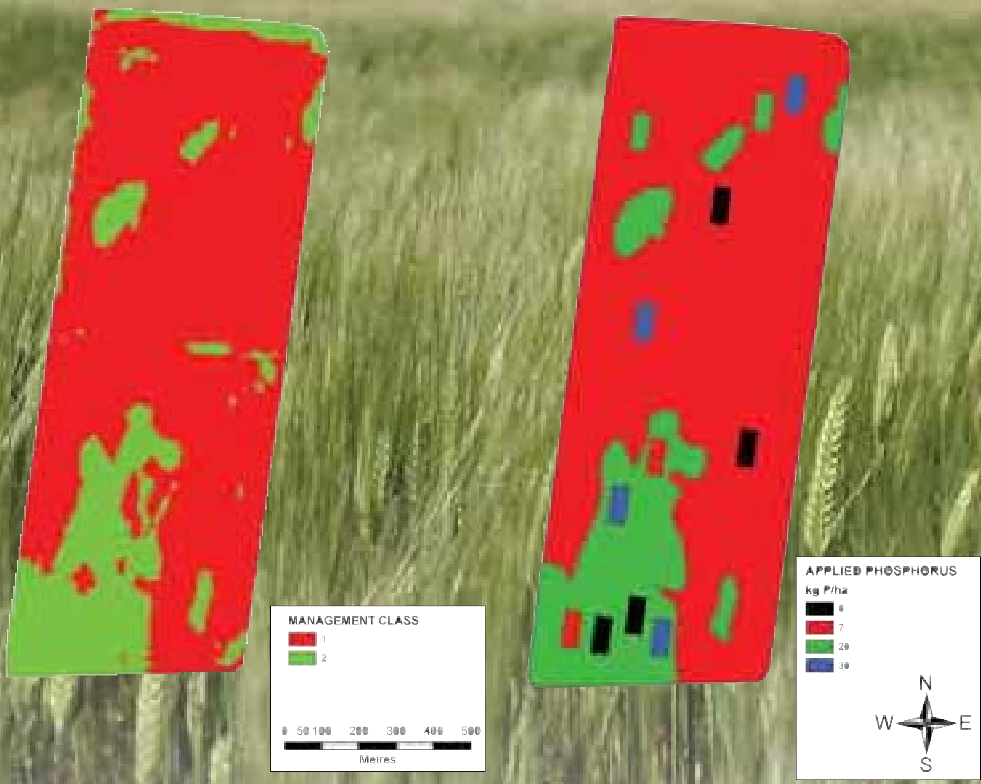


Figure 1. (a) Management classes in Road paddock (b) Fertiliser application map.

Road Paddock – variable rate P results

Brett Whelan, *University of Sydney*

Over the past four years, Brett Whelan, University of Sydney, has run paddock trials on behalf of SPAA to quantify the impact of changing inputs based on management classes. The overall objective of the research is to improve the profitability of each paddock.

Six paddocks, two each located at Crystal Brook, Stockport and Snowtown were chosen in 2003 to be part of the SPAA research program. Three additional paddocks (YP, EP and the Murray Mallee) were added in 2004. Each paddock had up to seven years of yield data providing a visual assessment of paddock variability; each could roughly be divided into zones of low or high yield.

Here we look at the results for varying the phosphorus rate on Malcolm Sargent's Road Paddock, Crystal Brook. Background information on this trial can be found in previous issues of Precision Ag News including Volume 2 Issue 1 Winter 2003. Results from other paddocks will be reported in future issues.

The management classes in Road Paddock were constructed from an EM38 soil conductivity map, an elevation map and two years of yield map data (Figure 1a). Subsequent soil testing within these classes highlighted a significant difference in phosphorus fertility between the two classes in 2002, and again in pre-season testing in 2003 (Table 2). The fertiliser rate experiment was established with application strips located in Class 1 or in Class 2 providing either 0, 7, 20 or 30kg phosphorus per hectare (Figure 1b). Malcolm decided that from the beginning he would cut back the overall phosphorus applied to Class 1.

