Fertilising in a changing price environment

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KEY MESSAGES

- Higher prices for both fertiliser and grain mean that fertiliser needs to be better targeted and used more efficiently because of the increased risks of losses both at the over- and under-fertilising ends of the spectrum.
- Relative to fertilisers, options for overcoming non nutritional limitations to yield could be more attractive than they have been in the past.
- Changing rotation to take advantage of 'free' legume N can come at a cost that is greater than money saved on N.
- Be wary of low cost and silver bullet 'alternatives' to expensive fertiliser—their effectiveness has not improved just because fertilisers are more expensive.

BACKGROUND

Many growers in the spring of 2008, when fertiliser prices looked like being 2–3 times those of the previous year were faced with the extreme positions of either spending 2–3 times more on fertiliser in 2009 or buying 1/2–1/3 of the quantity. This dilemma had the positive effect of forcing growers to not only rethink their complete fertiliser strategies, but also to re-examine where fertiliser expenditure fitted within their overall, whole farm spending program.

Below, we discuss some of the general spending and management options which flow from this re-examination. These options have to be made specific for each grower's individual situation. Many tools are available to help growers and their advisers address their individual circumstances.

THE GUTS

Adjusting fertiliser applications—the impact of price

The initial response to a fertiliser price rise is that you are being forced to use less fertiliser. A necessary consequence of this is that you are forced to operate at a reduced level of production. In some circumstances, there is a lot of truth in this initial response. However, the general rule is that your profits are still quite insensitive to fertiliser rate when soil nutrient levels are high (as a consequence of generous past fertiliser applications) and the paddock is marginally (< 15%) responsive to fresh fertiliser. But much more care needs to be taken in determining your fertiliser requirements if the site is responsive to the nutrient in question because the initial response to cut fertiliser rate could substantially reduce returns on the fertiliser investment and margins on the whole crop. In other words, diagnosing the nutrient status of your paddocks (and zones within your paddocks) has become even more important with the significant price rises of fertiliser and grain.

At the new profit maximising rate of application, returns to fertiliser necessarily fall when the price increases from $400 to $1000/tonne. The new optimum rate of MOP goes down but the new cost/ha goes up. If the same number of dollars are spent on fertiliser after the price rise, the rate of application of MOP comes down and so does the yield. In the case of the 15% response situation, differences in returns from the new profit maximising rate are small ($5 and $4). In the responsive situation (50%), they are large ($27 and $60) even for the low yield (2 t/ha) potential crop ($27).

Table 1 **Yield and dollar responses to a change in the price of muriate of potash (MOP) from $400/tonne to $1000/tonne, for two levels of response to potassium (15% and 50%) and two levels of production (Max GY) of 2 t/ha and 4 t/ha)**

	15% response to K			50% response to K		
Max GY2000 kg/ha	**Optimum**	**Optimum**	**Same $**	**Optimum**	**Optimum**	**Same $**
Cost of MoP $/t	400	1000	1000	400	1000	1000
*Optimum rate kg K/ha	23	15	9	35	25	14
Cost of fertiliser $/ha	18	30	18	28	50	28
Modelled yield t/ha	1968	1933	1878	1970	1918	1753
Return net of fertiliser cost	**63**	**40**	**35**	**163**	**125**	**98**
Return vs 400 opt ($/ha)		-23	-28		-38	-65
Max GY 4000 kg/ha	**Optimum**	**Optimum**	**Same $**	**Optimum**	**Optimum**	**Same $**
Cost of MoP $/t	400	1000	1000	400	1000	1000
*Optimum rate kg K/ha	30	20	12	40	35	16
Cost of fertiliser $/ha	24	40	24	32	70	32
Modelled yield t/ha	3970	3919	3819	3963	3922	3596
Return net of fertiliser cost	**147**	**116**	**102**	**557**	**507**	**447**
Return vs 400 opt ($/ha)		-31	-35		-50	-110

Note: Grain $300/tonne, C fert K = 0.05.

This general message is true for most crops and nutrients and it emphasises the point that individual growers need to determine which paddocks and which areas within paddocks are going to be responsive to nutrient additions. In other words you need better diagnostics. This implies more soil (and tissue) testing and use of other means to assist these diagnostic tools. Recent (< 4 year old) soil P, K, pH and OC% tests can all be used as indicators of current status because they do not change dramatically with time.

The practice of applying 'insurance' dressings of nutrients just in case the paddock is responsive can be very wasteful of scarce fertiliser dollars. For example applying an NPK compound to a whole paddock when only 25% of the paddock is responsive to K represents wasting money on K on 75% of the paddock.

Improving fertiliser use efficiency

Most growers in WA already use their fertiliser in an efficient manner. At the broad scale they get their timing, placement and source choices in the ballpark for their farming systems. Efficiency is improved by better targeting of the areas needing the nutrients. Precision agriculture and variable rate technologies are becoming increasingly relevant.

Efficiency in the uptake of nutrients, particularly the ones which do not move readily through the soil can be improved by liming the surface soil where those nutrients are most abundant. Removal of constraints to root growth to depth can markedly improve the uptake of soil mobile nutrients like nitrate nitrogen and sulphate sulphur as well as potassium which often occurs at greater concentrations in the subsoil. Thus ripping to overcome mechanical hardpans or even to directly apply lime into the subsoil to overcome a toxic aluminium layer, can markedly improve the efficiency of fertiliser usage in certain situations. The trick is to be able to work out if such situations occur on your paddocks, and if so where they occur as well as if there are cost effective means (relative to other investments) to ameliorate them.

