Economics of phosphorus and zinc

By Chris Dowling, Back Paddock Company

PHOSPHORUS

In the northern grains region P is commonly the next limiting nutrient after nitrogen – but an adequate supply is vital to ensure N is used efficiently. Critical levels for soil testing and responsiveness were established for a range of commonly grown crops during the 1960s to the early 1980s based on the Colwell P method.

Part of managing P in the north is recognising and using the differences in responsiveness that exists between crop species. Recent research at Incitec Pivot's long-term sites at Colonsay and Tulloona has confirmed common observation that grain response in sorghum is more variable than in most other crops, and may be absent after short fallows even at low available soil P.

This poses questions about the use of P and managing the short-term economics of the crop or the longer-term viability and profitability of the farm.

Sorghum is generally a dominant crop in many rotations in the east of the northern grains region and a significant secondary crop in most other areas. Given this, we need to recognise that the recent research evidence from Colonsay and Tuloona for increasing the replacement/maintenance rates for sorghum – indicating that the commonly used removal figure of 2.3 kg P per tonne (0.23 per cent P in grain) – is probably too low for local conditions.

More recent studies have indicated that 3.7 kg P per tonne is more realistic for modern varieties grown on the soils of the vertosols of the Darling Downs and northern NSW.

Combining higher unit removal and high yield per unit of soil moisture makes sorghum the most influential determinant of soil P status in many areas and a key factor in soil P decline even where replacement rates are targeted.

With the lack of functional and up-to-date econometric P response models for crops in this region, there was significant uncertainty on best management options as a result of the 2008 fertiliser price peaks. Given that it appears to have been a single season aberration at this stage, it is assumed that there will be a return to usual practice once fertiliser prices return to a more 'normal' range and cash flow is re-established.

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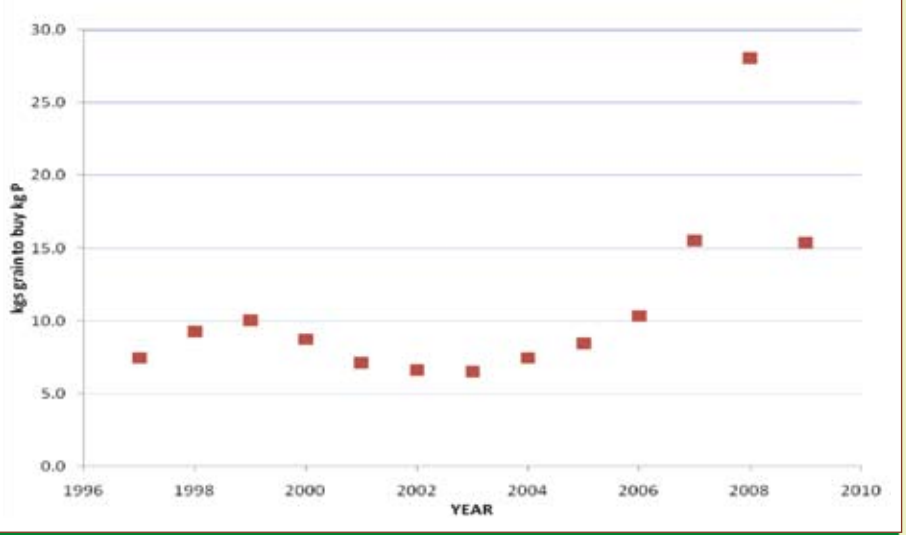
New understanding of the soil chemistry in northern region vertosols should prompt a re-think of sorghum nutrition management.

TAKE HOME MESSAGES...

- In the northern grains region phosphorus (P) is commonly the next limiting nutrient after nitrogen (N). Managing P profitably in vertosols can be complex as a result of contrasting responsiveness between crop species, complex soil chemistry and a lack of econometric analysis. In addition, these soils were often initially P adequate but are now in a negative balance. Re-interpretation of past response data can provide some answers to current questions. But outcomes must be interpreted in the light of significant changes to production systems.
- Zinc (Zn) is the trace element that has commonly limited yield. Large responses are probably now less frequent than in the past as a result of widespread use of zinc-fortified starter fertilisers and perhaps crop varieties with inherently better tolerance to low zinc availability. Plant tissue analysis is regarded as a more reliable guide to zinc requirement than testing soil and is a valuable guide to the ongoing need for zinc addition.

