Nitrogen – how hard can it be?
- a walk through the issues

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http://anz.ipni.net

Better Crops, Better Environment ... through Science

Skipton, March 2013.
The three rules about plant nutrition
If produce is removed, nutrients go with it – if not replaced, then the soil reserves go down.

You get nothing for nothing……..

This is soil not the “magic pudding”.

Address the limiting factor......

• Its no good checking to see if the hydraulic fluid is OK........

  – What is limiting production – until that is addressed, then no extra response.
There are no silver bullets……

“Frankly, I don’t know what to believe. They say if it sounds too good to be true, it usually is.”
Nutrition up the ladder

- Follow the season
- Mg/Micros
- Assess N (& S)
- Look at P (&K)
- Get the pH right

• Start at the bottom and work up
Where to start?

Where are you?

Where do you want to go?
Well – here is a good place!
Where are you and your soils?

Do it simple – or do it fancy – or get someone to do it. Just do it!

For N – root depth!
• 0-60 (get S as well)
• maybe divide into 2 sections
• use as the starting point for a NUTRIENT BUDGET

Most soil tests calibrated to 0-10 cm.

They indicate SUFFICIENCY of supply.
Deep soil N – in combination with other tests

• Get an assessment of other limits
  – pH, P, K, etc.
• Get a measure of the amount of N in the profile (kg/ha)
• Get an idea of in-crop N supply
  » SOC mineralised to minN
  » Rainfall/temperature
  » Time
What sort of values can be expected?

In-crop mineralisation

1.5% OC * 300 mm / 6

= 75 kg N/ha (gross)

(2012 estimate 30-40 kg N)
So – our starting point is:

- Deep Soil N test (for example) = 50 kg N/ha
- In-crop mineralised N = 75 kg N/ha
- Start at 125 kg N of supply from the soil over the season.

- Typically
  - Wheat to DC30
    - 40-50 kg N
  - Canola to Stem Elong.
    - 50-60 kg N
Where are we going though?

<table>
<thead>
<tr>
<th>Crop &amp; Yield</th>
<th>N content/t</th>
<th>N removal/ha</th>
<th>N demand/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat @ 3 t/ha</td>
<td>21</td>
<td>63</td>
<td>120</td>
</tr>
<tr>
<td>Wheat @ 6 t/ha</td>
<td>126</td>
<td>126</td>
<td>250</td>
</tr>
<tr>
<td>Canola @ 2 t/ha</td>
<td>35</td>
<td>70</td>
<td>140</td>
</tr>
<tr>
<td>Canola @ 4 t/ha</td>
<td>140</td>
<td>140</td>
<td>280</td>
</tr>
</tbody>
</table>

NUE
Make a realistic estimate of demand...

For example – Yield Prophet estimates – Bolac 07/12 (Gregory sown 01May).
Supply and demand -

• Supply of 125 kg N over the season
  – = about a 3 t/ha wheat crop or 1.8 t/ha canola crop.

• Dry profile but good seasons
  – Target 5 t/ha wheat or 3 t/ha canola
  – 200-220 kg N

• Deficit of 80-100 kg N

• How to fill that gap?
So what to do?

- Select the right source/product, apply it at the right rate, and at the right time and in the right place!
- 4 Rights of nutrient management.
N at sowing

• Can use basal applications of N to fill part or all the gaps

• Issues
  – Seed damage
  – Seasonal Risk
  – Losses & poor efficiency
Seed damage – Using DAP/Urea

Row Spacing

Fertilizer Spread

SBU = %FS/RS

<table>
<thead>
<tr>
<th></th>
<th>20 cm</th>
<th>30 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 mm Share</td>
<td>33</td>
<td>22</td>
</tr>
<tr>
<td>Spear Point</td>
<td>13</td>
<td>8</td>
</tr>
</tbody>
</table>

http://anz.ipni.net/articles/ANZ0042-EN
Seed damage – Using DAP/Urea

• Is it OK to supply 50 kg N at sowing as
  – Urea (100 kg urea/ha)
  – DAP (250 kg DAP/ha)
  – UAN (130 l UAN/ha)

http://anz.ipni.net/article/ANZ-3076

<table>
<thead>
<tr>
<th>Safe Rate</th>
<th>Soil Type</th>
<th>Point &amp; Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Share</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15cm</td>
</tr>
<tr>
<td>Wheat &amp; Urea</td>
<td>Sandy Moist</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Loam Moist</td>
<td>90</td>
</tr>
<tr>
<td>Canola &amp; Urea</td>
<td>Sandy Moist</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Loam Moist</td>
<td>60</td>
</tr>
<tr>
<td>Canola &amp; DAP</td>
<td>Sandy Moist</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Loam Moist</td>
<td>150</td>
</tr>
</tbody>
</table>

NO UREA AT SEEDING WITH CANOLA!

