The best yields of wheat were just under 1 t/ha with the late seeding and if no P had been applied, yields were less than 0.6 t/ha. Rates of P fertiliser had to be at least 20 kg P/ha (equivalent to 100 kg/ha of MAP or DAP) to achieve maximum yields, but rates higher than 20 kg P/ha had little or no benefit on wheat yields. This relatively high rate of P to overcome P deficiency was common last year and was probably due to the very dry conditions last season. P fertiliser is very poorly available in soils which are often dry.

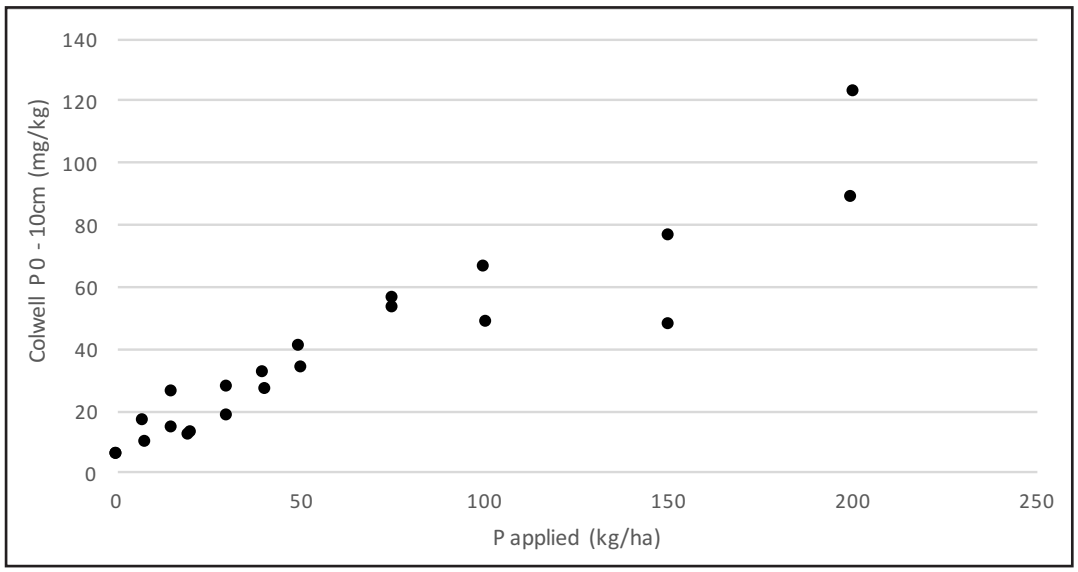

Figure 1 Soil phosphorus measured as Colwell P (mg/kg) for soil samples taken at 0-10cm in every plot of the wheat trial after treatment application at Pildappa, SA in 2018

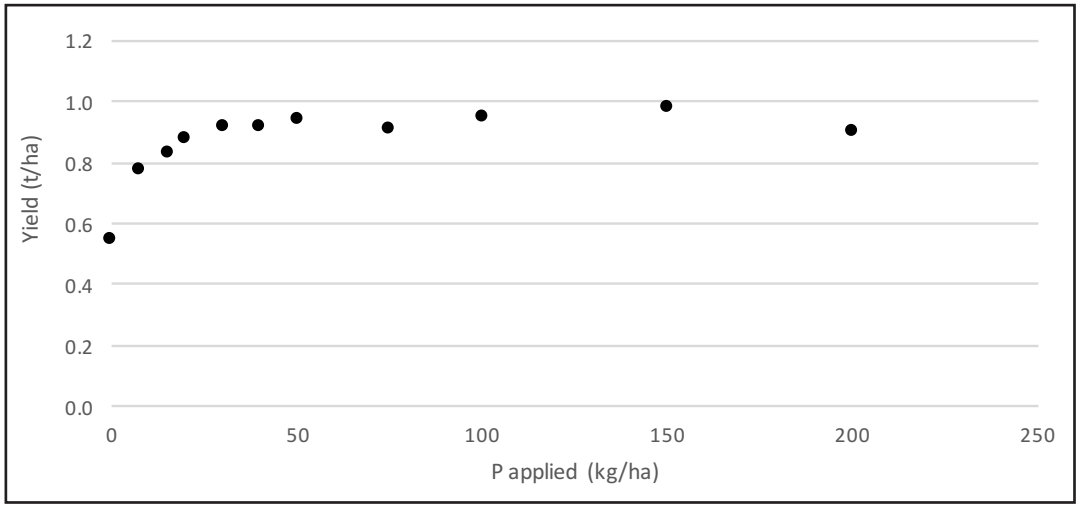

Figure 2 Yield (t/ha) for treatments with a range of applied phosphorus (kg P/ha) at Pildappa, SA in 2018

What does this mean?

Preliminary calibration of the Colwell P soil test for wheat suggest that levels above 10 mg/kg were sufficient to maximise grain yields in 2018 (without the addition of P fertiliser) (Figure 2). This critical level is substantially lower than the current standard of 20-25 mg/kg for mallee-type soils. The value from 2018 is probably low due to the very low production levels experienced in the 2018 season. Under these conditions, the crop requires very little P to maximise growth. These are very much provisional conclusions because we are concerned that in the setup years for these trials, soil test values may be confounded by lots of fresh fertiliser (whole granules) also being in the soil.

The trials will be re-seeded in 2019 to check calibrations in a different season and to evaluate canola requirements relative to wheat under identical conditions.

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