Be careful on the (yield) curve

Nitrogen recommendations for cereal crops

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The dramatic increase in fertiliser costs, particularly nitrogen, has led many farmers and advisors to rethink how we use nitrogen on cereal crops. While the increase in grain prices is welcome, it is unlikely to fully cover the increased fertiliser costs, especially if yields are less than optimum.

So, when you are developing a fertiliser plan for your crops this year, there are three key questions that need to be answered when it comes to nitrogen use;

• Firstly, how much should I apply to my cereal crop? This might sound simple, but it is actually quite complex, as it depends on a number of factors like the crop itself, the rotation and the potential yield.

The nitrogen fertiliser recommendations in Table 1 are derived from the Teagasc Green Book and the current Nitrates Directive. The data shows the nitrogen index rate based on the cropping history and the recommended rates for the different cereal crops. Index 1 areas have low soil nitrogen, while index 4 soils are considered to have high levels of available soil nitrogen.

Where average yields for the farm are higher than the reference yields, an extra 20kg/ha of nitrogen per additional tonne of yield is normally justified. However, be aware that these rates are based on optimum agronomic performance and not optimum economic performance in the current climate.

With the cost of nitrogen now in excess of €2.50/kg, the economic return from applying extra nitrogen has to come into question. We know that the yield response to additional nitrogen increases rapidly at lower rates, but as we reach the optimum rate for the crop, this rate of increase decreases. Eventually, there is no yield response to additional nitrogen and you may risk crop lodging.

As the rate of yield response to additional nitrogen decreases, then at some point, the extra yield achieved doesn't cover the cost of the nitrogen, which is called the Break Even Ratio (BER) i.e the point at which the extra yield stops covering the cost of the additional nitrogen.

In a normal year, we would expect 3.5kg of grain to pay for 1kg of nitrogen. It now takes approximately 12kg of grain to pay for 1kg of nitrogen.

Based on the current grain price compared to the cost of nitrogen, the rates shown in the table should be adjusted downwards by 20-30kg/ha for wheat and barley.

There is little yield response in spring barley over, on average, 150kg/ha. Applying extra nitrogen above this level is not economic. Most of the yield is achieved when up to approximately 120-125kg N/ha is applied.

The level of yield increase from approximately 125-150kg/ha is lower, but is economically justified in years when fertiliser prices are lower.

Therefore, the current rate of nitrogen to give the best financial margin for spring barley on an index 1 site is somewhere between 120-130kg/ha.

If you are trying to achieve a 7.5t per hectare crop based on Table 1 (135kg + 20 kg (bonus yield) – 30 kg), this may reduce yield by 0.2-0.5 t/ha.

However, if you are normally applying 125-130 kg of nitrogen to your crop e.g malting barley, then reducing the rate of nitrogen applied further could lead to larger decreases in yield.

• Secondly, how can I reduce the cost of the nitrogen? Simply applying less will reduce the cost, however, as mentioned, we have to be careful that there may be a yield penalty if we decrease the rate too much unless there are other factors to consider.

There is scope to decrease the amount needed if the cereal crop is following a break crop like oilseed rape or beans, for example, as outlined in the table. Crops following beans, ie soil index 2, typically need 30kg/ha of nitrogen less than those after a cereal crop.

Where organic manures are available, not only are they a source of P and K, they are also a source of nitrogen, with poultry manure having the highest levels. Farmyard manure has the lowest nitrogen level.

In order to capture as much of the nitrogen as possible, manures must be incorporated soon after application, ideally within four hours. So, there is a logistical hurdle that needs to be dealt with in using organic manures.

Another option to reduce the cost of the nitrogen is to look at the different nitrogen sources other than CAN, often the most expensive. Urea, if available, is generally 20% cheaper per unit of nitrogen than CAN and is certainly an option on winter crops. It will be riskier to spread in dry

Table 1: Recommended nitrogen rates at different soil indices.

Crop	Reference yields (t/ha)	Nitrogen index			
		1 (kg/ha)	2 (kg/ha)	3 (kg/ha)	4 (kg/ha)
Winter wheat	9.0	210	180	120	80
Spring wheat	7.5	160	130	95	60
Winter barley	8.5	180	155	120	80
Spring barley	6.5	135	100	75	40
Winter oats	7.5	145	120	85	45
Spring oats	6.5	110	90	60	30

weather on crops like spring barley.

It is slightly more difficult to spread at wider tramline widths (see also article by Dermot Forristal and Francis Quigley), but up to 24m there should be no issues. Also, as the product contains 46% nitrogen, you need less actual kilos of product than you do with CAN. So there is a small saving on fuel when using urea-based products rather than CAN.

Protected urea products generally cost the same as CAN. The product can be safer to use than normal urea and there is a small saving in the cost of fuel for applying it over CAN.

Farmers are increasingly interested in using liquid forms of nitrogen that can be applied using the sprayer. This is more accurate and again, in theory, should reduce costs. This is especially the case on headlands or short ground, especially if using GPS-enabled sprayers with automatic shutoff on the booms.

The actual cost of the product, the cost of additional nozzles, the cost of storage tanks and possible extra passes through the crop, all need to be taken into account to establish if this is indeed a cheaper way of applying nitrogen.

• Thirdly can I use my nitrogen more efficiently? As I mentioned previously, the marginal yield response to nitrogen decreases as the rates applied get higher. Therefore, in theory, if we used slightly less than the recommended rates, we may increase the efficiency of the product used.

Here are a few more tips to get the most from your nitrogen:

•**Apply lime** – where pH is low, fertiliser use efficiency will be lower than if the soil pH is in the optimum range.

•**Spreader set up** – make sure that the fertiliser spreader is serviced and set properly for the fertiliser being used i.e CAN, urea and protected urea each require different settings.

•**GPS** – where GPS-enabled spreaders are available, they will help to apply the nitrogen more accurately and ensure maximum efficiency by reducing overlap, etc.

•**Conditions** – only apply nitrogen fertilisers when conditions are suitable e.g soil temperatures should be over 5°C, no heavy rain is forecast and there is some growth for the plant to take up the nitrogen.

•**Trace elements** – where there are known trace element deficiencies, correct these before nitrogen is applied. This will help to increase nitrogen use efficiency.

•**Stress** – don't apply nitrogen if crops are stressed, as they are unlikely to use nitrogen efficiently.

•**Yield potential** – not all fields have the same yield potential (consult your memory or records). Avoid over-applying on fields or areas where the known yield potential is low.