

What's new to help nitrogen decisions in spring 2010?

The information below is provided by ADAS and has been agreed with Defra.

Summary

- Crops emerging from the winter are variable so crop inspection of each field is essential to judge the need for early N. Thin or backward crops justify some early N (40 kg/ha to cereals, up to 100 kg/ha for rape) applied between mid/late Feb to early March when ground conditions are suitable.
- The map of winter rainfall (to 27 Jan) indicates that, if there is normal rainfall in February and March, many areas will end up having an average or wetter than average winter. Where this is combined with thin or backward crops with low N uptake, then SNS levels this spring might be slightly lower than average – *but every field must be judged individually!* An updated map will be issued in late March.
- SNS levels will often be high where organic manures have been used, crops have under-performed or have been over-fertilised; SMNs will usually be low where there have been long runs of combinable crops with no manures applied.
- SMN analysis (before any N is applied) is not a precise measure but is very worthwhile to estimate the SNS 'ball-park' in fields where large and unpredictable soil nitrogen residues are suspected (e.g. where there have been regular manure applications).
- SMN samples must reach the laboratory with minimum delay. Ongoing research indicates that results can increase by up to 10% for each days delay between sampling and analysis, even when samples are kept cool.
- The Breakeven ratio (BER) for cereals this year is around 5.5-6, and 2.5 for oilseed rape.
- A table of the NPK content of different types of organic manures is provided with their current financial value. Allowing for these nutrients can result in large financial savings.
- All farms and land inside an NVZ must comply with all the NVZ rules. Key requirements now are to plan nitrogen use in each field (SNS, crop N requirement, crop available manure N, fertiliser N) before applying any N, and keeping the required field records (a common failing). Non compliance can result in a reduction in the Single Farm Payment.
- The NVZ N max limit for spring N applied to oilseed rape is now 250 kg N/ha but including any N applied in the autumn.
- Applications for a derogation to the NVZ Livestock Manure N Farm Limit (170 kg N/ha) must be submitted by 31 March. To be eligible, farms must have 80% or more as grassland.

Soil N residues in autumn 2009, and over-winter rainfall

The amount of soil N supply in spring largely depends on the soil N in autumn 2009, and the leaching of this N overwinter. Factors that can result in higher than average soil N residues are:

- Regular, or high application rates of organic manures. Figure 1 shows the large effect of manure use on SMN levels (72 kg/ha N where no manures ever; 125 kg/ha where manures applied in the previous autumn).
- Unexpectedly low yielding crops.
- Crops leaving lots of leafy debris (e.g. leafy veg) or milling wheat that has received high N rates in order to achieve 13% grain protein.
- Runs of crops that have been over-fertilised.

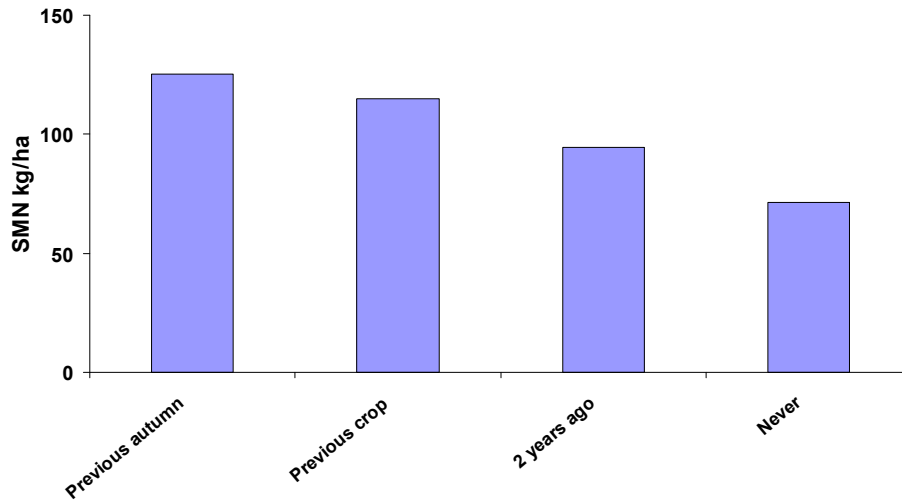


Figure 1. Autumn SMN (kg/ha N) according to use of organic manures (data from over 500 analyses, Defra NIT18 project)

