my technical brief

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News and crop production advice from Frontier

# Precision drilling payback

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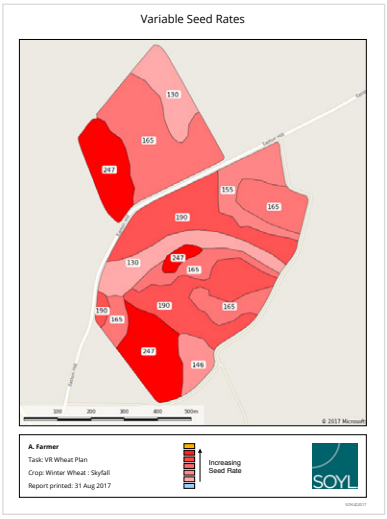
**Before drilling your 2017/18 crop, consider the evenness of establishment in previous years and the consistency of your return on investment for each field. The inherent variability in soil type in most fields makes variable rate seed drilling a sensible option and a strong payback via yield gain means adopting this approach is an easy decision for many growers. SOYL commercial director, Simon Parrington considers the benefits and how growers can get started.**

## Getting started

Many growers already have the necessary kit for their first foray into variable rate drilling. The essential items are a map of the main soil type zones for each field, a GPS system to control the drill, a drill capable of being connected to a GPS system and some prior knowledge and experience of the field. Yield maps, satellite imagery and plant counts from previous years would also be useful, but these are not vital.




## Soil type zone maps

The soil type zone map can be combined with your knowledge of the field and an agronomic model built by SOYL to allocate an establishment estimate to each zone. This estimate represents the percentage of winter sown seeds likely to become viable plants in the spring. SOYL provides a recommended percentage which can then be fine tuned to reflect on-farm experience.

Soil type maps with establishment estimates can be produced using a number of techniques at a low cost and can support other management decisions too. Crucially, once they have been produced, they never need to be done again. The establishment map is combined with your target plant population and thousand grain weight to work out a seed rate in kg/ha for each soil type zone.

## Equipment

GPS applications from most precision suppliers, including John Deere, Trimble, Topcon and Agleader, are capable of variable rate drill control. The simplest approach is to use SOYL's cost effective iPad solution, iSOYL, which combines ease of use in field with simple wireless data download.

Most drills purchased in the last six years will likely have a controller capable of connection to a GPS system, including Vaderstad, Horsch, Amazone and Sumo. Each manufacturer has a range of models, so it's worth checking compatibility with our technical support team. When purchasing a new drill it's a good idea to make your variable rate drilling intentions clear to avoid facing hidden costs to unlock this functionality later.

## The payback

Like any other activity on farm, variable rate seed has to produce a return in excess of its cost. As this is the cost of the soil type zones depreciated over a number of years, this is relatively modest. Seed rate maps can be made in MySOYL at a low subscription level.

SOYL trials have assessed fields that have been variable rate drilled but with part of each soil type drilled at the usual flat rate. Comparing the yield of each zone has shown typical gains of 4% in winter wheat over flat rate drilling.

This approach works for all crops, as plant population can affect overall yield and if you can manipulate poor establishment or lush areas to be at the target range, use of inputs will be more efficient. Targets can be used to achieve the optimum for a variety of crops, whether plants tiller like cereals or are single plant species like maize or sugar beet.

With visible improvements and more even fields to harvest, it's easy to see why the precise approach is popular.

"Variable rate drilling trials have shown typical yield gains of 4% over flat rate drilling in winter wheat."

**Simon Parrington**
SOYL commercial director

# Can your crops access adequate phosphate this autumn?

**To ensure good establishment, all crops need to easily access phosphate. Though good reserves of phosphate are often present, you shouldn't rely on it being fully accessible. Fertiliser technical development manager, Mike Slater and Kings sales manager, Richard Barnes explain why nurturing your soils is worth investment and how the Soil Life report can help.**

## Identifying phosphate levels with the Soil Life report

The Frontier Soil Life report highlights many of the key factors affecting phosphate availability. As carried out in a standard soil analysis, the phosphate concentration is measured and indicates the amount that should be available to crops; the target is index 2 on the ADAS scale. However, as phosphate hardly moves in the soil and the roots of crops have to grow to find it, any compaction problems will restrict access to phosphate.

