Nutrient Management Guide (RB209)

Updated January 2021

FACTS

AHDB

Section 5 Potatoes

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AHDB

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ADAS NIAB CUF

Greenhouse Gas Action Plan:
The industry-wide Greenhouse Gas Action Plan (GHGAP) for agriculture focuses on improving resource use efficiency in order to enhance business performance while reducing GHG emissions from farming.

greenhouse gas action plan

Using the Nutrient Management Guide (RB209)

The Nutrient Management Guide (RB209) helps you make the most of organic materials and balance the benefits of fertiliser use against the costs – both economic and environmental. The guide outlines the value of nutrients and soil, and explains why good nutrient management is about more than just fertilisers. It can save you money as well as help protect the environment.

AHDB first published the Nutrient Management Guide (RB209) in May 2017. Since its publication, recommendations have been revised, with the latest independent research funded by AHDB and its partners. A list of updates is available at **ahdb.org.uk/rb209**

To improve the accessibility and relevance of the recommendations and information, the Nutrient Management Guide (RB209) is published as seven sections that are updated individually.

Further information

The Nutrient Management Guide (RB209) will be updated regularly. Please email your contact details to **comms@ahdb.org.u**k so that we can send you notifications of when they are published.

RB209: Nutrient Management

Download the app for Apple or Android devices to access the current version of the guide. With quick and easy access to videos, information and recommendations, it is practical for use in the field.

Always consider your local conditions and consult a FACTS Qualified Adviser if necessary.

This section provides guidance for potato crops and should be read in conjunction with Sections 1 and 2. For each crop, recommendations for nitrogen (N), phosphate (P_2O_5) and potash (K_2O) are given in kilograms per hectare (kg/ha). Magnesium (MgO) and sulphur (as SO_3) are given in kg/ha where these nutrients are needed.

Recommendations are given for the rate and timing of nutrient application. The recommendations are based on the nutrient requirements of the crop being grown, while making allowance for the nutrients supplied by the soil.

When grown in soil with a good structure, potatoes are capable of producing extensive root systems that are efficient in taking up water and nutrients, therefore, every effort should be made to ensure seedbeds are free of compaction. The value of the potato crop is dictated by the marketable yield, not the total yield and, in consequence, decisions about fertiliser rates should be considered together with factors such as site selection and seed rates.

Because of the very wide range of varietal characteristics and quality requirements for different market outlets, guidance from a FACTS Qualified Adviser should be used when making decisions for a specific crop.

Contents

Checklist for decision-making

Individual decisions for fertiliser use must be made separately for every field. Where more than one crop is grown in a field, these areas must be considered individually.

1. Confirm the crop to be grown and the intended market. Identify any crop quality criteria required by this market, e.g. dry matter content and skin finish.
2. Identify the dominant soil type in the cropped area (**Section 1: Principles of nutrient management and fertiliser use**).
3. Assess soil structure and take action to remove soil compaction, if necessary. Poor soil structure can restrict crop growth and results in poor nutrient and water use efficiency.
4. Carry out soil analysis for pH, P, K and Mg every 3–5 years (page 7). Target values to maintain in arable rotations are:
    - Soil pH 6.5 (5.8 on peat soils)
    - Soil P Index 2
    - Soil K lower Index 2 (2-)
    - Soil Mg Index 2
5. Identify the Soil Nitrogen Supply (SNS) Index of the field, either by using the Field Assessment Method (page 11) or the Measurement Method (page 18). The Measurement Method is recommended where nitrogen supply from crop residues is expected to be high (SNS of more than 120 kg N/ha for arable rotations), or is uncertain.
6. Calculate the total and crop-available nutrients from organic materials that have been applied since harvest of the previous crop, or which will be applied to the crop being grown (**Section 2: Organic materials**). Deduct these nutrients from the recommended rates given in the tables.
7. Also check if the field is within a Nitrate Vulnerable Zone (NVZ) – consider the rules for application rates and timing for fertilisers and organic materials and adjust plans to comply with NVZ requirements.
8. Decide on the strategy for phosphate and potash use. This will be building up, maintaining or running down the Soil Index (**Section 1: Principles of nutrient management**). Allow for any surplus or deficit of phosphate or potash applied to previous crops in the rotation.
9. Calculate the amount of phosphate and potash removed in the harvested crop according to targeted crop yield (page 8). This is the amount of these nutrients that must be replaced in order to maintain the soil at the current Index.
10. Using the tables, decide on the required rate of each nutrient. Decide on the optimum timings for fertiliser application, then find the best match for these applications using available fertilisers.
11. Check that the fertiliser spreader or sprayer is in good working order and has been recently calibrated (**Section 1: Principles of nutrient management**).
12. Keep an accurate record of the fertilisers and organic manures applied.

Further information

Soil management for potatoes
ahdb.org.uk/knowledge-library/soil-management-for-potatoes

Think Soils
ahdb.org.uk/thinksoils

AHDB Field drainage guide
ahdb.org.uk/knowledge-library/field-drainage-guide

Nitrate Vulnerable Zones
gov.uk/guidance/nutrient-management-nitrate-vulnerable-zones

Information on seasonal water management for potatoes
ahdb.org.uk/knowledge-library/seasonal-water-management-for-potatoes

Phosphate, potash and magnesium recommendations

Current phosphate, potash and magnesium recommendations are based on achieving and maintaining target Soil Indices for each nutrient in the soil throughout the crop rotation. Soil analysis is used as a basis for making fertiliser decisions and it should be done every 3–5 years.

Soil samples can be collected by walking in a 'W' pattern through a field following the steps on page 7. Identifying the major soil type and yield variation in the field is a key step in establishing the need for GPS sampling.

PAAG
Professional Agricultural Analysis Group

Most UK laboratories are members of the PAAG that offers farmers and advisers confidence in laboratory analysis.

- Proficiency tests (often called ring tests) carried out by Wageningen University, guaranteeing that analysis from any member can be trusted **wepal.nl**
- List of UK laboratories **ahdb.org.uk/knowledge-library/soil-testing-companies**
- Sampling guidelines **nutrientmanagement.org/library/sampling**

Taking soil samples for phosphorus, potassium and magnesium

Soil sampling must be done well to avoid misleading results and expensive mistakes.

- The soil in each field should be sampled every 3–5 years
- Collect samples at the same point in the rotation and well before growing a sensitive crop e.g. sugar beet
- Ideally, sample immediately after the harvest of the previous crop
- Do not sample within six months of a lime or fertiliser application (except nitrogen) and avoid sampling when the soil is very dry
- Do not take samples in headlands, or in the immediate vicinity of hedges, trees or other unusual features
- The soil sample must be representative of the area sampled. Areas of land known to differ in some important respects (e.g. soil type, previous cropping, applications of manure, fertiliser or lime) should be sampled separately. Small areas known to differ from the majority of a field should be excluded from the sample
- Ideally, the sampled area should be no larger than four hectares
- Clean tools before starting and before sampling a new area
- Walk a ‘W’ pattern across the sampling area, stopping at least 25 times
- At each point, collect a subsample (core) to 15 cm depth using a gouge corer or screw auger
- The subsamples should be bulked to form a representative sample and sent to the laboratory for analysis
- Use appropriate packaging (normally available from the laboratory) and label samples clearly, providing as much information about the field and crop as possible

On soils where acidity is known to occur, more frequent testing may be needed than the four-year cycle used for phosphate, potash and magnesium. Since acidity can occur in patches, spot testing with a soil test kit across the field is often useful. Soil tests can also be useful on soils which contain fragments of free lime, since these can give a misleadingly high pH when analysed following grinding in the laboratory.

