

Estimating Soil Nitrogen Supply (SNS)



Gouge auger

Estimating Soil Nitrogen Supply (SNS) is an important step in determining the nitrogen requirement of a crop. It can be estimated using either the Field Assessment Method (FAM) or by measuring Soil Mineral Nitrogen (SMN, nitrate-N plus ammonium-N).

Which method should be used to estimate SNS?

In most continuous arable fields not receiving organic manures, SNS is likely to be small or moderate (below 120 kg/ha) and can be estimated most cost-effectively by the **field assessment method (FAM)**.

Careful identification of the soil type and soil organic matter content is very important to get an accurate FAM estimate. See the Fertiliser Manual (RB209) or SAC Technical Note TN625 for further details.

Measuring Soil Mineral Nitrogen (SMN) on a few fields can provide a useful check of how SNS on a farm compares to that estimated by the field assessment method.

Measuring SMN becomes progressively more worthwhile on a field-by-field basis as SNS (as predicted by the FAM) increases beyond 120 kg/ha. Measuring SMN is also useful where SNS is uncertain, for example:

- Fields in which organic manures have been regularly used
- Where grass has been ploughed out, although the FAM should be used in the first season
- Following a vegetable crop that has left N-rich residues

SMN measurements are most useful on silt and clay soils in low rainfall areas. They are less worthwhile on light and shallow soils and should not be used on peat soils.

The process of measuring SMN is described in the Fertiliser Manual (RB209) and HGCA's *Nitrogen for winter wheat – management guidelines*; however, aspects of the process are clarified here.

Measuring Soil Mineral Nitrogen (SMN)

When estimating SNS by measuring SMN:

$$\text{SNS} = \text{an estimate of crop N} + \text{a measurement of SMN} + \text{an estimate of subsequent N mineralisation}$$

For a worked example, see HGCA's *Nitrogen for winter wheat – management guidelines* (page 11).

Estimating crop N

Crop N, for both winter cereals and oilseed rape, should be estimated when soil samples are collected and should be included in the estimate of SNS (Table 1).

Table 1. Estimate crop N using Green Area Index (GAI)

| Wheat GAI | Crop N (kg/ha) | Oilseed rape GAI | Crop N (kg/ha) |
|-----------|----------------|------------------|----------------|
| 0.5 | 15 | 0.5 | 25 |
| 1.0 | 30 | 1.0 | 50 |
| 1.5 | 45 | 2.0 | 80-100 |

Action

Estimate SNS by either the field assessment method (FAM) or by SMN measurement.

When using the FAM, careful identification of soil type and soil organic matter is important.

Adopt SMN measurement with caution. Avoid large changes to N use without confirmatory evidence.

Sample from 10-15 positions in a W pattern.

Keep soil samples cool (but not frozen) and have them analysed within three days.

Use SNS estimates to support recommendations in the Fertiliser Manual (RB209) or HGCA's *Nitrogen for winter wheat – management guidelines*.

Always consider your local conditions and consult a professional agronomist if necessary.



Sampling for Soil Mineral Nitrogen measurement

Sampling in the spring (February) gives slightly better predictions of SNS than sampling in the autumn (November) because account is taken of overwinter leaching. The difference on clay and silt soils is small. Avoid sampling within two to three months after application of nitrogen fertiliser or organic manures, or within a month after sowing.

Sampling from 10-15 positions in a W pattern is adequately representative for most fields.

If differences in soil type or past management are large within a field, these areas should be sampled separately. Do not sample unrepresentative areas, such as ex-manure heaps or headlands.

Sampling from more than 10 positions is warranted where fields are highly variable, where fields are larger than 20 ha or if SNS is expected to be high (>160 kg/ha).

Each position should be sampled at three depths in the spring: 0-30 cm, 30-60 cm and 60-90 cm. Sampling to 60 cm is adequate in the autumn. Samples from each depth should be bulked. If the bulk sample is too big, sub-sample by taking many small representative portions; do not mix the sample excessively.

Samples should be analysed within three days of sampling. **Samples must be kept cool (approx. 4°C) but not frozen during storage and transport.**

Estimating N mineralisation

For spring sampling, an assessment of the amount of N that is likely to be released following mineralisation should be made. Mineralisation tends to be greater where soil organic matter is high or where there is a history of organic manures or grass. In these situations, a commercial measurement of Additionally Available N (AAN) gives the most useful prediction of mineralisation.

As a crude guide, around 10 kg/ha more SNS may be expected for each 1% increase in soil organic matter above 4% in England and Wales or above 10% in Scotland and Northern Ireland. Where soil organic matter is less than this, mineralisation has generally been ignored until now. However, evidence from HGCA-funded project RD-2007-3425 suggests that, at least after cold winters, an estimate of around 20 kg/ha may be appropriate.

Adopting changes to N use

Large SMN measurements can overestimate SNS and small SMN measurements can underestimate SNS. Uptake of soil N by crops is rarely less than 50 kg/ha, so SNS estimates less than this should be treated as 50 kg/ha and no less.

Unless high SNS results (>160 kg/ha) are confidently expected, they should also be treated with caution.

If Soil Nitrogen Supply estimates indicate that large changes (either increases or decreases) in N fertiliser use are required, crops should be monitored closely through spring for signs of N deficiency or excess and the planned N strategy should be adjusted if necessary. It may be best for changes in N use to be introduced gradually over a few seasons so that experience can be gained of effects on crop performance.

Overview

This publication is based on HGCA project RD-2007-3425, which investigated SNS in more than 160 winter cereal crops between 2008 and 2010.

Project partners were: ADAS, Ecopt, Eurofins, GrowHow UK Ltd, HDC, HGCA, Hill Court Farm Research, NIAB TAG, NRM Laboratories, PGRO, PlantNutrition Consulting, Rothamsted Research, SAC and Scottish Agronomy.

Further information

Daniel Kindred, ADAS
daniel.kindred@adas.co.uk

Stuart Knight, NIAB TAG
stuart.knight@niab.com

James Holmes, HGCA
james.holmes@hgca.ahdb.org.uk

Fertiliser Manual (RB209)
www.defra.gov.uk/rb209

Nitrogen for winter wheat –
management guidelines (HGCA,
2009)
HGCA Project Report 485
HGCA Project Report 490
www.hgca.com/publications

HDC Factsheet 09/12 Soil Nitrogen
Supply for field vegetables
www.hdc.org.uk

Crop nutrition for potatoes (Potato
Council, 2009) www.potato.org.uk

Tried and Tested
www.nutrientmanagement.org

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