Instead of applying a blanket rate of 11kg P/ha at seeding, Malcolm reduced the rate to 7kg P/ha on Class 1 the poorer performing zone, and increased the rate to 20kg P/ha on Class 2, the more productive zone. These rates were used for the rotation of wheat, field peas, wheat, barley, grown between 2003 and 2006.

The yield responses for the full rotation are shown in Figures 2 to 5. The graphs identify that the yield response to phosphorus was much greater in the more productive Class 2 areas. Therefore, targeting more inputs to these areas was the correct decision. In contrast, there was no yield response with the cereals to any rate of phosphorus in the class 1 areas. On average the yield on Class 2 was 14 % higher than on Class 1.

Figure 2. 2003 Wheat

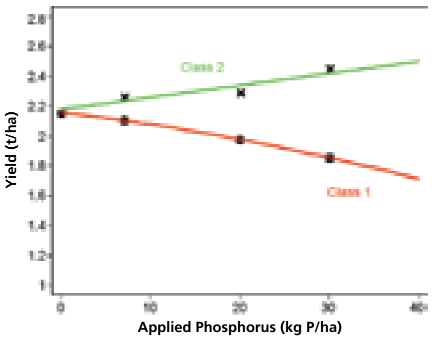


Figure 3. 2004 Field Peas

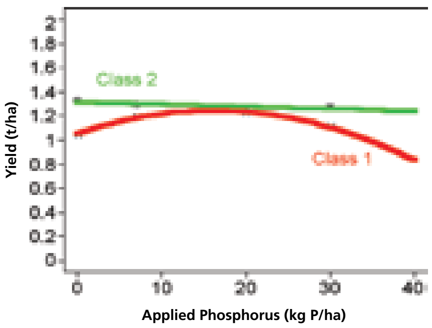


Figure 4. 2005 Wheat

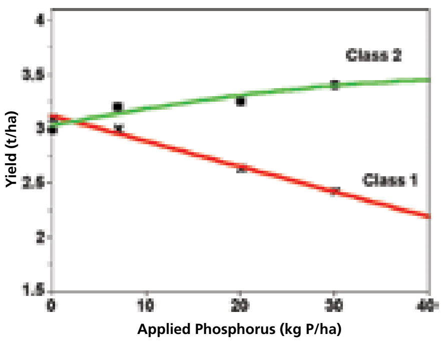
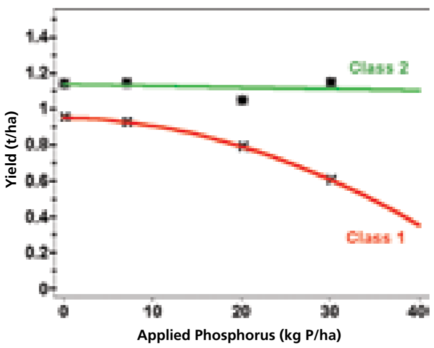


Figure 5. 2006 Barley



Economics of variable rate

The experiments were analysed for the dollars wasted due to over application. The potential wastage figure was calculated based on the cost of excess phosphorus when a blanket 11kg P/ha was applied across the whole paddock, compared to the cost of applying the optimum phosphorus determined from yield and soil data gathered as part of the experiments (Table 1). Over the rotation an average over expenditure on phosphorus of $35.55/ha/year was calculated

The differential fertilisation of the field peas was the only year to produce a loss. In three out of the four years (not 2005), a reduction in Class 2 phosphorus application to less than 20kg P/ha would have been more profitable. This data suggests further modifications in phosphorus rates would offer Malcolm better returns.

soil testing highlighted that available water content is on an average 14% lower in Class 1 than Class 2

The simple rate change Malcolm actually made, based on soil tests, was calculated to improve the average margin per hectare, over the four years by $9/ha/year.

Paddock changes in P

The differential fertilisation undertaken by Malcolm has been successful in slowly levelling out the phosphorus concentration across the paddock. The levels in Class 1 have declined, while those in Class 2 have increased (Table 2).