Classification of soil analysis results into Indices

The laboratory soil analysis results for P, K and Mg (in mg/kg dry soil) can be converted into Soil Indices using Table 5.1.

Table 5.1 Classification of soil P, K and Mg analysis results into Indices

Index	Phosphorus (P)	Potassium (K)	Magnesium (Mg)
	Olsen P	Ammonium nitrate extract	
	mg/litre		
0	0–9	0–60	0–25
1	10–15	61–120	26–50
2	16–25	121–180 (2-) 181–240 (2+)	51–100
3	26–45	241–400	101–175
4	46–70	401–600	176–250
5	71–100	601–900	251–350
6	101–140	901–1,500	351–600
7	141–200	1,501–2,400	601–1,000
8	201–280	2,401–3,600	1,001–1,500
9	Over 280	Over 3,600	Over 1,500

Phosphate, potash and magnesium recommendations

The phosphate recommendations are higher than that required to replace offtake and are intended to achieve optimum yield. The potash recommendations are required to replace the offtake and maintain target Soil Indices. The larger recommended applications for soils at Index 0 and 1 will bring the soil to Index 2 over a number of years. By not applying fertiliser at Index 3 or above, soil will run down over a number of years to the target Index.

Points to consider

- Recommendations assume good soil structure, water supply and pest and disease control
- Recommendations are given as phosphate (P_2O_5), potash (K_2O) and magnesium oxide (MgO). Conversion tables (metric–imperial, oxide–element) are given on page 25
- Organic materials supply phosphate and potash which contribute to crop requirements. Don't forget to make allowance for the phosphate and potash applied in organic materials (**Section 2: Organic materials**)
- All recommendations are given for the midpoint of each Index. The K recommendations for the lower half (2-) and upper half (2+) of K Index 2 are the same
- Where a soil analysis value (as given by the laboratory) is close to the range of an adjacent Index, the recommendation may be reduced or increased slightly, taking account of that given for the adjacent Index. Small adjustments of less than 10 kg/ha are generally not justified
- Where more or less phosphate and potash are applied than suggested in the tables, adjustments can be made later in the rotation

The amounts of phosphate and potash shown in Table 5.2 at Index 2 are those recommended to achieve a total yield of 50 t/ha. Crops grown on soil at Indices 0 and 1 would be expected to respond to the extra amounts of phosphate, potash and magnesium shown in Table 5.2.

There is no need to adjust the recommended phosphate rates if the target yield is higher or lower than 50 t/ha.

However, the potash recommendation at target or lower Indices can be adjusted when yield is likely to be larger or smaller than 50 t/ha by multiplying the difference in expected yield by 5.8 kg/t.

Example 5.1

At K Index 1, the potash recommendation for an expected yield of 70 t/ha is 330 + (20 x 5.8) = 446 kg K_2O/ha. No adjustment for yield should be made where the Soil Index is higher than target.

Table 5.2 Recommended phosphate, potash and magnesium rates for a crop yielding 50 t/ha of tubers

Nutrient	P, K or Mg Index				
	0	1	2	3	4 and higher
	kg /ha				
Phosphate (P_2O_5)	250	210	170	100	0
Potash (K_2O)	360	330	300	150	0
Magnesium (MgO)	120	80	40	0	0

The amount of phosphate recommended for soils at P Index 2 or 3 is more than sufficient to replace the phosphate removed by a 50 t/ha crop (about 50 kg P_2O_5). The surplus phosphate will help to maintain the soil at a target P Index 2 for an arable crop rotation and should be allowed for when assessing the need for phosphate for following crops.

On soils at P Index 0 and 1, the surplus phosphate will help increase the soil P Index and no allowance should be made when deciding the phosphate requirement of a subsequent crop. On soils at P Index 2 or below, a large proportion of the phosphate should be water-soluble.

The amount of potash recommended at K Index 2 will only replace the amount removed by a 50 t/ha crop and potash should be applied for the next crop in the rotation to maintain the soil at K Index 2. The extra amounts of potash shown for K Index 0 and 1 soils will slowly increase the soil K Index.

Figure 5.1 Potash deficiency
Photograph © Eric Anderson, Scottish Agronomy

Figure 5.2 Magnesium deficiency
Photograph © Eric Anderson, Scottish Agronomy

Timing of application

All the phosphate should be applied in the spring and either worked into the seedbed or placed at planting.

Where more than 300 kg K_2O/ha is required, apply half in late autumn/winter and half in spring. On light sandy soils, all the potash fertiliser should be applied after primary cultivation and no sooner than late winter. Large amounts of potash can sometimes reduce tuber dry matter content. If applicable, reference should be made to recommendations from the processing customer. Where this occurs, the decrease may be smaller when muriate of potash (MOP, potassium chloride) is replaced by sulphate of potash (SOP, potassium sulphate).

These recommendations should be used for both bed and ridge and furrow systems. Where fertiliser is placed, a small reduction in the recommended rate of phosphate could be considered.

Points to consider

- Ensure the potash offtake is balanced by an application of potash fertiliser on Index 2 soils
- Check the soil is maintained at Index 2 for both phosphate and potash by soil sampling every 3–5 years

Further information

Farming Rules for Water
gov.uk/government/publications/farming-rules-for-water-in-england

Example 5.2

Soil analysis shows P Index 2 and K Index 2 and main crop potatoes are to be grown. The expected yield is 65 t/ha tubers.

Based on 1 t/ha of tubers containing 1 kg P_2O_5/ha and 5.8 kg K_2O/ha, a crop yielding 65 t/ha will remove:

Phosphate 65 x 1.0 = 65 kg P_2O_5/ha

Potash 65 x 5.8 = 377 kg K_2O/ha

However, Table 5.2 recommends 170 kg P_2O_5/ha and 300 kg K_2O/ha for a crop yielding 50 t/ha.

For phosphate, the recommendation is much larger than the offtake because potatoes are likely to respond to extra phosphate at P Index 2. Therefore, the phosphate application rate is not adjusted for non-standard yield in potatoes. The surplus phosphate – 105 kg P_2O_5/ha (170 - 65 = 105) – should be allowed for when deciding on the phosphate application for the next crop(s) grown in the rotation.

For potash, the recommendation should be adjusted for the additional yield expected: 300 + (15 x 5.8) = 387 kg K_2O/ha.

- Where organic manure is applied, it is important to calculate the quantity of nutrients added in the manure (**Section 2: Organic Materials**) and adjust the amount of fertiliser accordingly. Allowing for the nutrients in manure reduces the need for fertiliser, improves farm profits and reduces the risk of nutrient pollution of water
- Construct a nutrient balance sheet for each field and ensure the phosphate and potash offtake is balanced by an equivalent application of phosphate and potash on Index 2 soils. Check that the soil is maintained at Index 2 by soil analysis every 3–5 years

Sulphur recommendations

Potato crops are not generally thought to be responsive to sulphur. However, atmospheric sulphur emissions have declined significantly and a yield response to sulphur is possible. If deficiency does occur, it is most likely to show first in crops grown on deep sand soils with low organic matter and in areas well away from industrial pollution.

Farmers are advised to monitor the sulphur requirements of their crops. Where sulphur deficiency has previously occurred or is expected, apply 25 kg SO_3/ha as a sulphate-containing fertiliser in the seedbed.