Since 2009 was a year of considerable variation in crop performance due to a dry spring followed by a wet summer in many (but not all) areas, it is important to reflect on the performance of last year's crops when assessing likely soil N residues for 2010. For instance, crops yielding well (e.g. 1st cereals, oilseed rape) are likely to have lower than average soil N residues last autumn than poor low yielding crops (e.g. 2nd cereals). Generally in 2009, 1st cereals yielded well but grain proteins on average were lower (11.6%) than the long term average (12.2%) especially in the SW (source: HGCA Grain Quality survey).

The amount of N leaching will depend on the rainfall to the end of March (or later) and the soil type (sandy soils leach more quickly than heavy soils). So far this winter, although there have been wet and dry periods, overall there has been an average or above average amount of winter rainfall in most places. Figure 2a) shows the map of 'excess winter rainfall (EWR)' up to 27 January 2010. This is the amount of rainfall that drains through a soil causing leaching of nitrate that was left in the soil following harvest of last year's crop. For comparison, Figure 2b) shows the long term average winter rainfall for a full winter period.

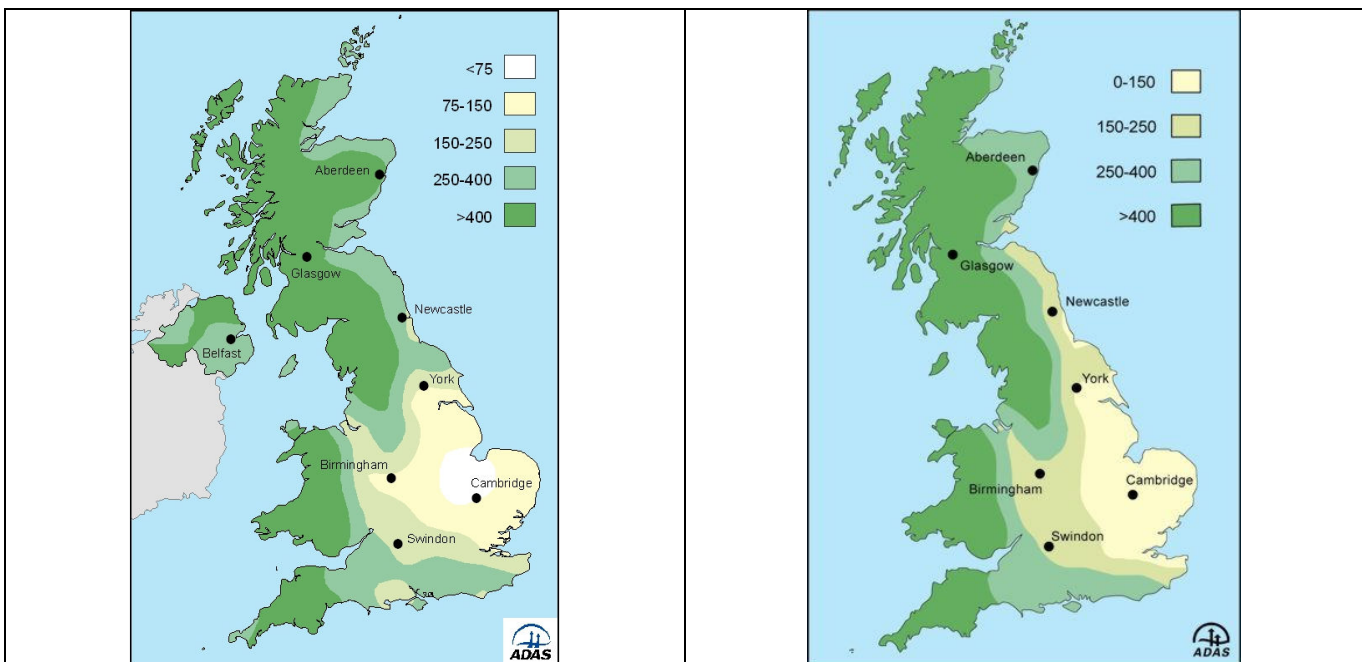


Figure 2a). Excess winter rainfall to 27 January 2010

Figure 2b). Long term average excess winter rainfall (whole winter)

Comments

- The winter is not yet over! Soils usually continue to drain until the end of March or later. This means that the amount of rainfall in February and March will influence the overall leaching of autumn soil N residues, and what is left for uptake by spring crop growth.
- The winter rainfall map to 27 January indicates that, if there is normal rainfall in February and March, many areas will end up having an average or wetter than average winter. Where this is combined with thin or backward crops with low N uptake, then SNS levels this spring might be slightly lower than average – **but every field must be judged individually!**
- An updated rainfall map will be issued at the end of March.

Making best N decisions this spring

Early spring N

Recent cold and wet weather means that most soils are currently wet and cold, and there has been no significant crop growth since November. This means that most crops are either in average or poor condition, with few advanced crops (well tillered or good canopy cover). The forecast is for more cold weather so the start of spring growth is still some way off.