After a couple of years the soil phosphorus levels in the application strips were measured, before sowing, to see if a soil response to fertiliser application had occurred. By combining the available phosphorus in the soil with the rate of phosphorus applied we were able to establish the real amount of soil phosphorus available to the crop. The results for 2005 and 2006 are detailed in Figure 6a and b. The red line represents the data from the strips in Class 1 and the green line for those in Class 2.

Table 2. Levels of soil phosphorus per year (ppm) by Class.

Class	1	2
2002	57	27
2003	76	35
2004	54	28
2005	48	52

Underlying causes

From the data it appears that for Road Paddock, a total phosphorus load of more than 80kg/ha may be associated with some economic loss in cereals (more so in barley), especially in Class 1. While this does not mean that high phosphorus levels are necessarily restricting growth, this level is certainly diagnostic of where yield will be restricted.

Soil testing highlighted that available water content (AWC) is on an

Table 1. The dollars wasted due to over application of phosphorus when a blanket rather than a variable rate was applied across the paddock.

Year	Crop	Wastage ($/ha)	% fertiliser over application
2003	Wheat	35.55	100%
2004	Field Peas	8.22	38%
2005	Wheat	65.02	78%
2006	Barley	33.40	100%

Table 3. Soil texture and available water content by Class.

Depth	Property	CLASS 1	CLASS 2
0-10cm	Clay Silt Course Sand Fine Sand	37.7 8.9 22.5 30.9	27.7 13.1 27.6 31.8
10-30cm	Clay Silt Course Sand Fine Sand	43.5 6.9 18.3 31.3	35.1 11.2 24.8 28.9
30-60cm	Clay Silt Course Sand Fine Sand	47.6 7.6 16.2 28.6	38.2 12.1 21.3 28.4
0-60cm	AWC	68.8	80.3

average 14% lower in Class 1 than Class 2; this is certainly contributing to the different yield potentials given the relatively flat topography (Table 3).

Figure 7 illustrates that where the application strips received high rates of phosphorus, the concentration of available phosphorus was increasing in Class 1 but not in Class 2. These results are the combination of 2005 and 2006 soil test data. Therefore, the application of any more phosphorus than required to maintain phosphorus level in Class 1 is economically unwise. Indeed, a greater reduction in phosphorus in Class 1 and 2 than has been undertaken by Malcolm, may be financially beneficial for the next year or two.

Figure 7. Soil phosphorus in test strips according to the treatment rate 2005 and 2006.

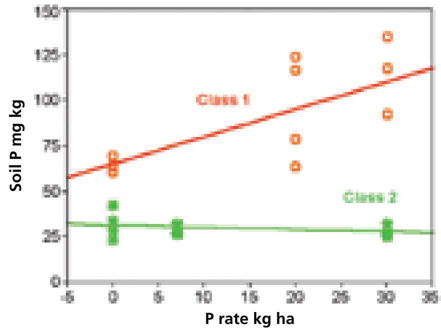


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Figure 6 (a).
2005 Wheat (Total P = Pre sowing + Applied)

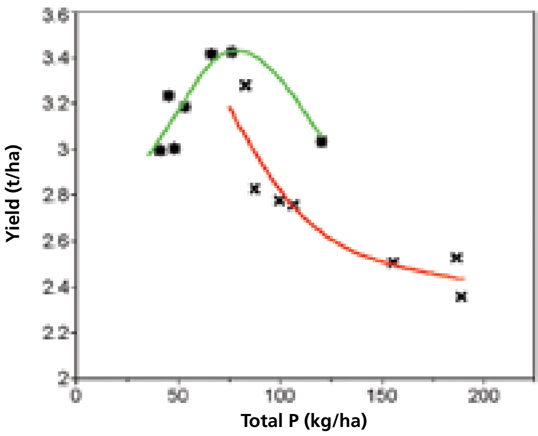

Figure 6 (b).
2006 Barley (Total P = Pre sowing + Applied)