Nutrients for Crops in 2010 - How Much Nutrition did you Export to the Silo Last Year and How Much Fertiliser are you Applying This Year?

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EXTENSION

Key messages

- **Calculate the quantity of key nutrients (N and P) that you removed from your paddocks in grain last year using simple rules of thumb – aim to at least replace this and add more if you can.**
- **Deep N soil test in paddocks where protein was low.**
- **Sow into standing stubbles if possible.**
- **Make more informed nutrient decisions - know your soil organic carbon & PBI.**

The average or better than average crops of last year mean that soil nutrient reserves will be depleted. Realistically no one has had huge budgets for fertiliser with the last 3 poor seasons complicated by high fertiliser prices. Protein in grain delivered in 2009 was down and whilst some of this may be due to soil moisture later in the season it is part of an indicator that crops would have benefited from extra N. Hopefully with grain in the silo and dollars from the grain sold it is time to consider at least replacing what has gone off the farm, back into the soil for the next crop and if there is enough cash flow maybe anticipating another better than average season to come and planning for that!!

Obviously grain quality (protein) will influence the exact amount of N taken off but as a rough guide for each ton of grain sold you have exported 20 units of N/t. So a ten bag/acre or 2 t/ha wheat crop exported 40 units of N equivalent to approx 90 kg of urea or 220 kg of 18:20 fertiliser.

Working on a simple replacement for removal in grain is a reasonable strategy but does not account for the recycling that occurs via organic matter in standing stubbles and the soil. The recycling is important to consider for N because such large amounts are required compared to other nutrients like P and Zn. Although as P fertilisers increase in price we are starting to think about how the soil might supply more P too.

Aside from what you add as fertiliser this year the nutrients for the coming year's crops will come from three other sources in soil: (1) from any residual fertiliser, (2) from last year's stubble input, and (3) from cycling of long term soil organic matter.

1. Residual fertiliser

Likely to be low as the good crops last year will have accessed a large proportion of the applied fertiliser, but even under best conditions 40% of applied fertiliser tends to remain in soil. It may no longer be in a form that plants can access (this especially is true for P and Zinc on alkaline and calcareous soils which can get permanently locked up) or in case of N it may have leached beyond root zone, gone into the atmosphere as a gas or be tied up temporarily in microbes. You can expect some of your fertiliser N tied up in microbes to be released during the season but only a very small % of the original fertiliser application.

2. Nutrients from breakdown of residues (roots & stubble from last year's crop)

Above and below ground residues from last year's crop are the freshest additions to the soil organic matter although most of the information we have is about above ground residues (roots are rarely considered). There are rules of thumb to work out what N you are likely to get from the previous year's residues and it will depend on whether it was a legume or cereal.

For example: Assuming your grain production of 2 t/ha was half of the total dry matter production on the paddock (50% harvest index) then you would have about 2t/ha of cereal stubble. Mature wheat stubble contains less than 0.5% N so your 2 t of stubble will contain at best 10 kg N/ha. Up to 25% of this can be released in the first season of decomposition which gives you at most 2.5 kg/ha available N. Cereal stubbles are considered low quality as they contain a lot more carbon in proportion to nitrogen and so the microbes tend to require N in order to break them down. This means some of the fertiliser N you add will be temporarily used by microbes to break down cereal stubbles. So it is very important to recognise that with high cereal stubble loads there is quite likely to be temporary tie up of N and allow for this in the fertiliser application.

Medic residues as a rule of thumb contain more N (25 kg/t) dry matter although again only some of this N becomes available to plants in the first year of decomposition. Also the residue input will depend on how the paddock was managed during last year and over the summer. Heavy grazing and some mechanical weed control measures will remove a lot of the residue input.

Note: There is a good explanation of this in a PIRSA publication by Michael Wurst called 'Nitrogen Management for Wheat and Malting Barley'. Contact Michael Wurst on (08) 8664 1408 or email michael.wurst@sa.gov.au

3. Nutrients from cycling of long term soil organic matter (organic carbon)

Any rule of thumb for nutrient cycling is highly dependent on soil moisture conditions, soil temperature and biological activity. It also relates strongly to the amount of organic matter in the soil. Do you know your organic matter or carbon contents?? Generally the higher your organic matter base then the more nutrient cycling occurs as the carbon feeds microbes so there are more of them and they work harder and faster. The amount of N released from your long term organic matter build up is very difficult to predict so that a rule of thumb is hard to apply, although often the contribution may be as important as the fertiliser.

Maintain standing stubbles if feasible

Density of stubble may pose handling issues in 2010 for regions that don't normally have this problem. Ideally leaving the stubble standing will have huge benefits:

- Easier to sow into.
- Shades the soil and reduce soil evaporation.
- Allows longer wetter periods for soil biota activity.
- Reduction of wind and water erosion.
- Reduce wicking in Magnesia patches.
- Less N will be needed by soil biota to convert the straw in the first year.
- Provides food for the microbes over the coming 2-3 years.

Deep N test if you can

The dry summer in many places so far has meant that there has been nothing for the microbes to drink and so little opportunity for breakdown of stubbles or soil organic matter cycling. If you have had some summer rains and good weed control then some of your stubble may have broken down and old organic matter may have recycled to available N. A deep N test as close to sowing as possible in early autumn will give an idea of what available N will be there for the start of the season and help you to decide how much N to apply at sowing or during the season.

What about P?

Recent research is showing that the usefulness of Colwell tests for available P can be improved if the phosphate buffering index (PBI) of the soil is also known, but this does not help for many calcareous soils. The new DGT test for available P is currently in the pipeline and should help P fertiliser decisions on many EP soils (see Mason and Bates, 'Improving Phosphorus Management on Upper EP using the DGT Soil Test')

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Table 1 Simple rules of thumb for nutrients removed in the grain of a wheat crop

Element	N	P	K	S	Ca	Mg	Cu	Zn	Mn
kg/t grain	20	3	4	2	0.3	1.5	0.007	0.016	0.04
kg removed in a 2.3 t/ha crop	46	6.9	9.2	4.6	0.69	3.45	0.016	0.037	0.092