Do high inputs always lead to high returns?

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Take home messages:

- The highest yielding plots were the 'Medium' input which was 150kg urea at tillering and 100kg/ha urea at stem elongation
- The High input plots were the lowest yielding
- Protein levels were directly related to nitrogen at stem elongation
- Nitrogen response is varied depending on timing of application so make decisions wisely!

Location: Westmere
Crop: Wheat
Variety: Beaufort

"Expect the best. Prepare for the worst. Capitalise on what comes." Zig Ziglar.

Objective

A high input trial was created in 2012, with the aim of demonstrating that a crop will continue to respond to nitrogen if the season is suitable, leading to higher yields. Results were interesting and perhaps create more questions than answers in the quest to understand the relationship between nitrogen, yield and protein.

Results

In 2012, many growers in the western districts under supplied their crops with nitrogen. Although most growers were happy with their yields many crops had proteins which were generally lower than desired across the board. Making decisions on nitrogen amounts and timing in August and September is extremely difficult when conditions in the late spring are so uncertain and many growers have not seen a return on a late application of nitrogen as tight finishes in recent times have become the norm.

Timing of application

Due to uncertainty of seasonal conditions, applying nitrogen in smaller doses, rather than upfront, is a wiser way to apply nitrogen. This practice has been readily adopted in the HRZ, where nitrogen is usually put out in a split application, often during the stem extension phase (GS 30 onwards) for optimum contribution to yield components. Applying N at stem extension can have a significant bearing on the numbers of grain sites per ear, which is a key determinant in influencing crop yield.

Applying too much nitrogen prior to stem extension, say during tillering, can boost the number of tillers which survive, which can be a good thing in a good season, but can also produce significantly more dry matter, using

valuable nutrients and stored moisture, that may not necessarily improve yield. There is little point producing lots of tillers if the tillers don't go on to be grain producing stems.

Manipulating a wheat canopy with sowing rates and timing of nitrogen is based around the concept of canopy management and ultimately producing an optimum number of viable heads per square metre. In the western districts we should be aiming for 400 – 450 ears per square metre to provide for a yield potential of around 8t/ha given the right conditions. Any extra heads are wasteful in terms of plant resource and the increase in dry matter has a greater chance of using too much soil moisture which is often at a premium.

The timing of the nitrogen application as urea also needs consideration with regards possible losses due to volatilisation and caution is needed for any late applications used in a split application.

Table 1. Inputs and results

Treatment	Yield (t/ha)		Protein (%)		Screenings (%)	
Normal (Urea -150kg/ha at tillering GS22)	7.00	ab	9.9	c	7.5	a
Medium (Urea - 150kg/ha at GS22 + 100kg/ha GS 31)	7.11	a	11.3	b	7.0	ab
High (Urea - 150kg/ha at GS22 + 200kg/ha GS 31)	6.36	b	12.4	a	6.0	b
Lsd (p= 0.05)	0.74		0.9		1.2	

A quick look at the results (see Table 1) shows that surprisingly, the high input treatment was not the highest yielding. In fact, it yielded significantly lower (p=0.05) than the medium and low input treatments. Looking at the data tells us that there was a 750 kg/ha decrease in yield when an extra 100kg/ha of urea was applied at GS31. So where did this nitrogen go? The clue is in the increase in grain protein suggesting that with the tight finish to the spring these crops didn't have sufficient moisture for any further yield increase over the medium treatment. Applying 200kg/ha at GS31 to a crop canopy that had already had 150kg/ha of urea at tillering provided a classic situation for the crop to 'hay off 'as the canopy was too large, given the finish to the season.

What about protein?

Late nitrogen that isn't utilised by the crop for grain yield will contribute to increased grain protein; which may be of significance to you if you require minimum protein levels. A grain protein level of less than 11.5% indicates that the nitrogen available to the crop during the season may have been insufficient and grain yield would almost certainly be increased if more nitrogen fertiliser had been applied. Given this rule of thumb, the results are quite interesting. The highest protein was seen in the high input treatment, which ironically had the lowest yield.

What does this mean for me?

The utilisation of nitrogen in crop is rather complex and can change season to season depending on the conditions. Being prepared to make the most of opportunities as they present themselves through the season can be important particularly if you are aiming toward a certain market, to prevent falling short. Knowing your starting soil nitrogen level can mean less money wasted on over feeding the crop and this can also work the other way, by not falling short in potential yield, particularly if there is sufficient moisture in the profile.