

NPKS fertiliser decisions – things to think about in spring/summer 2010

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

Summary

- Total overwinter rainfall (to 24 March) indicates that winter 2009-2010 was wetter than average in many arable areas. This can be taken into account when assessing SNS Indices in fields using the Index tables in RB209, and may result in slightly higher recommended N rates (up to 20 kg N/ha) in some situations. Final N decisions should also take account of other information, local experience and the performance of previous crops.
- Some reports have indicated that measured SMN levels in early spring 2010 were on the low side. This corresponds with some research evidence that average SMN levels in autumn 2009 were also very slightly lower than normal. However, *delayed* mineralisation this year due to the unusually cold winter may mean that less of this soil N pool was picked up in SMN analyses this year. However, the full contribution of mineralised N is still likely to be available for crop uptake in the spring and summer.
- Most samples for SMN analysis will now have been taken. Any last minute sampling should only be considered if there has been no application of N fertiliser or organic manure this spring. Remember that samples must reach the laboratory with minimum delay, as results can increase by up to 10% for each day's delay between sampling and analysis, even when samples are kept cool.
- Main N dressings may need to be slightly delayed this year but the principles of applying N are unchanged.
- For land inside an NVZ, make sure that all nitrogen applications to crops (fertiliser and livestock manures) comply with the N max limit which is calculated across the whole area of each crop type on NVZ land on the farm. The NVZ N max limit for spring N applied to oilseed rape is now 250 kg N/ha but including any N applied last autumn.
- All farms and land inside an NVZ must also comply with all other NVZ rules. Key requirements now are to keep plans of nitrogen use up to date and to keep the required field records (a common failing). Non-compliance can result in a reduction in the Single Farm Payment.
- Water soluble sulphur should be applied this spring to potential deficient crops. One of the most potentially deficient crops is grass silage and consideration should be given to whether sulphur application is needed to each cut.
- A summary of over 110,000 commercial routine soil analysis results from 2008-09, shows a wide range of soil PK Indices ranging from worryingly low to unnecessarily high.
- 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.

Making best NPKS decisions this spring

Nitrogen rate

Final decisions on main dressings should take account of several factors that are commonly used to help make the best decisions on N use, including:

Winter rainfall. Figure 1a shows the map of winter rainfall to 24 March 2010 compared to the long term average (Figure 1b). This shows that winter 2009-2010 has been wetter than average in most arable areas. When using the SNS Index tables in RB209, there is considerably less land that has had 'Low' excess rainfall (less than 150mm, use Table A), and more land that has had 'Moderate' (150-250mm, use Table B) or 'High' (over 250mm, use Table C) amounts. Some farmers will find that they should be using a different

SNS Index table to normal which may result in a higher N recommendation. However, an increase of more than 20 kg N/ha on normal practice is unlikely to be justified.



Figure 1a). Excess winter rainfall to 24 March 2010

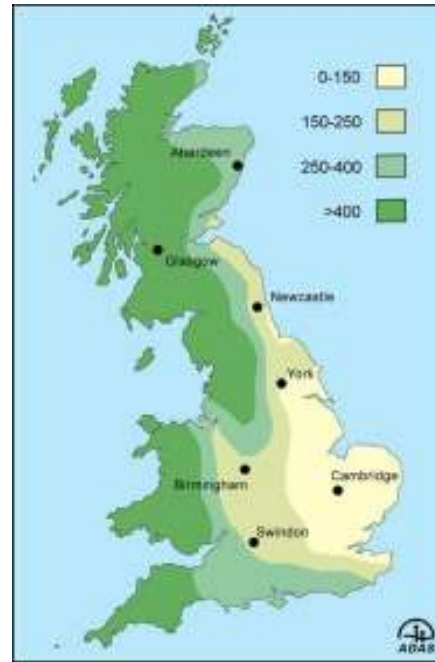


Figure 1b). Long term average excess winter rainfall (whole winter)

The Soil N Supply (SNS). Some measured Soil Mineral N (SMN) results from early spring samplings on arable land are indicating that levels in 2010 may be slightly lower than average though, as usual, actual levels in individual fields are primarily influenced by the soil type and past management of the field.

- Low SNS likely – sand and shallow soils, no organic manures used, combinable crops grown with accurate N management of the previous crop.
- Moderate SNS likely – medium or heavy soils following break crops or combinable crops receiving high N rates (e.g. milling wheat).
- High SNS likely – medium or heavy soils receiving high and/or regular applications of organic manures (see Figure 2).