Figure 5.3 Sulphur deficiency

Points to consider

- Organic materials can supply useful amounts of sulphur (**Section 2: Organic materials**)
- Sulphur recommendations are given as SO_3. Conversion tables (metric–imperial, oxide–element) are given on page 25. If applying liquid fertilisers, manufacturers can supply tables which convert kg/ha of nutrient to litres/ha of product
- Further information on the occurrence of sulphur deficiency and diagnostic methods can be found in **Section 1: Principles of nutrient management and fertiliser use**

Lime and micronutrient recommendations

Although essential for plant growth, in most cases the very small quantities of micronutrients needed for potatoes can be supplied from soil reserves. The only significant trace element deficiency in potatoes is manganese (Mn), which can occur on peaty, organic or sandy soils at high pH and on other soil types if over-limed.

Manganese deficiency usually occurs in patches during periods of rapid growth and can be treated by one or more foliar sprays of a suitable manganese-containing material.

Potatoes can tolerate a degree of soil acidity and are best grown at soil pH levels that are lower than for most other arable crops. However, liming immediately before potatoes should be avoided unless the soil pH is very low, as this can increase the risk of common scab and manganese deficiency.

Figure 5.4 Manganese deficiency
Photograph © Blackthorn Arable

Calculating Soil Nitrogen Supply (SNS)

Fields vary widely in the amount of nitrogen available to a crop before any fertiliser or manure is applied. This variation must be taken into account to avoid inadequate or excessive applications of nitrogen.

The Soil Nitrogen Supply (SNS) system assigns an Index of 0 to 6 to indicate the likely extent of this background nitrogen supply. The Index is used in the recommendation tables to select the amount of nitrogen, as manufactured fertiliser, manure or a combination of both, that typically would need to be applied to ensure optimum yield.

The SNS Index for each field can be estimated either by the Field Assessment Method using records of soil type, previous cropping and winter rainfall, or by the Measurement Method. This uses measurements of Soil Mineral Nitrogen (SMN) plus estimates of nitrogen already in the crop (at the time of soil sampling) and of available nitrogen from the mineralisation of soil organic matter and crop debris during the period of active crop growth.

Field Assessment Method

The Field Assessment Method does not take account of the nitrogen that will become available to a crop from any organic manures applied since harvest of the previous crop. The available nitrogen from organic materials applied since harvest of the previous crop, or those that will be applied to the current crop, should be calculated separately using the information in **Section 2: Organic Materials** and deducted from the fertiliser nitrogen application rates shown in the recommendation tables.

There are five essential steps to follow to identify the appropriate SNS Index:

Step 1. Identify the soil category for the field
Step 2. Identify the previous crop
Step 3. Select the rainfall range for the field
Step 4. Identify the provisional SNS Index using the appropriate table
Step 5. Make any necessary adjustments to the SNS Index

Step 1. Identify the soil category for the field

Careful identification of the soil category in each field is very important. The whole soil profile should be assessed to one metre depth for arable crops. Where the soil varies, and nitrogen is to be applied uniformly, select the soil type that occupies the largest part of the field.

The soil type can be identified using Figure 5.5, which categorises soils on their ability to supply and retain mineral nitrogen. The initial selection can then be checked using Table 5.3. Carefully assess the soil organic matter content when deciding if the soil is organic (10% to 20% organic matter for the purposes of this guide) or peaty (more than 20% organic matter). If necessary, seek professional advice on soil type assessments, remembering this will only need to be done once.