Three physical parameters are measured in the Soil Life report. Soil density should be around 1.4 kg/l for optimum root growth, but this target varies depending on soil texture, sand, silt and clay content, so this is reported as well. The porosity of the soil indicates whether rainfall will infiltrate adequately into the soil, as if water runs off a field, there is a high risk that clay particles will be lost with phosphate attached. The vulnerability of any soil to further compaction is also highlighted to warn that subsequent field operations carried out in wet conditions will increase compaction.

When fresh phosphate is applied, it starts to be held within the soil after a short period. This is mainly by two processes, where phosphate adsorbs onto the clay particle and at this stage is recoverable by plant roots, then over time becomes absorbed into the structure of the clay particle and is held firmly in the soil.

"High levels of microbial activity will help to ensure that more of the total phosphate in soils is available to crops."

**Mike Slater**
Fertiliser technical development manager

This is a problem on high clay content soils where the proportion of total phosphate available to crops is low. Also in high pH conditions, phosphate will bond with the free calcium in the soil to form calcium phosphate, while at the opposite end of the scale in low pH conditions, phosphate bonds with iron and aluminium ions. These precipitate forms of phosphate can only be resolubilised by microbial activity in the soil.

The Soil Life report gives an indication of microbial activity and thus the potential to resolubilise phosphate to improve phosphate availability. This is most critical for crops soon after germination as the tiny root structure is searching the soil for available phosphate.

## Organic matter and microbial activity

To support this microbial activity, the bacteria, fungi and protozoa need a food supply and this comes from the organic matter in the soil. High levels of microbial activity will help to ensure that more of the total phosphate in soils is available to crops. This is most important at crop establishment so that seedlings can access adequate phosphate. A key soil component, organic matter also holds nutrients for crop roots to access and by identifying current levels with the Soil Life report, you can take action to protect or increase these levels as required.

The addition of fresh organic material will have the greatest effect on microbial activity. This could be from manures or the incorporation of catch crops and cover crops. Manures and compost certainly have their place, but heavy machinery and repeated trafficking can cause considerable damage to soil structure and set back any soil improvement work. With limited supplies and significant costs associated with procuring, importing and spreading the material too, including cover crops in the rotation is an attractive alternative.

## Cover crops can help

The introduction of green cover crops can bring many benefits, helping soils to thrive and delivering financial gain in terms of reduced establishment costs and improved yields and quality. Choosing the right green cover crop is key to this and can help meet numerous other objectives, such as fulfilling Ecological Focus Area and agri-environment needs, providing grazing for stock, limiting soil erosion and protecting watercourses.

Growers are increasingly recognising the opportunities for catch crops, sown after harvest but before the autumn crop, and cover crops, sown after harvest and destroyed prior to spring cropping. Choosing a mix of crop species will help to deliver a wide range of rooting systems and activity that can help to address the microbial and bulk density elements of the Soil Life report.