UNLESS
http://seed-damage-calculator.herokuapp.com
Options

• Pre-drill the N source – lower efficiency (placement & losses)

• Use lower N fertilizer source in the seed row (eg MAP/TSP)
  – Little N supplied though 100 kg MAP = 10 kg N.

• Twin Chuting – 2-3 cm separation OK

• Minimal N at seeding
  – 50 kg N enough to get to 5 leaf stage of the crop.

• ~30% up front?
So where are we now?

Probably around 50-80 kg N used up

- time to review and revise
As Slim says “the rain tumbles down in July”

Read the season
Read the crop

S Marcroft, MGP
Recovery from waterlogging – maybe not!
You only die once!
What is the penalty of delaying?

<table>
<thead>
<tr>
<th>Rate</th>
<th>All predrilled</th>
<th>TD early*</th>
<th>TD late*</th>
<th>Split early*</th>
<th>Split late*</th>
<th>Nil N</th>
<th>LSD (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (90 kg N)</td>
<td>2.11</td>
<td>2.30</td>
<td>1.92</td>
<td>2.10</td>
<td>2.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate (50 kg N)</td>
<td>1.80</td>
<td>2.11</td>
<td>1.63</td>
<td>2.03</td>
<td>1.69</td>
<td>1.36</td>
<td>0.33</td>
</tr>
<tr>
<td>Low (9 kg N)</td>
<td>1.60</td>
<td>1.37</td>
<td>1.67</td>
<td>1.55</td>
<td>1.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wallup Ag Group, 2011
Right Product

- Losses from Urea top dressed – 10% (Turner et al. 2010)
- Loss reduced to 1% with NBPT

- Losses 8-10%
  - Rain >7 mm 50% reduction
  - Bury to 5 cm – 75% reduction
  - NBPT – 90% reduction
  - Polymner coating – 50-98%
  - UAN – 30% reduction (half of the N is urea)
    (Bishop and Manning, 2011)

- Degree of loss depends on conditions after spreading!
N losses via volatilization (46 kgN)

Turner et al. 2012 (Nutrient Cycling in Agroecosystems, 93, 113-126.

- 1 expt in Mallee
  - 5.4% N loss from urea
  - 2% loss from UAN
  - 4 mm rain 2 DAF

- 2 expts in Wimmera
  - 23% N loss from urea
  - 12% N loss from UAN
  - 12% N loss from AS
  - Rain 9 DAF
  - 13% N loss from urea
  - 3% N loss from AS
  - Rain 1 DAF
UAN? A good option?

• Convenience #1
• Crops can take N through the leaves
  – About 10 kg N/ha in a full cover crop
  – Rest enters via the soil & then roots.

• Good recovery from early canopy damage
  – Later application @ high rates problematic

• Row boat option?
• If it is too wet to get across the paddock, then it is probably too wet to apply N.
• 10 kg rule, rest washes away and/or denitrifies.
• Wait
Review and reassess

- What is the yield potential now?

- 25 mm of rain
  - 0.3 t/ha canola
  - 0.45 t/ha wheat

- To meet that extra yield = 18-20 kg N.

Lake Bolac – September
Yield Prophet estimate.
How late can N be applied?

• Early N stimulates shoots & grain numbers (=yield)
• Late is better for protein (if you are interested)
• Can target N applications to raise protein
  – As late as flowering (Sept/Oct)
  – Small amounts – source differences.
Are you kidding?

<table>
<thead>
<tr>
<th>N</th>
<th>Yield</th>
<th>N removed</th>
<th>Partial Nutrient Bal.</th>
<th>N remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.49</td>
<td>77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>4.23</td>
<td>94</td>
<td>2.5</td>
<td>35</td>
</tr>
<tr>
<td>50</td>
<td>4.84</td>
<td>112</td>
<td>1.9</td>
<td>26</td>
</tr>
<tr>
<td>100</td>
<td>5.04</td>
<td>136</td>
<td>1.0</td>
<td>34</td>
</tr>
</tbody>
</table>

SFS N trial – 100 kg N applied and all was removed in grain.

Question to ask – how much more yield was there? another t/ha
Review and revise – be the opportunities are bigger than you might think!
But do take care!
sometimes things are not as easy as the books say.
The Process – Take a tactical view

Sowing

Tillering/SE

Stem Elong/FF

Low N

Poor season
Maybe?

Average or better season

Increased certainty of the season

Poor season - No action

Average season – Top Up

Poor season - No action

Good season – Maybe Not

Average season – Top Up

Good season – Go for it!?
Summary

• Deep soil test to know where you are
• Make a realistic yield estimate
• Care with N in-furrow with canola – especially light & dry soils, wide rows.
• Be mean with N and review N every time it rains.
• Review the N removal (grain yield X protein)
  – How efficient is your strategy?
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