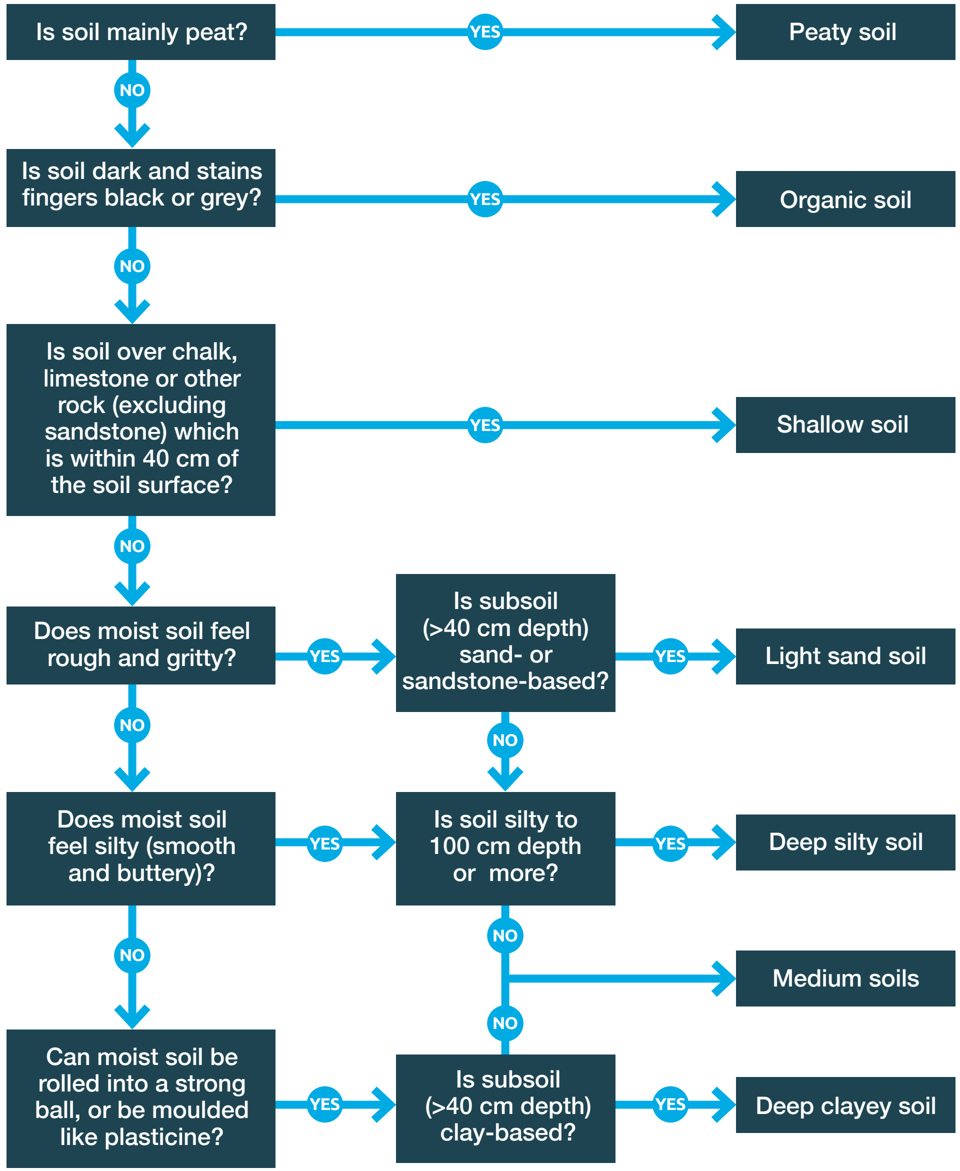

Figure 5.5 Soil category assessment

Table 5.3 Soil category assessment

Soil category	Description of soil types within category	Properties
Light sand soils	Soils that are sand, loamy sand or sandy loam to 40 cm depth and are sand or loamy sand between 40–80 cm, or over sandstone rock.	Soils in this category have poor water-holding capacity and retain little nitrogen.
Shallow soils	Soils over impermeable subsoils and those where the parent rock (chalk, limestone or other rock) is within 40 cm of the soil surface. Sandy soils developed over sandstone rock should be regarded as light sand soils.	Soils in this category are less able to retain or supply nitrogen at depth.
Medium soils	Mostly medium-textured mineral soils that do not fall into any other soil category. These include sandy loams over clay, deep loams and silty or clayey topsoils that have sandy or loamy subsoils.	Soils in this category have moderate ability to retain nitrogen and allow average rooting depth.
Deep clayey soils	Soils with predominantly sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay or clay topsoil overlying clay subsoil to more than 40 cm depth. Deep clayey soils normally need artificial field drainage.	Soils in this category are able to retain more nitrogen than lighter soils.
Deep silty soils	Soils of sandy silt loam, silt loam or silty clay loam textures to 100 cm depth or more. Silt soils formed on marine alluvium, warp soils (river alluvium) and brickearth soils are in this category. Silty clays of low fertility should be regarded as other mineral soils.	Soils in this category are able to retain more nitrogen than lighter soils and allow rooting to greater depth.
Organic soils	Soils that are predominantly mineral but with between 10–20% organic matter to depth. These can be distinguished by darker colouring that stains the fingers black or grey.	Soils in this category are able to retain more nitrogen than lighter soils and have higher nitrogen mineralisation potential.
Peat soils	Soils that contain more than 20% organic matter derived from sedge or similar peat material.	Soils in this category have very high nitrogen mineralisation potential.

Step 2. Identify the previous crop

Usually, this is straightforward, but sometimes clarification may be needed:

High residual nitrogen vegetables (‘high N vegetables’) are leafy, nitrogen-rich brassica crops such as calabrese, Brussels sprouts and some crops of cauliflower where significant amounts of crop debris are returned to the soil, especially in rotations where an earlier brassica crop has been grown within the previous twelve months. To be available for crop uptake, this organic nitrogen must have had time to mineralise but the nitrate produced must not have been at risk to loss by leaching.

Medium residual nitrogen vegetables (‘medium N vegetables’) are crops such as lettuce, leeks and long-season brassicas such as Dutch white cabbage where a moderate amount of crop debris is returned to the soil.

Low residual nitrogen vegetables (‘low N vegetables’) are crops such as carrots, onions, radish, swedes or turnips where the amount of crop residue is relatively small.

Step 3. Select the rainfall range for the field

The appropriate rainfall category should be identified, based on either annual rainfall or excess winter rainfall. Ideally, an estimate of excess winter rainfall is required because this is closely related to drainage by which nitrate will be lost through leaching. Figure 5.6 below shows long-term (1981–2010) average excess winter rainfall and in an average year can be used to select the rainfall category.

There are three SNS Index tables representing 'low rainfall' (annual rainfall less than 600 mm, or less than 150 mm excess winter rainfall), 'moderate rainfall' (between 600–700 mm annual rainfall, or 150–250 mm excess winter rainfall), and 'high rainfall' areas (more than 700 mm annual rainfall, more than 250 mm excess winter rainfall).

Figure 5.6 Excess winter rainfall (mm)

Step 4. Identify the provisional SNS Index using the appropriate table

Tables 5.4 (low rainfall), 5.5 (moderate rainfall) and 5.6 (high rainfall) should be used where the field has not been in grass within the past three years. Select one of these tables according to rainfall for the field. Take account of the footnotes to the tables.

Higher than typical Indices can occur where there has been a history of grassland or frequent applications of organic manures. Soil analysis for Soil Mineral Nitrogen (SMN) is recommended in these situations.

If grass has been grown in the previous three years, also look at Table 5.7. Select the higher of the Index levels based on the last crop grown (from Table 5.4, 5.5 or 5.6) and that based on the grass history (Table 5.7).

Points to consider

- Do not confuse SNS (Soil Nitrogen Supply) and SMN (Soil Mineral Nitrogen)
- SMN is the measured amount of mineral nitrogen (nitrate-N plus ammonium-N) in the soil profile
- SNS = SMN (0–90 cm or maximum rooting depth in shallow soils over rock) + crop N (at time of sampling for SMN) + estimate of available N from mineralisation of organic matter

Table 5.4 Soil Nitrogen Supply (SNS) Indices for low rainfall (500–600 mm annual rainfall, up to 150 mm excess winter rainfall) – based on the last crop grown

Previous crop	Soil type					
	Light sand soils or shallow soils over sandstone	Medium soils or shallow soils not over sandstone	Deep clayey soils	Deep silty soils	Organic soils	Peat soils
Beans	1	2	3	3	All crops in SNS Index 3, 4, 5 or 6. Consult a FACTS Qualified Adviser.	All crops in SNS Index 4, 5 or 6. Consult a FACTS Qualified Adviser.
Cereals	0	1	2	2		
Forage crops (cut)	0	1	2	2		
Oilseed rape	1	2	3	3		
Peas	1	2	3	3		
Potatoes	1	2	3	3		
Sugar beet	1	1	2	2		
Uncropped land	1	2	3	3		
Vegetables (low N)[a]	0	1	2	2		
Vegetables (medium N)[a]	1	3	3[b]	3[b]		
Vegetables (high N)[a]	2	4[b]	4[b]	4[b]		

a. Refer to Step 2.

b. Index may need to be increased by up to 1 where significantly larger amounts of leafy residues are incorporated (see Step 5). Where there is uncertainty, soil sampling for SMN may be appropriate.

Table 5.5 Soil Nitrogen Supply (SNS) Indices for moderate rainfall (600–700 mm annual rainfall, or 150–250 mm excess winter rainfall) – based on the last crop grown

Previous crop	Soil type					
	Light sand soils or shallow soils over sandstone	Medium soils or shallow soils not over sandstone	Deep clayey soils	Deep silty soils	Organic soils	Peat soils
Beans	1	2	2	3	All crops in SNS Index 3, 4, 5 or 6. Consult a FACTS Qualified Adviser.	All crops in SNS Index 4, 5 or 6. Consult a FACTS Qualified Adviser.
Cereals	0	1	1	1		
Forage crops (cut)	0	1	1	1		
Oilseed rape	0	2	2	2		
Peas	1	2	2	3		
Potatoes	0	2	2	2		
Sugar beet	0	1	1	1		
Uncropped land	1	2	2	2		
Vegetables (low N)[a]	0	1	1	1		
Vegetables (medium N)[a]	0	2	3	3		
Vegetables (high N)[a]	1	3	4	4		

a. Refer to Step 2.

Table 5.6 Soil Nitrogen Supply (SNS) Indices for high rainfall (over 700 mm annual rainfall, or over 250 mm excess winter rainfall) – based on the last crop grown

Previous crop	Soil type					
	Light sand soils or shallow soils over sandstone	Medium soils or shallow soils not over sandstone	Deep clayey soils	Deep silty soils	Organic soils	Peat soils
Beans	0	1	2	2	All crops in SNS Index 3, 4, 5 or 6. Consult a FACTS Qualified Adviser.	All crops in SNS Index 4, 5 or 6. Consult a FACTS Qualified Adviser.
Cereals	0	1	1	1		
Forage crops (cut)	0	1	1	1		
Oilseed rape	0	1	1	2		
Peas	0	1	2	2		
Potatoes	0	1	1	2		
Sugar beet	0	1	1	1		
Uncropped land	0	1	1	2		
Vegetables (low N)[a]	0	1	1	1		
Vegetables (medium N)[a]	0	1	1	2		
Vegetables (high N)[a]	1[b]	2	2	3		

a. Refer to Step 2.

b. Index may need to be lowered by 1 where residues are incorporated in the autumn and not followed immediately by an autumn-sown crop.

