EASY N® AN OPTION FOR LATER NITROGEN APPLICATIONS IN WINTER CROP

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Nitrogen (N) is the key driver for yield in winter crop farming systems. Assessment of available soil mineral N, mineralization, and subsequently applied fertiliser Nitrogen is driven by the crop yield potential based on moisture.

The practical difficulty of fertiliser applications is environmental conditions in the later stages of crop development. While soil available moisture at topdressing may be known, future rainfall events, frosts, heat shocks, and grain fill length, are all unknowns and can have an impact on both yield and protein.

The graphic (Figure 1) below shows Nitrogen accumulation in whole tops of a wheat crop (yield approx. 5t/ha) as the crop develops. During vegetative growth stages, Nitrogen demand is relatively low. However, once the crop moves into the reproductive growth stage, Nitrogen demand increases significantly.

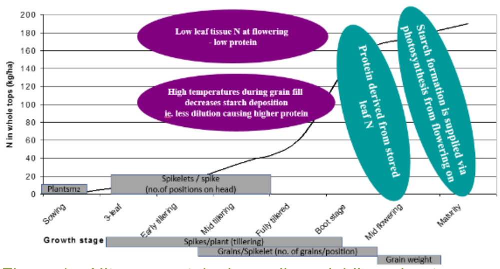

Figure 1 – Nitrogen uptake in medium yielding wheat crop, and influences on grain yield and protein. Source – Incitec Pivot Fertilisers 2003

Also highlighted in Figure 1 are the influencers of yield components for the crop. The first is the number of tillers that are established on plants. Tiller numbers are determined by the variety (shorter season spring wheats have fewer leaves and subsequently lower tiller numbers compared to longer season varieties and winter wheats), sunlight, moisture and Nitrogen. Plant stresses during and post fully-tillered growth stage can decrease tiller set, or cause tiller death and subsequently influence the number of spikes/plant or heads/m2. Ear initiation commences at 4-leaf growth stage and concludes at fully tillered stage. This is where the number of spikelets/tiller are set. Each of these spikelet positions can have several florets that develop from 1st node to booting. Around flag leaf emergence to booting the ear grows rapidly, and egg and pollen cells are initiated.

At the conclusion of booting, the maximum floret number has been set, with Nitrogen influence on yield past booting being minimal. Therefore, maintaining and extending Nitrogen adequacy up this this point is critical in not only setting yield but also protecting the potential.

Leaving the majority of Nitrogen applications to influence yield closer to booting is fraught with danger, as the requirements of adequate soil moisture to maintain surface root activity, and effective rainfall to move nitrogen into the soil, are required urgently prior to further plant development. In the instance of increasing yield potential (moisture building) above existing Nitrogen budgets and a rainfall opportunity, Nitrogen applications up to boot growth stage can be warranted.

The final grain number/head is determined at flowering. Grain weight is determined during grain fill through the process of starch deposition, supplied via photosynthesis of plant parts including leaves, stem and head. The longer and cooler the season finish, the greater starch deposition can occur, culminating in larger and heavier grains.

Grain protein is derived from stored leaf Nitrogen. Low leaf tissue Nitrogen levels at flowering can lead to low protein values, although grain size determined by the length of the season can play a large role in the concentration of protein with the grain.

With increasing dry matter accumulation during reproductive growth stages, longer days and warmer temperatures, plant evapo-transpiration rates increase to >5mm/day. A 25mm rainfall event captured by surface wheat roots will supply the plant moisture for only 5 days, with the plant then reverting back to roots deeper in the soil profile to recover moisture.

This is one of the reasons why later crop stage Nitrogen applications can be less efficient. Several rainfall events would be required to maintain moisture in the top of the soil profile, firstly to move the Nitrogen into the soil, and secondly to encourage prolonged surface root activity to recover the applied Nitrogen. As the crop develops past anthesis, roots begin to senesce, further decreasing the plants nutrient and moisture foraging capability.

At most crop growth stages, the type of Nitrogen fertiliser does not make a significant difference to fertiliser recovery. However, later in the crop's development, Easy N has shown to be more effective than Urea. This could be because of some leaf uptake, lower volatilisation potential (lower solution pH, ammonium and nitrate forms of Nitrogen) and nitrate Nitrogen that is rapidly taken up via mass flow with moisture.

The graphic below (Figure 2) shows a wheat trial at Dookie in 2013 where wheat yield and protein are influenced by the Nitrogen rate (80 and 100 kgN/ha), split timing (sowing, 1st node, flag leaf and anthesis), product choice (Easy N, Easy N + fungicide and wetter, Urea) and application method (broadcast, SJ streaming nozzles, FF flat fan nozzles).