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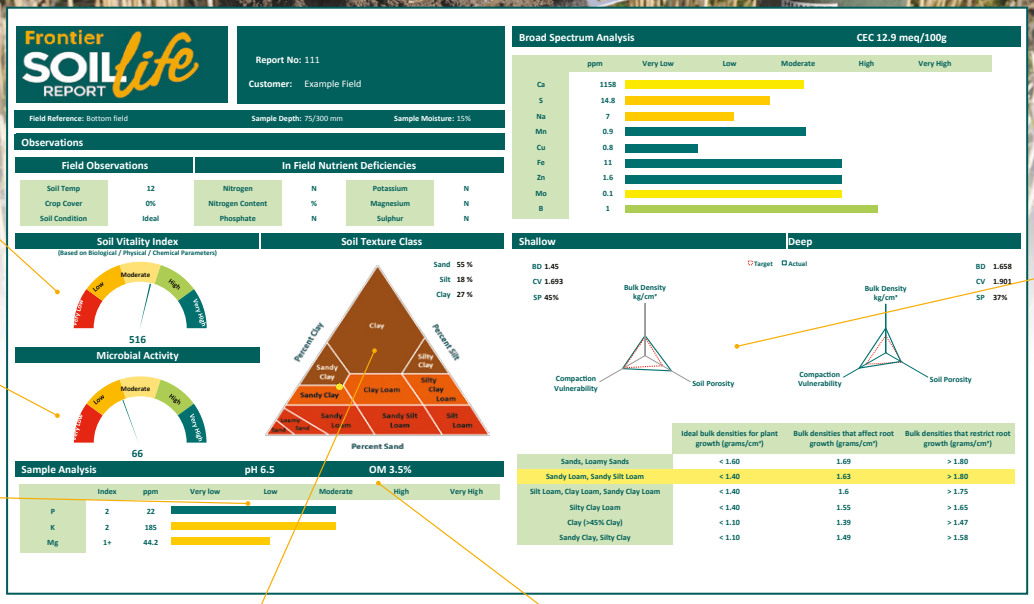
## Example of a Soil Life Report:




**Soil Vitality**

Using biological, physical and chemical soil measurements, the vitality index gives an overall score, which is a guide to the yield potential. A higher soil vitality score means the soil will be able to support higher crop yields.

**Microbial Activity**

Healthy soil has a high level of microbial activity. Microbes interact with the crop's roots, increasing the uptake of water and nutrients.

**Soil pH**

Correcting acidity is one of the most cost effective ways to improve crop performance and maintain a healthy soil.

**Soil Density**

Compacted soils restrict root development and reduce air spaces in the soil. This increases the risk of water logging in winter and reduces the level of microbial activity. Light soils can need consolidation to achieve good root to soil contact.

**Soil Texture**

The soil texture classification indicates the proportion of sand, silt and clay and is the basis for all soil management decisions.

**Organic Matter**

Increasing the level of organic matter improves the soil's capacity to hold nutrients and resist compaction. In most soils improving organic matter levels will ensure a more reliable crop performance and reduce cultivations when preparing a seed bed.

**The Soil Life report leads to action plans which deliver long term improvements in soil health.**

## Species selection

Rooting activity can be targeted to meet the bulk density results highlighted within the report. If the shallow zone needs attention then common oat, rye, vetch, oil radish and phacelia are all worthy of consideration. Where deeper rooting activity is required, oil radish and Tillage radish come into play along with carefully targeted soil loosening using a low disturbance sub-soiler. In this instance, roots and steel are a powerful combination in addressing soil structure challenges.

In terms of encouraging microbial activity, the first base is to consider harvesting sunshine effectively to convert this into biomass that can be returned to the soil. Kings' trials work and experience in the field shows that radish based cover crops will deliver the highest biomass volumes. Additional complementary benefits can be achieved by selecting key radish varieties that have activity against soil borne pests, such as beet cyst and free living nematode species.

Combined with interpretation and support from expert advisors, the Soil Life report provides a baseline to identify your soil's current status and enables a plan to be created to implement key actions for improving soil structure, soil vitality and ultimately your farm business' bottom line.

*Healthy soil is fundamental to a successful crop*

"Cover crops can bring many benefits, helping soils to thrive and delivering financial gain in terms of reduced establishment costs and improved yields and quality."