Table 5.7 Soil Nitrogen Supply (SNS) Indices following ploughing out of grass leys

	SNS Index		
Light sands or shallow soils over sandstone – all rainfall areas	**Year 1**	**Year 2**	**Year 3**
All leys with 2 or more cuts annually receiving little or no manure 1–2 year leys, low N 1–2 year leys, 1 or more cuts 3–5 year leys, low N, 1 or more cuts	0	0	0
1–2 year leys, high N, grazed 3–5 year leys, low N, grazed 3–5 year leys, high N, 1 cut then grazed	1	2	1
3–5 year leys, high N, grazed	3	2	1
Other medium soils and shallow soils – not over sandstone – all rainfall areas			
All leys with 2 or more cuts annually receiving little or no manure 1–2 year leys, low N 1–2 year leys, 1 or more cuts 3–5 year leys, low N, 1 or more cuts	1	1	1
1–2 year leys, high N, grazed 3–5 year leys, low N, grazed 3–5 year leys, high N, 1 cut then grazed	2	2	1
3–5 year leys, high N, grazed	3	3	2
Deep clayey soils and deep silty soils in low rainfall areas (500–600 mm annual rainfall)			
All leys with 2 or more cuts annually receiving little or no manure 1–2 year leys, low N 1–2 year leys, 1 or more cuts 3–5 year leys, low N, 1 or more cuts	2	2	2
1–2 year leys, high N, grazed 3–5 year leys, low N, grazed 3–5 year leys, high N, 1 cut then grazed	3	3	2
3–5 year leys, high N, grazed	5	4	3
Deep clayey soils and deep silty soils in moderate (600–700 mm annual rainfall) or high (over 700 mm annual rainfall) rainfall areas			
All leys with 2 or more cuts annually receiving little or no manure 1–2 year leys, low N 1–2 year leys, 1 or more cuts 3–5 year leys, low N, 1 or more cuts	1	1	1
1–2 year leys, high N, grazed 3–5 year leys, low N, grazed 3–5 year leys, high N, 1 cut then grazed	3	2	1
3–5 year leys, high N, grazed	4	3	2

The Indices shown in Table 5.7 assume that little or no organic manure has been applied. Where silage fields have received the organic manure produced by livestock that have eaten the silage and the manure has been applied in spring, they should be regarded as containing nitrogen residues equivalent to a previous grazing history.

'Low N' grassland means average annual inputs of less than 250 kg N/ha in fertiliser plus crop-available nitrogen in manure used in the last two years, or swards with little clover.

'High N' grassland means average annual applications of more than 250 kg N/ha in fertiliser plus crop-available nitrogen in manure used in the last two years, or clover-rich swards or lucerne.

Step 5. Make any necessary adjustments to the SNS Index

When using the Field Assessment Method, it is not necessary to estimate the amount of nitrogen taken up by the crop over winter. This is already taken into account in the tables.

Manure history: Where regular applications of organic manures have been made to previous crops in the rotation, increase the Index value by one or two levels depending on manure type, application rate and frequency of application.

Point to consider

- The nitrogen contribution from manures applied after harvest of the previous crop should not be considered when deciding the SNS Index; this contribution should be deducted from the recommended nitrogen application rate using the information in **Section 2: Organic Materials**

Field vegetables as previous crop: On medium, deep silty or deep clayey soils, nitrogen residues in predominantly vegetable rotations can persist for several years, especially in the drier parts of the country. This is likely to be especially evident following 'high' or 'medium N vegetables'. The SNS tables make some allowance for this long persistency of nitrogen residues, but the Index level may need to be adjusted upwards, particularly where:

- Winter rainfall is low
- The history of vegetable cropping is longer than one year
- Larger than average amounts of crop residue or unused fertiliser are left behind (see footnote to Table 5.4)

In rotations where vegetable crops are grown infrequently and where there is uncertainty, soil sampling for SMN may be appropriate.

Fertiliser residues from previous crop: The Index assessments assume that the previous crop grew normally and that it received the recommended rate of nitrogen applied as fertiliser and/or organic manures. The Index should be increased if there is reason to believe nitrogen residues are likely to be greater than normal and these residues will not be lost by leaching. This could occur where a cover crop was sown in autumn and grew well over winter. The Index may need to be adjusted downwards if there is reason to believe nitrogen residues are likely to be smaller than usual.

After any adjustment, the SNS Index can be used in the recommendation tables.

Measurement Method

This method is particularly appropriate where the SNS is likely to be large and uncertain. This includes:

- Fields with a history of organic manure application and vegetable rotations where the timing of residue incorporation can strongly affect Soil Mineral Nitrogen (SMN) for the following crop
- Fields where long leys or permanent pasture have been recently ploughed out (but not in the first year after ploughing out)
- Fields where there have been problems such as regular lodging of cereals, very high grain protein or nitrogen contents, or previous crop failure (for example, due to drought or disease)
- Fields where there is significant variation in soil texture and/or large amounts of crop residues are incorporated. Nitrogen residues also can be large following outdoor pigs

The SNS Index can be identified using the results of direct measurement of SMN to 90 cm depth in spring, 60 cm depth in autumn/early winter, or to maximum rooting depth in shallow soils over rock. An estimate of net mineralisable nitrogen must be added to the SMN result when calculating the SNS.

SNS is likely to be low on light sand and shallow soils that have not received regular additions of organic manure or crop residues, particularly in moderate to high rainfall areas. In this scenario, prediction of SNS using the Field Assessment Method is advised.

The Measurement Method is not recommended for peat soils, or in the first season after ploughing out long leys or permanent pasture, where net mineralisation can be very large and uncertain and the measured SMN may be a relatively small component of SNS. For these soils, the Field Assessment Method or local experience will be better guides to SNS.

Points to consider

- Do not confuse Soil Nitrogen Supply (SNS) and Soil Mineral Nitrogen (SMN)
- SMN is the measured amount of mineral nitrogen (nitrate-N plus ammonium-N) in the soil profile
- SNS = a measurement of SMN + an estimate of subsequent N mineralisation

The Measurement Method does not take account of the available nitrogen supplied from organic manures applied after the date of soil sampling for SMN. The available nitrogen from manures applied after sampling should be calculated separately using the information in **Section 2: Organic Materials** and deducted from the nitrogen rate shown in the appropriate recommendation table.

The nitrogen contribution from manures applied before sampling for SMN will be largely taken account of in the measured value and should not be calculated separately.

When using the Measurement Method, there are three steps to follow:

Step 1. Measure Soil Mineral Nitrogen (SMN)
Step 2. Make an allowance for net mineralisable nitrogen
Step 3. Identify the Soil Nitrogen Supply (SNS) Index

In detail, these three steps are:

Step 1. Measure Soil Mineral Nitrogen (SMN)

Soil sampling must be done well to avoid misleading results and expensive mistakes.