- If not already done, field inspection of each crop in February will be essential to judge the need for early spring N. Crops that are likely to benefit from early spring N (40 kg N/ha for winter sown cereals; up to 100 kg N/ha for winter oilseed rape) are shown below. This N will encourage tillering and canopy development.
 - Thin or backward crops.
 - 2nd cereals where take-all risk is high
 - Cereals intended to be processed for bio-fuel where starch not protein is wanted
- Do NOT apply early N to:
 - crops with lush canopies, shoot numbers over 1200/m² by spring, or where organic manures have been applied recently.
 - Oilseed rape with a Green Area Index (GAI) over 2. Go to www.totaloilseedcare.co.uk to estimate GAI from a digital photo of the crop.
- Early spring nitrogen applications should not be made until soils have dried out and warmed up a bit, even if this is not until early March.
- **Do not apply nitrogen to waterlogged, frozen or snow covered ground.** This is financially wasteful as it can result in surface runoff and N losses into local watercourses, and denitrification to nitrous oxide, a powerful greenhouse gas. *In NVZs, application of N under these ground conditions is not allowed.*

Main dressings

Final decisions on main dressings cannot be made now, but should take account of various factors including:

The Soil N Supply (SNS). This can be assessed using the Field Assessment method including allowing for seasonal weather and crop growth (as discussed above), or by soil sampling and analysis (see below).

Previous crop performance. Reviewing how previous crops have performed is important to help N decisions for the current crop. The crop is often (in hindsight) the best indicator of whether N use has been right, and this 'experience' can be used to adjust N use for future crops.

- Use grain N/protein% of previous feed wheat crops to judge if N use has been too low, about right or too high. The optimum grain protein content is around 11% (1.9% N).

- Crop lodging can indicate excessive use of N.

The Break-even Ratio (BER). N fertiliser prices are much lower this year but grain prices are also weak. Based on ammonium nitrate at £200/t (58p/kg N) and grain at £100/t, the BER for cereals is 5.8. This is very close to BER 5 which is the basis for the N recommendations given in the HGCA 'Nitrogen for winter wheat – management guidelines' booklet. This difference does not justify any adjustment to these recommendations. For winter oilseed rape, the BER is c.2.5 (seed at £240), so again no adjustment to N recommendations is needed.

Organic manures. The NPK content of all organic manures is very valuable even though fertiliser prices have dropped from last year's highs. Allowing for the NPK content of manures can result in large savings in purchased fertiliser.