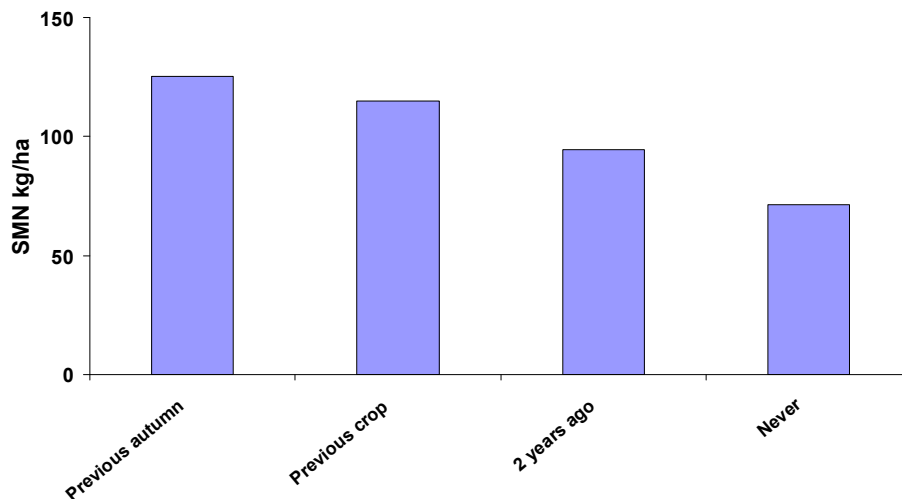


Figure 2. Autumn SMN (kg/ha N) according to use of organic manures (data from over 500 analyses, Defra NIT18 project)

Unusually low SMNs in early spring 2010 may in part be due to the very cold winter resulting in slower release of mineral N from mineralisation of soil organic matter. If there has been a delay in mineralisation, then SMN testing in Jan-March may have picked up less mineralised N than in a normal year. However, this soil N pool is still likely to be released for crop uptake though later than normal in 2010. Our view is that for SMN samples taken in early spring, more allowance than usual should be made for N that will be mineralised in spring and summer – this may mean that average levels of SNS (that also takes account of mineralised N) are close to normal. Unfortunately there is no research evidence to test this, but it should be considered when interpreting the results of SMN tests this season.

Additionally, a long term research study that includes measurement of SMN levels in the autumn before any N leaching, indicates that levels were very similar in autumn 2009 to previous autumns in rotations where organic manures were not used (Figure 3). These SMN data reflect the soil N residues left following harvest in 2009. It is difficult to see consistent differences between different previous crop types though autumn SMN following sugar beet is usually low, and high after peas.

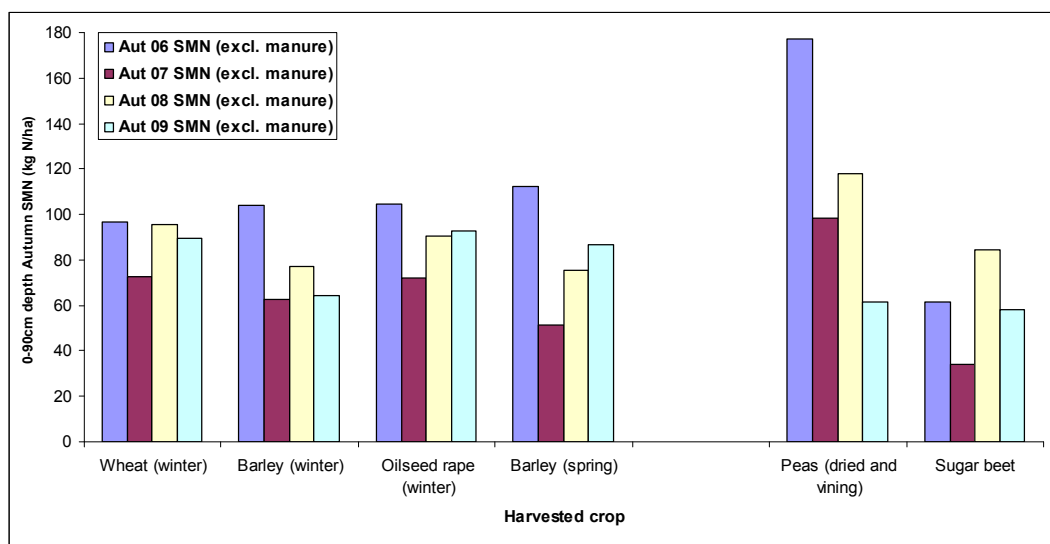


Figure 3. Autumn SMN (kg N/ha in 0-90cm depth) in 2009 compared to 2006-2008 following different previous crops where organic manures have not been used (data from NIT18 research project, over 150 field tested per year)

Yield potential in 2010. Although the long cold winter has delayed crop growth and development, spring has now arrived. Provided we do not now get any particularly unusual weather, most autumn sown crops still have good potential to achieve high yields and should be fertiliser accordingly. Clearly though, if crops have suffered badly due to the weather and are now thin and very backward, then yield potential may be limited. In these cases, consideration should be given to reducing planned N rates.

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 cereal 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. On many farms, ammonium nitrate was bought at or below £200/t (58p/kg N). If grain is valued at £100/t, this would give a BER for cereals of 5.8 Or a BER of 7.2 if AN was bought at £250/t. 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 (AN at £200/t and seed at £240), so again no adjustment to N recommendations is needed.