Guidance on how to collect an SMN sample

- In most situations, sampling in late winter or early spring before nitrogen fertiliser is applied gives slightly better predictions of SNS than sampling in the autumn because overwinter leaching is accounted for, especially in high rainfall areas or on shallow or light sand soils. On soils less prone to leaching, sampling in autumn or early spring is equally effective
- Avoid sampling within two to three months of applying nitrogen fertiliser or organic manures, or within a month after sowing
- Areas of land known to differ in some important respects (e.g. soil type, previous cropping, application of manures or nitrogen fertiliser) should be sampled separately
- Do not sample unrepresentative areas, such as ex-manure heaps or headlands
- Avoid collecting and sending samples immediately before the weekend or a public holiday
- Samples must be taken to be representative of the area sampled. A minimum of 10–15 soil cores should be taken following a 'W' pattern across each field/area to be sampled
- In larger fields (10–20 ha), increase the number of cores to 15–20, unless the soil type is not uniform, in which case more than one sample should be taken. This can be done by dividing the field into smaller blocks from each of which 10–15 soil cores are taken
- 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 to form a representative sample of that depth. If the bulk sample is too big, take a representative subsample to send to the laboratory; do not stir the sample excessively
- Use appropriate packaging (normally available from the laboratory) and label samples clearly, providing as much information about the field and crop as possible
- Samples should be analysed within three days of sampling; samples must be kept cool (2–4°C) but not frozen during storage or transport

It is important to avoid cross-contamination of samples from different depths. Using a mechanised one-metre-long gouge auger (2.5 cm diameter) is a satisfactory and efficient method, but care must be taken to avoid excessive soil compaction and contamination between soil layers. If each depth layer is to be sampled individually by hand, a series of screw or gouge augers should be used where the auger diameter becomes progressively narrower as the sampling depth increases.

Analysis in the laboratory

Samples should be analysed for nitrate-N and ammonium-N. Analytical results in mg N/kg should be converted to kg/ha, taking into account the dry bulk density of the soil, then summed to give a value for the whole soil profile. For the majority of mineral soils, a 'standard' bulk density of 1.33 g/ml can be used and the calculation can be simplified to:

SMN (kg N/ha) = mg N/kg x 2 (for each 15 cm layer of soil)

SMN (kg N/ha) = mg N/kg x 4 (for each 30 cm layer of soil)

SMN (kg N/ha) = mg N/kg x 8 (for each 60 cm layer of soil)

Step 2. Make an adjustment for net mineralisable nitrogen

Nitrogen mineralised from soil organic matter and crop debris after soil sampling is a potentially important source of nitrogen for crop uptake. However, in mineral soils of low to average organic matter content (<4% in England and Wales or <10% in Scotland and Northern Ireland), the amount of net mineralisable nitrogen will be relatively small and, for practical purposes, no further adjustment is needed when using the recommendations in this guide. The only exception being after cold winters, when an estimate of around 20 kg N/ha may be appropriate.

An adjustment may be needed where soil organic matter content is above average or where there has been a history of regular manure applications. In these situations, a commercial measurement of additionally available nitrogen (AAN) gives the most useful prediction of mineralisation.

As a guide, where measurement is not done, for every 1% organic matter above 4%, a topsoil may release an additional 10 kg N/ha. Therefore, a soil that has a topsoil organic matter content of 10% may release around 60 kg/ha more potentially available nitrogen than an equivalent soil with 4% organic matter content.

However, some soils with an organic matter content of above 4% may release little nitrogen and local knowledge must be used when estimating mineralisable nitrogen. Therefore, it is not possible to specify a routine amount by which to adjust SNS based on soil organic matter level.

Add any adjustment for net mineralisable nitrogen to the total of SMN and nitrogen in the crop to give SNS.

Step 3. Identify the Soil Nitrogen Supply (SNS) Index

Table 5.8 Soil Nitrogen Supply (SNS) Index

SNS	SNS Index
Less than 60	0
61–80	1
81–100	2
101–120	3
121–160	4
161–240	5
More than 240	6

Adopting changes to nitrogen 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 N/ha, so SNS estimates less than this should be treated as 50 kg N/ha and no less.

Unless high SNS results (>160 kg N/ha) are confidently expected, they should also be treated with caution. If SNS estimates indicate that large changes (either increases or decreases) in nitrogen fertiliser use are required, crops should be monitored closely through spring for signs of nitrogen deficiency or excess and the planned nitrogen strategy should be adjusted if necessary. It may be best for changes in nitrogen use to be introduced gradually over a few seasons so that the effect on crop performance can be monitored.

Nitrogen recommendations

Identifying the variety determinacy group

Nitrogen recommendations split potato varieties into one of four groups according to their degree of determinacy (a measure of the crop's capacity to maintain leaf production after the first appearance of flowers). AHDB research at NIAB-CUF has consistently shown that for a given length of growing season, indeterminate varieties (variety groups 3 and 4) require less nitrogen than determinate varieties (variety groups 1 and 2).

Table 5.9 lists potato varieties by determinacy group. It includes the ratings for those varieties included in previous editions of this guide while others are assigned to a determinacy group based on a new protocol developed by AHDB.

ahdb.org.uk/knowledge-library/in-field-method-for-assigning-nitrogen-group-determinacy-in-potatoes

In addition, factors such as total nutrient balance, water availability and seed management will also influence foliage longevity. The list is provided as an indication of determinacy groups, but you are advised to seek the latest information from your agronomist or seed supplier for any particular variety.

Table 5.9 Variety determinacy groups

Group 1 – Short haulm longevity	Group 2 – Medium haulm longevity		Group 3 – Long haulm longevity		Group 4 – Very long haulm longevity
Determinate varieties	Partially determinate varieties		Indeterminate varieties		
Accord	Atlantic	Osprey	Agria	Picasso	Asterix
Annabelle	Amanda	Pentland Javelin	Ambo	Record	**Brooke**
Anya	Arcade	Rembrandt	Amora	Rooster	Cara
Colmo	Carlingford	Romano	**Arsenal**	Russet Burbank	**Electra***
Estima	Charlotte	Saxon	Cabaret	Sante	Lady Balfour
Innovator	Courage	Shannon	Caesar	Sassy	Markies
Maris Bard	Dundrod	Shepody	Cosmos	Saturna	Royal
Minerva	Endeavour	Vivaldi	Cultra	**Shelford**	Vales Everest
Premiere	Harmony	**VR808**	Daisy	Slaney	Vales Sovereign
Rocket	Juliette	Wilja	Desiree	Stemster	
Vales Emerald	Kestrel		Eos	Valor	
Winston	Lady Claire		Fambo	Victoria	
	Lady Rosetta		Fianna		
	Marfona		Hermes		
	Maris Peer		**Jelly**		
	Maritiema		Kerr's Pink		
	Melody		King Edward		
	Miranda		Lady Christl		
	Mozart		Lady Valora		
	Nadine		Maris Piper		
	Nectar		Morene		
	Nicola		Navan		
	Orchestra		Pentland Dell		
	Orla		Pentland Squire		

Information provided by NIAB-CUF and AHDB

*At the high end of recommendations

January 2021

Identifying the growing season length

The length of the growing season is the number of days between 50% emergence and haulm death from either natural senescence or defoliation.

Table 5.10 Recommended N application rate for potatoes (kg/ha) per season length and variety determinacy group

Length of growing season	Variety determinacy group	SNS Index		
		0 and 1	2, 3 and 4	5 and 6
		kg N/ha		
<60 days	1	100–140	70–110	40–60
	2	80–120	50–80	0–40
	3	60–100	40–70	0–40
	4[a]	N/A	N/A	N/A
60–90 days	1	160–210	130–160	90–120
	2	100–160	60–120	40–80
	3	60–140	40–100	0–60
	4	40–80	20–40	0–40
90–120 days	1	220–270	190–220	150–180
	2	150–220	110–160	80–120
	3	110–180	80–100	40–60
	4	80–140	40–60	0–40
>120 days	1	N/A	N/A	N/A
	2	190–250	150–180	120–150
	3	150–210	120–140	80–100
	4	100–180	60–80	20–40

N/A= Not Applicable

a. Consideration can be given to group 4 varieties grown for less than 60 days with the addition of 0 to 40 kg/ha for all Soil Indices.