- Assess the nutrient content of the manure using standard 'typical' values, or carefully take some samples and get them analysed. Analysis will provide the most accurate information.
- Apply manures to fields where the crop has a moderate/high N requirement (i.e. not peas or beans), or PK requirement (e.g. fields with average or low soil PK Indices).
- Apply manures in the spring (Feb onwards) to make best use of the N content. Slurries and poultry manures can very effectively be topdressed through young growing crops using specialist equipment.
- The NPK content and current financial value of some typical manures is shown below.

	Readily available N ¹	Total phosphate	Total potash	Approx. financial value ²
	kg/t or kg/m ³			£/t or £/m ³
Cattle FYM (old)	1.2	3.2	8.0	7
Pig FYM (old)	1.8	6.0	8.0	9
Cattle slurry (6% DM)	1.2	1.2	3.2	3
Pig slurry (4% DM)	2.5	1.8	2.4	4
Layer manure	9.5	14	9.5	19
Broiler litter	10.5	25	18	30
Liquid digested sludge	0.8	3.0	0.1	2
Digested cake	1.6	18	0.6	11
Green compost	<0.2	3.0	5.5	5

1. Readily available N content is before any losses of N due to leaching or ammonia emission. The values apply to spring application of manures and will be lower from autumn application.
2. £ value is based on AN @ £200/t (58 p/kg), TSP @ £250/t (54p/kg), MoP @ £350/t (58p/kg)

The following information has recently been published to help nitrogen decisions this spring.

- Nitrogen for winter wheat – management guidelines (HGCA, autumn 2009).
- Crop nutrition for potatoes (Potato Council, November 2009)

Soil sampling to assess Soil N Supply (SNS)

Assessing the SNS of a field is a crucial part of effective nitrogen planning and one of the required steps that must be completed as part of the Nitrogen Planning requirement (before any N is applied) for all fields that are inside an NVZ. The Field Assessment method is based on look-up tables of soil type, previous cropping and winter rainfall, but soil sampling and analysis for soil mineral N (SMN) provides a more reliable estimate of the SNS.

Soil sampling and analysis is costly and it is important to recognise that the results only provide an estimate of the SNS to the crop during the season. Due to inherent uncertainties in the measurement and prediction process, it cannot provide a precise measure. Nevertheless, this method is very worthwhile to estimate the SNS 'ball-park' in fields where large and unpredictable soil nitrogen residues are suspected. It is less valuable in fields with expected low N residues that are probably within a narrow and low range. Target fields for analysis are therefore:

- where organic manures have been used regularly in recent years
- following crops leaving lots of leafy or N-rich crop debris
- where grassland has recently been ploughed out (but not in first year after ploughing)
- in fields where lodging has been a problem, or after a poor or failed crop
- selected 'indicator' fields to assess seasonal variation

When sampling in 2010, most meaningful results will only be obtained if the following approach is taken.

- Sample BEFORE any spring N fertiliser or organic manure is applied. This will usually be between January to March.
- Sample in 3 layers (0-30, 30-60 and 60-90 cm) and from at least 15-20 points in the field. Bulk soil from each layer, thoroughly mix and take a representative sub-sample for analysis.
- **Make sure that soil samples reach the laboratory with the minimum of delay after sampling (e.g. within 48 hours).** Ongoing HGCA-funded research is showing that, for some soils, results can increase by up to 10% for each days delay between sampling and analysis, even when samples are kept cool. Refrigeration seems to have little effect on this change. Do not freeze the samples.
- Choose a recognised laboratory. The main laboratories are working together to ensure consistency in SMN analysis results.
- Make sure that the laboratory provides an analysis for nitrate-N and ammonium-N which are immediately available for crop uptake. An assessment/analysis should also be made of the amount of N that will be released during the season due to mineralisation. This is most likely to be useful on soils of above average organic matter content.
- At the time of sampling, it is essential to assess how much N is already in the crop. This can be a significant amount for advanced crops.