FIGURE 1: Fertiliser P cost (as DAP) and the grain price ratio for wheat (APW), 1996–2008



◁v...ECONOMICS OF P AND Zn

Applying the pricing data of 2008 to some of the original P response data – on which current recommendations for wheat are founded – indicates that as the additional amount of wheat required to purchase a kilogram of P approaches 30 kg any rate of phosphorus fertiliser is not profitable based on returns for a single season.

For each increase in the ratio of 1 (above 10) there is a need to decrease suggested P rate by about five per cent to maintain profitability. This ratio was in excess of 30:1 during some months last year (Figure 1).

Recent studies into the changes in soil chemistry resulting from long-term P addition and development of modern soil management techniques – including reduction in tillage and controlled-traffic – has caused some questioning of the fate of nutrients.

This is particularly the case for the sampling protocols for those nutrients of low mobility such as phosphorus and zinc.

Lack of response and undetectable decline in low P soil with a large net negative balance suggest that the current Colwell extraction methods may not be universally effective. Recent changes in the understanding of the chemistry of soil P in vertosols of this type indicates the need for a 'new' approach that may include a back-to-the-future step of resurrecting the Whitehouse dual index for P responsiveness that was subsequently refined and promoted by Chisholm and Strong.

ZINC

Zinc has a long history of research and use in the northern grains region dating back to the 1960s. Initially broadcast as zinc sulfate or zinc oxide, the growth of reduced tillage saw a change to broad adoption of zinc-fortified starter fertilisers.

Commonly, around five per cent of the zinc applied is actually removed in the year of application – the majority becoming soil residual with 40–50 per cent being detectable in subsequent soil testing.

The combination of low removal, high residual value and regular application for Zn fortified products has seen widespread build-up of soil Zn across the region to the point where continued use of Zn at current rates or frequency should be questioned.

Plant tissue analysis is generally the most reliable method to assess adequacy.

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Rice trials in the north

Central Highlands irrigation farmers could be adding rice to their summer grain cropping options based on the performance of the region's first varietal trials and three commercial plantings. Department of Primary Industries and Fisheries principal research scientist Dr Richard Sequeira is overseeing the 2008–09 trial plantings of 15 rice varieties in a project supported by the Riverina-based company SunRice.

In addition to the varietal trial assessment, close to 200 hectares of Amaroo variety rice has been planted by three regional growers – Ross Ingram at Arcturus Downs, Springsure; Steve Morazwitz, Comet; and, Les Fluerty in the Emerald Irrigation Area.

Richard said that with an anticipated 90 to 95-day growing period in Central Queensland's summer season, a rice grain cash crop would be a welcome addition to an irrigator's crop rotation.

DPI&F farm supervisor Tony Hawke planted the first trial plots on December 20 at the Australian Agricultural College Corporation's Emerald Campus with a follow-up second trial plot planting on January 19.

Three replications of each variety were planted dry to a depth of 2.5 cm at 15.5 kg per hectare. The planter was set to plant four rows (37 cm row spacing) on two metre wide beds which were then irrigated with syphon hoses in the side furrows.

Tony said that unlike paddy rice where the crop was inundated, the aerobic rice production system relied on watering every six to seven days initially and increasing frequency to five-day intervals post-flowering to promote grain fill.

"Our management objective is to keep the soil profile moist during the growing season and this has been helped with two major in-crop rainfall events," Tony said.

"The biggest falls this year have been 82 mm on Australia Day and 125 mm on February 10. But there has also been days of extreme heat which has visibly stressed some of the December 20-planted varieties."

Richard said the total irrigation requirement for the rice could still reach 10 megalitres per hectare before the anticipated late March–early April harvest.

"The quickest maturity line has been Quest variety which flowered at 55 days whereas the varieties that have been less stressed and look most impressive are Yunlu 29 and Jefferson," he said.

"At present there are no known insect or disease pest issues of major significance to impact on rice production in the Central Highlands but birds such as magpie geese and brolgas have severely damaged crops previously grown in the Ord and Burdekin irrigation areas."

Richard said all rice grain produced on the Central Highlands this summer would be trucked to a SunRice processing plant in southern New South Wales. ■

DPI&F Emerald farm supervisor Tony Hawke (left) inspects developing grain heads on a trial plot of Quest variety rice with DPI&F principal research scientist and rice trial project leader Dr Richard Sequeira (centre) and DPI&F Director Regional Services (Central) Paul Walmsley, Rockhampton.