One of the following four options should be selected in Table 5.10:

- Less than 60 days
- Between 60 and 90 days
- Between 90 and 120 days
- More than 120 days

Nitrogen increases yield by prolonging haulm life. It has no consistent effect on tuber numbers and, consequently, where it gives an increase in yield, the mean tuber size will be greater.

Similarly, if the intended season length is at the lower (or upper) end of the ranges given in Table 5.10, consider nitrogen applications at the lower (or upper) end of the ranges given.

Fine-tuning nitrogen recommendations

Planting date

The recommendations assume that loss of ground cover should begin close to the time of defoliation and harvest. If crops are planted later than intended but the defoliation date remains unaltered, this will reduce the length of the growing season, which will justify a reduction in the nitrogen application rate.

Cold soils

Crops planted into cold soils are slow to emerge and often have restricted canopy development. For determinate crops planted into cold soils and where emergence is delayed but the intended season length remains the same, consider increasing the amount of nitrogen applied by 15–20 kg N/ha.

Also, for all varieties at the upper end of season length, consider using the nitrogen recommendation from the upper end of the range.

Timing of nitrogen application

If top dressing is planned for management reasons or to reduce the risk of leaching for crops grown on light sand and shallow soils, apply about two-thirds of the nitrogen recommendation in the seedbed and the remainder shortly after emergence. Aim to apply all the nitrogen by the time of tuber initiation (about three weeks after 50% plant emergence).

For other crops, apply all of the recommended nitrogen in the seedbed.

The effect of irrigation

Differences in the nitrogen requirement of irrigated or rain-fed crops are generally small. However, nitrogen rates could be reduced by 15–20 kg N/ha in rain-fed, determinate crops in order to achieve the same yield.

Further information

Information on seasonal water management for potatoes
ahdb.org.uk/knowledge-library/seasonal-water-management-for-potatoes

Placement of nitrogen in bed systems

The same recommendations should be used for bed as well as ridge and furrow systems. Where fertiliser application methods reduce the amount of nitrogen falling into furrow bottoms (e.g. placement or banded applications), reductions in the total amount of nitrogen applied could be considered.

Problems with previous potato crops

If similar crops grown in previous seasons have had problems with excessive canopy production and were defoliated at complete ground cover, consider reducing the nitrogen application rate.

Similarly, if there have been frequent problems with delayed skin-set, consider reducing the nitrogen rate towards the lower end of the recommended range.

Allowances should be made for the likely supply of nitrogen from incorporated cover crop residues. However, growers will need guidance on how to assess the amount of N taken up by the cover crop and what proportion is likely to be made available. Growers should refer to **Section 1: Principles of nutrient management and fertiliser use** for further information.

Points to consider

- Excess (or 'insurance') applications of nitrogen can:
- Decrease yield, especially in shorter-season indeterminate varieties
- Increase haulm size, prevent effective penetration of fungicidal sprays, delay natural senescence and create difficulties with desiccation
- Delay achievement of skin set
- Sometimes affect achievement of target dry matter concentrations

Selecting the most appropriate fertiliser

For a single nutrient, the recommended amount can be applied using a straight fertiliser. Where more than one nutrient is required, a compound or blended fertiliser can be used. In this case, the compound or blend selected will depend on the ratio of the nutrients in the fertiliser; the amount applied should give as near the recommended amount of each nutrient as possible.

Often, it will not be possible to match exactly the recommendations with available fertilisers. In most cases, the first priority is to get the amount of nitrogen correct because crops respond most to nitrogen. Slight variations in the rates of phosphate or potash will have less effect on yield, especially on Index 2 soils, and any discrepancy can be corrected in fertiliser applications to future crops. The approximate nutrient content of commonly used fertilisers is described on page 26..

Example 5.3

Field location:	Cambridge
Variety:	Maris Piper
Intended planting date:	15 April
Intended defoliation date:	15 September
Soil type:	Medium
Previous crop:	Winter barley
Use of organic manure:	No
Other information:	All N to be applied before tuber initiation; no previous problems with either premature canopy senescence or excess canopy production

1. Calculate SNS. It is a low rainfall area, the soil type is medium and the previous crop is a cereal. Table 5.4 indicates that the SNS Index = 1.
2. Identify variety group using Table 5.9, Maris Piper is variety group 3.
3. Calculate length of growing season. The crop is to be planted mid-April (emerging mid-May) and defoliated in mid-September. Total 125 days (>120 days).
4. Use Table 5.10 to calculate N requirement. 180 kg N/ha (150–210 kg N/ha).
5. Assess factors to fine-tune recommendation (pages 22–23). The crop should have an effective root system and applied N should be efficiently used, but the growing season is long: 180 kg N/ha.
6. Include allowance for applied organic manures. No manures applied – 0 kg N/ha.
7. Manufactured-N fertiliser 180 kg N/ha.

Example 5.4

Field location:	Somerset
Variety:	Estima
Intended planting date:	30 April
Intended defoliation date:	15 August
Soil type:	Medium
Previous crop:	Oilseed rape
Use of organic manure:	Yes
Other information:	All N to be applied before tuber initiation; 40 t/ha cattle FYM applied in winter after four months storage, and ploughed in one week later

1. Calculate SNS. It is a high rainfall area and the soil type is medium. Table 5.6 indicates that the SNS Index = 1.
2. Identify variety group using Table 5.9. Estima is variety group 1.
3. Calculate length of growing season. Planted end April (emerging end May) and defoliated in mid-August = 80 days. Season length = 60 to 90 days.
4. Use Table 5.10, to calculate N Requirement. 185 kg N/ha (160–210 kg N/ha).
5. Assess factors to fine-tune recommendations (pages 22–23). It was an unusually cold spring, crop slow to emerge, with the potential for a restricted canopy, therefore consider additional N: 200 kg N/ha.
6. Allowance for applied organic manures: 40 t/ha of cattle FYM, 24 kg/ha of crop-available N.
7. Manufactured-N fertiliser 176 kg N/ha.

Conversion tables

Metric to imperial

1 tonne/ha	0.4 tons/acre
100 kg/ha	80 units/acre
1 kg/tonne	2 units/ton
10 cm	4 inches
1 m^3	220 gallons
1 m^3/ha	90 gallons/acre
1 kg/m^3	9 units/1,000 gallons
1 kg	2 units

Note: a 'unit' is 1% of 1 hundredweight, or 1.12lbs.

Imperial to metric

1 ton/acre	2.5 tonnes/ha
100 units/acre	125 kg/ha
1 unit/ton	0.5 kg/tonne
1 inch	2.5 cm
1,000 gallons	4.5 m^3
1,000 gallons/acre	11 m^3/ha
1 unit/1,000 gallons	
1 unit	0.5 kg

Element to oxide

P to P_2O_5	Multiply by 2.291
K to K_2O	Multiply by 1.205
Mg to MgO	Multiply by 1.658
S to SO_3	Multiply by 2.5
Na to Na_2O	Multiply by 1.348
Na to salt	Multiply by 2.542

Oxide to element

P_2O_5 to P	Multiply by 0.436
K_2O to K	Multiply by 0.830
MgO to Mg	Multiply by 0.603
SO_3 to S	Multiply by 0.4
Na_2O to Na	Multiply by 0.742
Salt to Na	Multiply by 0.393

Fluid fertiliser

kg/tonne (w/w basis) to kg/m^3	Multiply by specific gravity (w/v basis)

Analysis of fertilisers and liming materials

The materials listed below are used individually and some are used as components of compound or multi-nutrient fertilisers. The chemical and physical forms of nutrient sources, as well as growing conditions, can influence the effectiveness of fertilisers. A FACTS Qualified Adviser can give advice on appropriate forms for different soil and crop conditions.