Compliance with the NVZ N max limit. Nitrogen applied to the main arable crops and grassland grown on land in an NVZ must comply with the N max limit for the crop type. Spring N rates must be set at a level that will not exceed the limit for each crop type grown on the farm. The N max limit is calculated across the whole area of each crop type (e.g. winter wheat, spring wheat, potatoes, sugar beet, grassland) grown on NVZ land on the farm. The N applied as bag fertiliser plus the crop available N from livestock manures (as set out in the NVZ rules) must not be greater than the N max limit. Refer to Defra NVZ Guidance leaflet 7 for full details or use the PLANET software to do the calculations (www.planet4farmers.co.uk or ring 08456 023864).

Nitrogen timing for cereals

Although many crops are more backward than normal at this time of year, nitrogen timing should follow the normal strategy according to growth stage. However, the start of main dressings should not be delayed beyond GS30/31. This is more important this year since, if the weather gets warmer, then crop development will be rapid and careful planning will be needed to make sure that main N dressings can be applied across the whole cropped area without any crop suffering due to N shortage, especially if soil N levels this spring are a bit low.

Nitrogen for oilseed rape

Although many oilseed rape crops have been hit hard by the recent cold weather, recovery is now rapid. The main dressing should be applied at green bud, and the amount of N to use should be judged to achieve a target Green Area Index (GAI) of 3.5 at flowering stage. This canopy size is enough for light interception but does not prevent light penetration into the canopy. Over lush canopies will prevent light penetration, and will reduce pod set and seed yield. Visit www.totaloilseedcare.co.uk to estimate GAI from a digital photo of a crop. Crops with a high yield potential of more than 4 t/ha benefit from an additional late N application at yellow bud / early flowering, although this may need to be brought forward if a prolonged dry spell is predicted.

Sulphur

Sulphur is an essential plant nutrient and deficiency will have a large adverse effect on growth and yield. The symptoms of sulphur deficiency are often similar to those of nitrogen deficiency (i.e. pale leaves in most crops, interveinal yellowing in oilseed rape). Historically, large quantities of sulphur have been supplied for crop growth from atmospheric pollution, but these levels in 2007 were only about 10% of those in 1980. Consequently, more crops need applications of sulphur fertilisers, including cereals, oilseed rape, brassica vegetables, peas and grass. Sandy, shallow or medium textured soils with low organic matter levels are most prone to deficiency which can occur in any part of the country. Leaf analysis is a useful guide for diagnosing deficiency in cereals, oilseed rape and grass.

If deficiency is expected, the best treatment is to apply sulphur in the spring as water soluble sulphate (SO_4), which is rapidly available for crop uptake. Recommended rates are given as $\text{SO}_3\text{-S}$ (to convert S to SO_3 , multiply by 2.5):

Cereals:	25-40 kg/ha SO_3
Oilseed rape:	50-75 kg/ha SO_3
Vegetable brassicas:	50 kg/ha SO_3
Peas:	25 kg/ha SO_3
Grass:	25-40 kg/ha SO_3 per cut

Phosphate and potash

The principles of P and K use are well established but there is still scope on many farms to adjust use to make more cost-effective use of these nutrients. Often this can result in reduced use with no loss of crop yield or quality, though it is not uncommon to find that increased use is needed which can give increases in crop yields. Every field, every farm is different and needs to be assessed individually.

1. **Make sure that there is an up to date soil analysis for each field, i.e. within the last 4 years.** There is wide variation in results between fields. A recent 'Collation of data from routine soil analysis' summarising over 110,000 results from commercial laboratories on samples taken in 2008-09, reported that only 29% of samples were at P and K target Indices. 27% were low in P and 38% low in K indicating that increased P and K use were needed on these fields. However, 44% were unnecessarily high in P and 33% unnecessarily high in K indicating that there may be opportunities to reduce P and K use (see www.nutrientmanagement.org for full report). Fields with high PK Indices are commonly those that have received regular large applications of organic manures over many years.
2. **Calculate the P and K removed from the field in crop produce.** For most crops, P and K is applied to replace offtake with higher rates justified if soil Indices need to be increased and lower rates or none if soil Indices are unnecessarily high. High yielding crops or where crop debris (e.g. straw) is removed, will remove more PK than low yielding crops or where crop debris is incorporated back into the soil. For instance, a 10 t/ha winter barley crop with straw baled will remove 84 kg/ha of phosphate and 104 kg/ha potash, but an 8 t/ha crop with straw incorporated will remove only 62 kg/ha phosphate and 45 kg/ha potash.
3. **Allow for the total PK content of organic manures applied to each field.** Manure PK will often provide enough nutrient for the crop allowing savings in the use of PK fertilisers. The table below gives typical values for the NPK content of common organic manures.

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)

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 that need to be considered 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, and then kept up to date. 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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