Cereals (shoots/m ²)	Crop N content (kg N/ha)
500	5-15
1000	15-30
1500	25-50
Oilseed rape (crop height, cm)	
10	35-45
15	55-65
20	75-86

The Nitrate Vulnerable Zones (NVZ) regulations, and Amendments (in force from January 2010)

From January 2009, the area of designated NVZ land increased to 68% in England, and a range of new NVZ regulations came into force.

Land or holdings within new NVZs (i.e. designated in 2008 for the first time) must now comply with the rules from January 2010 except where there are special transition arrangements.

In January 2010, some amendments to the regulations also came into force (The Nitrate Pollution Prevention (Amendment) Regulations 2009; SI 3160) – see below.

Key points of the NVZ regulations, including amendments, that need to be thought about this spring are as follows.

For individual fields this spring

- A Nitrogen Plan must be prepared before any manure or N fertiliser is applied to the crop. The soil N supply, crop N requirement, crop available N from manure applications and the need for manufactured fertiliser N must all be assessed or calculated. Records must be kept of the Nitrogen plan for 2010 crops before applying any nitrogen this spring, and of each fertiliser and manure

application after application. These records must be available for inspection and kept for at least 5 years (Guidance leaflet 6).

- DON'T apply (Guidance leaflets 8 and 9):
 - manufactured nitrogen fertiliser or organic manure if the soil is waterlogged, flooded, frozen or snow covered (under extreme conditions, farmers should seek advice from the EA),
 - organic manure within 10 metres of a surface water, or 50 metres of a spring, well or borehole,
 - N fertiliser within 2 metres of surface water.
- All other required field Records must be kept, including details of the crop grown, the use of nitrogen fertiliser and manure following application, and any written advice from a FACTS qualified adviser. All records must be available for inspection and kept for at least 5 years (Guidance leaflet 6).
- The quantity of N applied (from manufactured fertiliser plus livestock manure N) must not exceed the N max limit for the whole area of each crop type grown on the farm (Guidance leaflet 7).
Amendment:- The N max limit for spring N applied to winter oilseed rape is now 250 kg N/ha but including the quantity of autumn N applied (previously 220 kg N/ha irrespective of autumn N). The limit of 30 kg N/ha in the autumn is unchanged.
- The amount of total N in organic manures applied to land must not exceed 250 kg N/ha in any rolling 12 month period (Guidance leaflet 8).
- By 1 January 2010, a Risk Map of the farm must be prepared to identify suitable field areas for manure applications, and for locating temporary field heaps of solid manures (Guidance leaflet 8).

For whole farms that carry farm livestock

- By 1 January 2012, there must be at least 6 months storage capacity for pig slurry and poultry manures, and at least 5 months storage capacity for cattle and other types of slurry. By 30 April 2010, farms must have a record of their storage requirement using the required calculation method (Guidance leaflet 4).
- Show compliance with the Livestock Manure N Farm Limit – 170 kg N/ha produced by livestock in a calendar year. *New from January 2010 – the Derogated Livestock Manure N Farm Limit. Farms with more than 80% grassland are eligible to apply for a derogation to the 170N limit. The derogation allows up to 250 kg N/ha/year produced by livestock but extra conditions apply. Applications for a derogation in 2010 must be submitted by 31 March (Guidance leaflet 5a).*
- By 30 April 2010, Records of livestock on the farm and the compliance calculations must be available for inspection (Guidance leaflets 5 and 6).

Full details of the NVZ rules can be found in Defra's NVZ Guidance leaflets (go to <http://www.defra.gov.uk/environment/quality/water/waterquality/diffuse/nitrate/help-for-farmers.htm>, or ring 0845 955 6000 for a copy).

Further important clarification of the rules by the EA can be found in the NVZ Q&A at <http://www.environment-agency.gov.uk/business/sectors/54714.aspx>.

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