The reactivity, or fineness of grinding, of liming materials determines their speed of action. However, the amount of lime needed is determined mainly by its neutralising value.

Nitrogen fertilisers	Typical % nutrient content
Ammonium nitrate	33.5–34.5% N
Liquid nitrogen solutions	18–30% N (w/w)
Calcium ammonium nitrate (CAN)	26–28% N
Ammonium sulphate	21% N, 60% SO_3
Urea	46% N
Calcium nitrate	15.5% N, 26% CaO

Phosphate fertilisers

Single superphosphate (SSP)	18–21% P_2O_5, typically 30% SO_3
Triple superphosphate (TSP)	45–46% P_2O_5
Di-ammonium phosphate (DAP)	18% N, 46% P_2O_5
Mono-ammonium phosphate (MAP)	12% N, 52% P_2O_5
Rock phosphate (e.g. Gafsa)	27–33% P_2O_5

Potash, magnesium and sodium fertilisers

Muriate of potash (MOP)	60% K_2O
Sulphate of potash (SOP)	50% K_2O, 45% SO_3
Potassium nitrate	13% N, 45% K_2O
Kainit	11% K_2O, 5% MgO, 26% Na_2O, 10% SO_3
Sylvinite	Minimum 16% K_2O, typically 32% Na_2O
Kieserite (magnesium sulphate)	25% MgO, 50% SO_3
Calcined magnesite	Typically 80% MgO
Epsom salts (magnesium sulphate)	16% MgO, 33% SO_3
Agricultural salt	50% Na_2O

Sulphur fertilisers

Ammonium sulphate	21% N, 60% SO_3
Epsom salts (magnesium sulphate)	16% MgO, 33% SO_3
Elemental sulphur	Typically 200–225% SO_3 (80–90% S)
Quarried gypsum (calcium sulphate)	40% SO_3
Polyhalite (e.g. polysulphate)	Minimum 48% SO_3, 14% K_2O, 6% MgO, 17% CaO.

Liming materials	Neutralising value (NV)
Ground chalk or limestone	50–55
Magnesian limestone	50–55, over 15% MgO
Hydrated lime	c.70
Burnt lime	c.80
Sugar beet lime	22–32 + typically 7–10 kg P_2O_5, 5–7 kg MgO, 3–5 kg SO_3/tonne

Glossary

Available (nutrient) Form of a nutrient that can be taken up by a crop immediately or within a short period so acting as an effective source of that nutrient for the crop.

Clay Finely divided inorganic crystalline particles in soils, less than 0.002 mm in diameter.

Content (nutrient) Commonly used instead of the more accurate ‘concentration’ to describe nutrients in fertiliser or organic manure. For example, 6 kg N/t often is described as the nitrogen content of a manure.

Cover crop A crop sown primarily for the purpose of taking up nitrogen from the soil and which is not harvested. Also called green manure.

Crop-available nitrogen The total nitrogen content of organic manure that is available for crop uptake in the growing season in which it is spread on land.

Crop nitrogen requirement The amount of crop-available nitrogen that must be applied to achieve the economically optimum yield.

Deposition Transfer of nutrients from the atmosphere to soil or to plant surfaces. The nutrients, mainly nitrogen and sulphur, may be dissolved in rainwater (wet deposition) or transferred in particulate or gaseous forms (dry deposition).

Excess winter rainfall Rainfall between the time when the soil profile becomes fully wetted in the autumn (field capacity) and the end of drainage in the spring, less evapotranspiration during this period (i.e. water lost through the growing crop).

FACTS UK national certification scheme for advisers on crop nutrition and nutrient management. Membership renewable annually. A FACTS Qualified Adviser has a certificate and an identity card.

Fertiliser See Manufactured fertiliser.

Fluid fertiliser Pumpable fertiliser in which nutrients are dissolved in water (solutions) or held partly as very finely divided particles in suspension (suspensions).

Grassland Land on which the vegetation consists predominantly of grass species.

Green manure See Cover crop.

Incorporation A technique (discing, rotovating, ploughing or other methods of cultivation) that achieves some mixing between an organic manure and the soil. Helps to minimise loss of nitrogen to the air through volatilisation and nutrient run-off to surface waters.

Leaching Process by which soluble materials such as nitrate or sulphate are removed from the soil by drainage water passing through it.

Ley Temporary grass, usually ploughed up 1–5 years (sometimes longer) after sowing.

Liquid fertiliser See Fluid fertiliser.

Manufactured fertiliser Any fertiliser that is manufactured by an industrial process. Includes conventional straight and NPK products (solid or fluid), organo-mineral fertilisers, rock phosphates, slags, ashed poultry manure and liming materials that contain nutrients.

Micronutrient Boron, copper, iron, manganese, molybdenum and zinc, which are needed in very small amounts by crops. Cobalt and selenium are taken up in small amounts by crops and are needed in human and livestock diets.

Mineral nitrogen Nitrogen in ammonium (NH_4) and nitrate forms (NO_3).

Mineralisable nitrogen Organic nitrogen that is readily converted to ammonium and nitrate by microbes in the soil, for example, during spring.

Mineralisation Microbial breakdown of organic matter in the soil, releasing nutrients in crop-available, inorganic forms.

Neutralising value (NV) Percentage calcium oxide (CaO) equivalent in a material – 100 kg of a material with a neutralising value of 52% will have the same neutralising value as 52 kg of pure CaO. NV is determined by a laboratory test.

Nitrate vulnerable zones (NVZs) Areas designated by Defra as being at risk from agricultural nitrate pollution.

Offtake Amount of a nutrient contained in the harvested crop (including straw, tops or haulm) and removed from the field. Usually applied to phosphate and potash.

Olsen P Concentration of available P in soil determined by a standard method (developed by Olsen) involving extraction with sodium bicarbonate solution at pH 8.5. It is the main method used in England, Wales and Northern Ireland and the basis for the Soil Index for P.

Organic material Any bulky organic nitrogen source of livestock, human or plant origin, including livestock manures, biosolids (sewage sludge), compost, digestate and waste-derived materials.

Organic soil Soil containing between 10% and 20% organic matter (in this manual). Elsewhere, sometimes refers to soils with between 6% and 20% organic matter.

Peaty soil (peat) Soil containing more than 20% organic matter.

Placement Application of fertiliser to a zone of the soil usually close to the seed or tuber.

Sand Soil mineral particles larger than 0.05 mm.

Silt Soil mineral particles in the 0.002–0.05 mm diameter range.

SNS Index Soil Nitrogen Supply expressed in seven bands or Indices, each associated with a range in kg N/ha.

Soil category Description based on soil texture, depth, chalk content and organic matter content.

Soil Index (P, K or Mg)	Concentration of available P, K or Mg, as determined by standard analytical methods, expressed in bands or Indices.
Soil Mineral Nitrogen (SMN)	Ammonium and nitrate nitrogen measured by the standard analytical method and expressed in kg N/ha.
Soil Nitrogen Supply (SNS)	The amount of nitrogen, (kg N/ha) in the soil that becomes available for uptake by the crop in the growing season, taking account of nitrogen losses.
Soil organic matter	Often referred to as humus. Composed of organic compounds ranging from undecomposed plant and animal tissues to fairly stable brown or black material with no trace of the anatomical structure of the material from which it was derived.
Soil texture	Description based on the proportions of sand, silt and clay in the soil.
Target soil Index	Lowest soil P or K Index at which there is a high probability crop yield will not be limited by phosphorus or potassium supply. See Soil Index (P, K or Mg).

Notes

Notes

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