Castlemains
Nutrient budgeting

The sixth meeting of the Castlemains Climate Change Focus Farm discussion group met at Dirleton Church hall for a meeting on nutrient budgeting.

Key points:
• Good soil management, correct nutrient applications and target pH ensures availability of soil nutrients
• Five essential soil nutrients: nitrogen, phosphorus, potassium, magnesium and sulphur.
• Work out the nutrient requirements for your crop using the technical notes.
• GPS soil sampling can help identify variation within a field and can target nutrients and lime more accurately

Know your soils
Soil management and nutrients

Previous meetings at Castlemains have focussed on soil structure and organic matter, which are important for maintaining good soils and productivity of the farm. In addition to assessing soil structure, soil testing for pH and nutrients is crucial to getting the most out of your soils and should be the starting point for planning nutrient applications. Routine soil analysis (24 cores taken in a W shape across the field) will give pH, P, K, S and Mg along with some other trace elements. A pH of 6.2 should be aimed for in an arable field. The chart below shows the influence of soil pH on nutrient availability, highlighting the importance of maintaining soil pH.
**Essential nutrients**

Good nutrient management for crop growth

There are five essential crop nutrients for crop growth; nitrogen, phosphorus, potassium, magnesium and sulphur.

**Nitrogen** is the yield driver, and is important for tillering and increased grain protein content. Recommendations for arable crops are based on previous crop, soil type and market for the crop. Farmers should be aware of the break even ratio for nitrogen applications and yield response of the crop. In addition, farms in the Lothians and Borders NVZ area need to be aware of the restrictions on nitrogen applications. To ensure good utilisation of nitrogen farmers should aim for well drained soils to prevent the release of nitrous oxide and good soil structure to maximise crop available nitrogen.

**Phosphorus** is essential for crop establishment, even crop ripening and root development. In oilseed rape it improves resistance to stress such as drought and cold weather, improves disease resistance and yield. Phosphorus availability is reduced on acidic soils or very alkaline soils, and soils with low organic matter. Recent research has highlighted that some areas, such as much of East Lothian, require more phosphorus to lift the levels in soils than other soils. In these areas, farmers should aim for a M+ status rather than M– for P.

**Potassium** is required to give the crops lush, green growth, increased yield and grain quality. Potassium availability and uptake is affected by low pH, light or sandy soils, heavy clay soils, soils with low K reserves and magnesium rich soils. During the peak growing season, the standard K recommendation is not enough, which can cause problems if the soil K status is low. It is essential to know your soil status and ensure that timings of K applications are targeted at peak growth (before GS30).

**Magnesium** is important for crop establishment, improved winter hardiness and tillering, and better grain quality. Deficiencies are worse on sandy soils, acidic soils, potassium rich soils, soils receiving high potash applications and cold wet periods.

**Sulphur** is needed for healthy green foliage, even crop maturity, more efficient use of nitrogen by the crop, even crop maturity, more efficient use of nitrogen by the crop, and improved grain protein content in cereals. In oilseed rape it encourages flowering and boosts grain yield and oil content.
Nutrient budgeting
How much of each nutrient do you need?

Nitrogen requirements can be calculated using the SAC Technical Note TN651, which uses soil type, previous crop, and market and yield adjustments to give a suggested nitrogen application rate for different crop types. It is worth bearing in mind that the Break Even Ration (BER) for applying fertiliser at the recommended rates fluctuates due to volatility in the fertiliser and grain prices, so it may not always be cost effective to apply the maximum rate recommended. For those in the Lothians and Borders NVZ area, make sure that nitrogen applications are also within the nmax limits for each crop type.

P and K recommendations can be found in the SAC Technical note TN633, and are worked out using the soil status, and P and K offtake depending on whether straw is removed or chopped. Remember that soil testing only tells us whether sufficient P and K is available in the soil, it does not predict crop uptake, which depend on crop, yield potential, rooting depth and weather.

These figures can then be multiplied up by yield to work out how much of each nutrient is required on a moderate soil. For example, for winter wheat yielding 9t/ha and removing straw, you will need to apply 76kg of P/ha and 94kg of K/ha. Where soil status is low, an additional 40kg/ha of P is required and an additional 20kg/ha of K is required to supply crop need and build the soil status up to moderate.

PLANET is a nutrient budgeting programme that can help plan your nutrient applications, and it also helps comply with the NVZ rules. Castlemains has been soil sampled and the information was run through PLANET. Using the current cropping year, there are some fields where savings can be made when compared with Bob’s usual fertiliser applications, due to soil status for P and K being high, or where he has applied organic manure in the autumn. Over the entire farm, if the new recommendations are adopted, savings of around £2,700 in fertiliser costs could be made.

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<thead>
<tr>
<th>Crop</th>
<th>Straw Removed</th>
<th>Straw Retained</th>
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<tbody>
<tr>
<td></td>
<td>P Removal (kg/t)</td>
<td>K Removal (kg/t)</td>
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<tr>
<td>WB / WW</td>
<td>8.4</td>
<td>10.4</td>
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<td>SB</td>
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<td>11.8</td>
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<td>WOSR</td>
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GPS soil sampling
Smart farming to save fertiliser and target applications

Hamish Knottenbelt from Soil Quest spoke about the technology available to help more accurately apply lime and fertilisers to target applications where they are needed, often saving in fertiliser costs and reducing wastage. GPS mapping and zone management allows you to map the soils into smaller zones than full fields, and will ultimately lead to more accurate applications. Mapping of soils can show huge variations within fields of pH and nutrients. Where soil status is below target for P and K, zone mapping can help to bring the whole field up to a more even range, and whilst may cost more in fertiliser, the benefits should be seen in yield increase. One in four soils in the UK is deficient in P, which equates to a £38/ha loss in yield on low soil status, or £112/ha on very low soils. One in three soils is deficient in K, which can lead to a £105/ha yield loss, on low soils, and £195/ha yield loss on very low soils.

What’s next?
The next meeting will be on tyre selection and management, with demonstrations from Redpath Tyres and Michelin. The meeting will be on Thursday 16th February from 11am to 2:30pm.

Meetings are free to attend and all farmers are welcome.

For Castlemains, contact farm facilitator Mary-Jane Lawrie on 0131 603 7523 or via email at mary-jane.lawrie@sac.co.uk for more information.

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