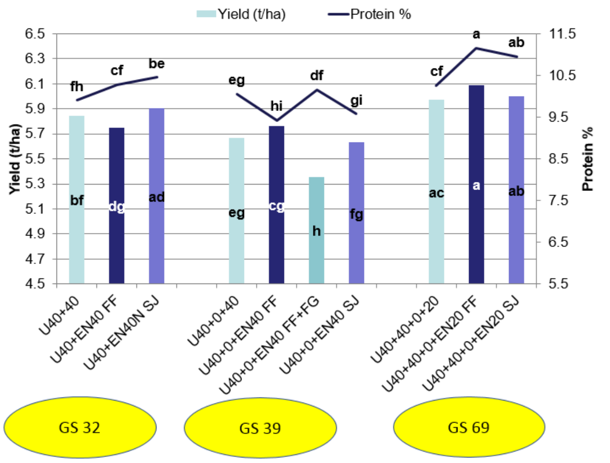

Figure 2 – Dookie 2013 trial comparing Urea and Easy N and different growth stages (GS0, GS32, GS39, GS69). Application rates are 40kgN/ha (94l/ha Easy N & 87kg/ha Urea) and 20kgN/ha (47l/ha Easy N and 43.5k/ha Urea). Source – Incitec Pivot Fertiliser 2013

Applications with flat-fan type nozzles can cause leaf damage, increasing with the addition of oil or wetters. Temperatures >18oC, Delta T conditions <2 >8, higher application rates and importantly crop growth stage, all play a role in visible damage, but more critically can impact yield loss. Streaming nozzles (SJ) are used to apply Easy N to minimize leaf damage.

GS32 applications saw no yield differences, however Easy N applied with streaming nozzles gave a significant protein increase over Urea.

GS39 applications provided no significant differences in yield, except the Easy N FF+FG treatment (Prosaro fungicide, wetter and Easy N) which was significantly less than the other treatments. This yield decrease can be attributed to large degree of leaf burn (see Photograph 1 below). Easy N flat-fan applications at 94l/ha (40kgN/ha) did not decrease yield compared to Urea and Easy N streaming nozzle applications. Protein levels were significantly higher in the Urea and Easy N FF + FG treatments.

Photograph 1 – Easy N + Prosaro fungicide and wetter applied at GS39 with

flat-fan nozzles. Incitec Pivot Fertiliser Trial Site – Dookie 2013

At GS69, another 20kgN/ha was applied that did not increase yield of any treatments. However, both of the Easy N treatments (FF and SJ) significantly increased grain protein.

As wheat crops develop and yield potential increases, opportunities remain to apply Nitrogen to match yield increases up to boot growth stage. Nitrogen applications around flowering can positively influence grain protein levels. These applications need to be considered in conjunction with price differences in protein spreads, efficiency of Nitrogen applications, and confidence in moving up to the next protein grade.

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To calculate Nitrogen required to lift protein, there has to be a base assumption of no yield increase. The efficiency of Nitrogen uptake will decrease with later applications and rainfall events will assist in recovery. As the seasons progress, it can be demonstrated that Easy N is the product of choice.

To influence grain protein the following calculation can be used as a guide to :

a. determine the Nitrogen rate to increase protein values

b. assess the associated cost of Easy N as the Nitrogen source

c. assess the potential return net of fertilsier cost, of moving wheat grade from ASW to APW

Yield X Protein Increase X Protein Factor (constant) X N Fertiliser Efficiency

1t/ha X 1% X 1.75 X 40% = 4.4kgN/1 tonne grain over a 4t/ha yield = 17.6kgN/ha

@ $1.54/kgN (Easy N bulk delivered on farm Swan Hill) = $27.10/ha

1t/ha X 1% X 1.75 X 30% = 5.8kgN/1 tonne grain over a 4t/ha yield = 23.2kgN/ha

@ $1.54/kgN (Easy N bulk delivered on farm Swan Hill) = $35.70/ha

Using the data in Table 1 below, if the protein level of wheat was moved from an ASW grade to an APW grade on a 4t/ha yield, it would represent a net increase in return of $32.90/ha at 40% fertiliser efficiency, or $24.30/ha at 30% fertiliser efficiency.

2020/2021 MG Spreads	Multi Grade Spreads - Wheat					
	H1	H2	AUH2	APW1	ASW1	AGP1
Melbourne	8	4	-5	BASE	-15	-30
Port Kembla	10	5	0	BASE	-15	-25

Table 1 – Current (18/8/20) AWB price MG protein spreads.

For more information on making the most of your fertiliser programs, please contact me on lee.menhenett@incitecpivot.com.au / 0412 565 176.