Playing the season using split applications has become standard practice for the efficient use of nitrogen fertiliser, especially given flexibility in storage and application options provided with fluid N fertilisers. By not putting all the N up front at or before seeding, you can avoid over fertilising if the season goes bad while retaining the flexibility to put out more N and avoid under fertilising if the season and crop look impressive.

What are the stoppers?

Higher prices have caused many farmers to re-evaluate where they put their discretional dollars.

Removing or ameliorating factors which constrain yield could be a better use of farm business dollars than spending on fertiliser. It may be better to remove a subsoil constraint to rooting depth not only for its effect on nutrient uptake (see above), but also for better water use efficiency giving higher potential yields. Deep ripping or deep incorporation of lime and/or nutrients may pay better than random use of expensive fertiliser. To maximise cash flow it is crucial that each situation is assessed. For example if pH is so low (because insufficient lime has been applied in the past) that a normal 1–2 t/ha application of lime won't increase pH enough or quickly enough to improve returns, then fertiliser can be a better short term investment. Likewise if P applications begin to be cut now in the wrong situations, in a few years time soil P levels could be so low that prohibitively expensive applications of P will be required to return the paddock to a productive state. Managing for higher potential yield using better weed and disease control is an option which needs to be examined. Yield potential has a major impact on fertiliser requirements and nutrient use efficiency.

More legumes and/or fallow in the rotation?

Many growers immediately think of the substitutability of 'free' legume nitrogen with fertiliser nitrogen via rotational changes, when the price of the fertiliser goes up. Fallow, which conserves soil water and releases mineral nitrogen, also becomes an option.

While these options need to be re-considered, it has to be done in an holistic way. There is a range of reasons why you have your existing cropping sequences and only one of these reasons will be the price of nitrogen fertiliser.

Simple calculations of the changes in the cost of nitrogen to your crop if you switch to an extra legume phase have to be weighed up against other economic arguments which are specific for how any individual grower prefers to farm. Fallowing or running 'pastures' without sheep might involve minimal costs but also minimal returns. The reduced cost of fertiliser nitrogen inputs in year two, may well have to cover little or no returns in year one. The so-called opportunity cost becomes important here; poorly performing non-legume crops across the two years might give better returns than a good crop in one year only.

Simple wheels, tables (2 and 3 below) or electronic decision aids (SYN, Ncalc) are available for you to get a feel for the order of magnitude of the nitrogen budgets you are dealing with.

Table 2 **Estimated available nitrogen supply (kg/ha) from pasture in the previous year**

% clover		Pasture dry matter kg/ha									
		3 000	4 000	5 000	6 000	7 000	8 000	9 000	10 000	11 000	12 000
Grass	**0**	14	18	23	27	32	36	41	45	50	54
Low	**25**	17	22	28	33	39	44	50	55	61	66
Median	**50**	20	26	33	39	46	52	59	65	72	78
High	**75**	23	30	38	45	53	60	68	75	83	91
All clover	**100**	26	34	43	51	60	68	77	86	94	103

Table 3. Estimated available nitrogen supply (kg/ha) from crop legumes in the previous year

	Grain legume yield tonnes/ha					
	0.5	**1**	**1.5**	**2**	**2.5**	**3**
High plant growth relative to yield	17	35	52	70	88	105
Average growth relative to yield	12	24	36	48	60	72
Low plant growth relative to yield	6	13	20	27	34	40

Alternative fertiliser sources?

As usual a price rise for fertiliser has opened the floodgates of publicity for alternative ways of providing nutrients, either with alternative products or products which are meant to help crops take up nutrients more efficiently or which make previously plant unavailable soil nutrients more available.

Alternative sources of nutrients need to be considered from a cost effectiveness point of view. For example, most of the **organic products** (compost, animal manures, biosolids), have an order of magnitude lower concentration of the major nutrients than do their fertiliser counterparts. They should be sold at an order of magnitude lower price per unit if they are to be competitive. Thus an organic fertiliser with 2% P and 1.8% N would need to be sold at about $180/t to be competitive with DAP at $1800/t. Transport cost needs to added to calculate on farm cost.

To complicate matters there are other considerations with organic products: they may have positive attributes such as the presence of other essential nutrients but negatives such as toxic elements and contaminating chemicals and pathogens. To meet crop demands, they have to be applied at very high rates (t/ha) with implied higher application and cartage costs. The relative 'availability' of the various nutrients in the organic sources compared with fertiliser equivalents becomes a moot point dependent on the conditions under which they are used but generally availability is a lot lower for organic nutrients. Slow release properties can be good under leaching conditions but detrimental under non-leaching conditions. Incorporation may be necessary to get best use from these products and in some cases may be mandatory.

The products which claim to facilitate nutrient uptake or to release unavailable soil reserves were also available before the price rises If they worked, they would have been cost effective years ago. Potential users of such products should satisfy themselves that the product(s) do for them what is claimed and that they are cost effective. Unsubstantiated claims and testimonials are no more valid now that fertiliser prices have risen than they were before. Magic or new principles should have swayed you before the price rises—if you weren't convinced before, they are unlikely to save you now.

Sources of help

Decision support tools used in WA are the best in Australia for addressing the questions raised by higher fertiliser prices. They need to be parameterised and focussed correctly to be able to answer the current questions for specific situations. However nothing replaces the value of seeking reputable advice from people who are trained in their use.

Decision support tools used on this topic in the last couple of months include:

N: wheels, tables, SYN, Ncalc, NPDecide, RONSON, Niterite. P: Soil test technote, NPDecide, Woolmodel, Pcalc, Psoil test update. K: KASM, Potassium in Agricultural Systems Model.
Lime: Optlime. All nutrition: NU logic.

Most of these are available on request from the authors.

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