**Richard Barnes**
Kings sales manager

# Cereal herbicide fundamentals: stacking the odds in your favour

**Most fields have now been cleared and thoughts are shifting to following crop establishment. When it comes to controlling difficult weeds, notably black-grass, ryegrass and bromes, it all starts with effective stubble management (see July's My Technical Brief). Building on this requires a fully integrated approach that takes a long term view but is flexible enough to react to seasonal differences. Success also relies on an appropriate herbicide programme combined with attention to detail when it comes to their application. Crop production technical lead, Dr Paul Fogg examines best practice and the options available.**

## Where to start

Removing the 'green bridge' is the first step to weed control, so treat stubbles with glyphosate before crop establishment. Look to apply a minimum of 540g a.s/ha (1.5L/ha of a 360g/L product) and add a water conditioner in hard water areas. Follow WRAG guidelines to minimise the risk of glyphosate resistance in the UK. The importance of this is clear, with early black-grass flushes being observed despite the surprising high dormancy being reported for this year's seed (Figure 1).

*Figure 1: Photo taken 1st August 2017 shows black-grass already germinating. Source: J Yeoman, Frontier agronomist*

## Tri-allate is vital

The next question is on the level of control afforded by a post-emergence treatment. The more the efficacy drops away from the post-emergence treatment, the greater the reliance on the pre-emergence programme. Tri-allate has now become an essential element of the pre-emergence stack, with good activity against black-grass, ryegrass and sterile and great brome. In-vitro studies have also demonstrated good activity against soft bromes, although efficacy in the field may lessen due to their protracted germination.

In the last two seasons, tri-allate has added around 30% control in black-grass trials. The granules must be applied pre-emergence to a level, well consolidated seedbed. Ensure application equipment is calibrated and check spread patterns. A liquid formulation is also available this season as a 450g/L CS formulation delivering 72% dose of tri-allate at the full label rate.

## Flufenacet foundations

Flufenacet is the foundation active ingredient to almost all herbicide programmes, having good activity against black-grass, ryegrass and brome. Average use rates have increased in recent years to 270g a.s/ha in response to the increasing importance of the pre-emergence spray. A minimum of 240g a.s/ha is required for 'difficult' grass weed situations, followed by a decision on if and when to top the rate up to 360g a.s/ha. In recent years, trials have shown a benefit from sequencing the treatment, with 240g/ha pre-emergence followed by 120g/ha (Figure 2). However, it's important to factor in drilling date, seedbed condition and available soil moisture. If committing to a sequence, the 'top-up' spray needs to happen, which can be a challenge in late drilled crops.

Flufenacet alone is not a complete solution. Historically only available in co-formulated products with diflufenican or pendimethalin, and more recently in three way mixes with flurtamone, straight flufenacet is now available, allowing more flexibility. Diflufenican adds persistency to the mix and while not renowned for its grass weed activity, on average adds 10-15% to grass weed control when the rate is topped up to 100–120g a.s/ha.

## Picolinafen and pendimethalin

If you're concerned about the amount of diflufenican being used in the rotation, another option is picolinafen. It has the same mode of action as diflufenican but the half-life in soil is one – two orders of magnitude lower depending on soil type (DT50, Diflufenican 224 – 624 days, Picolinafen 7.8 – 61.5 days). Picolinafen also offers improved contact activity over diflufenican, so the early post-emergence timing could be a good place for it.

Pendimethalin, another main stay active, should also be added to the mix. Look to apply 1200g a.s/ha pre-emergence, with the balance (800g a.s./ha) added with either the early post-emergence residual spray or the post-emergence contact herbicide.

## Flurtamone and prosulfocarb

Flurtamone is only available in co-formulated products. It is a mix partner active substance but when combined with flufenacet and diflufenican, grass weed control is improved, particularly for ryegrass.

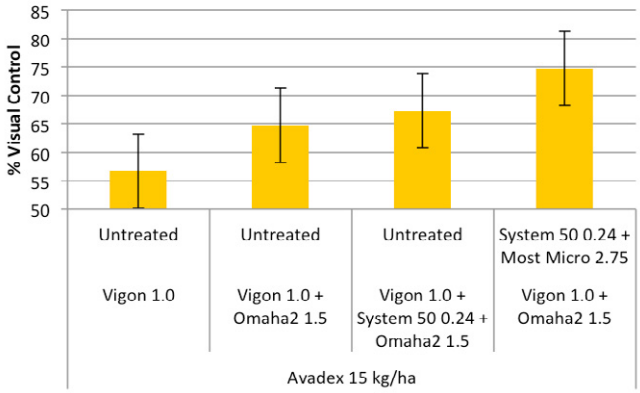



***Figure 2: Benefits of increasing flufenacet dose rate to 360 g a.s./ha, applied pre-emergence or a pre/ early post sequence. Pre-em applied 15th October, post em applied 12th November.***

Prosulfocarb is also seeing a renaissance. It has the same mode of action as tri-allate, which is different from the other key residual active ingredients. It is non-persistent (DT50 6.5 – 13 days) so needs good conditions to for the best results. Historically, 2.0L/ha would have been a typical pre-emergence rate in partner with other active substances, but increasing the rate to 3.0–4.0L/ha showed benefits in the field last year, particularly against ryegrass.

## Application

Application technique can have a significant impact on herbicide performance, as well as any non-target effects that may occur as a result of drift. Key factors to consider include application volume, nozzle type, boom height and forward speed (Figure 3). Application volumes have been falling in order to increase work rates and would typically be 100–150L/ha, though industry data now suggests a benefit of using higher water volumes (200 L/ha) to improve surface coverage.

Nozzle type will clearly have an impact on deposition and drift. Using conventional flat fan nozzles has historically been considered to give the best cover, though this has to be balanced with the need to manage fine, driftable droplets as well as the increasing requirement on product labels to use low drift (LERAP 3 star) nozzles. Low drift nozzles will help reduce drift, ensuring more of the spray solution hits the soil surface, particularly when used in conjunction with slightly higher water volumes.

When it comes to boom height and forward speed, the reality is that lower boom height improves coverage and reduces drift. Low boom heights (50cm) above the target, the soil surface in the case of residual herbicides, can represent a challenge, particularly with wide booms on undulating fields. Keeping forward speeds to 10–14 kph maximum can help with boom stability and allow them to run closer to the ground.

***Figure 3: Flat fan nozzle (left) vs. Low drift nozzle (right) – Source: Say No to Drift Campaign***

## Adjuvants

A final consideration is the use of adjuvants, which can help improve penetration into soil clods. This evens up the herbicide layer and retains higher concentrations of active ingredients near the soil surface. They can also help reduce the small spray droplets that may otherwise drift away from the intended target.

## Responsible use

Herbicides remain an essential tool when it comes to managing difficult grass weeds. With increasing resistance issues, potential restrictions on use and possible further loss of active substances as a result of the regulatory process, it's imperative that we use them responsibly as part of an integrated approach.

"Application technique can have a significant impact on herbicide performance. Key considerations include: application volume, nozzle type, boom height and forward speed."

**Dr Paul Fogg**
Crop production technical lead

# Reflecting on removals and how to replace them this harvest

**As combining nears completion, now is the time to reflect on the implications of harvest for next year's crops. Correctly accounting for the phosphate and potash removed by the crop is absolutely critical to managing the all important soil nutrient levels that will support next year's yields. With some modern energy crops capable of removing over 100kgs/ha of phosphate and nearly 300kgs/ha of potash, soil levels can now be depleted relatively quickly. National crop nutrition technical manager, Edward Downing considers the current situation and the action needed to provide sufficient nutrition for this season's crops.**

## Managing soil pH

Before we even consider P and K, it's vital to make sure the pH of all your soil is within the optimum range for all crops grown on the farm. The target pH for most arable soils is 6.5 with crops such as barley, peas and sugar beet the first to suffer where levels drop below this. The most recent Professional Agricultural Analysis Group (PAAG) report, based on around 65,000 arable soil samples analysed in 2016, shows 39% of samples were below this target and more concerning, 17% below pH 6. However, this is a slight improvement on the previous report where levels were 42% and 19% respectively.

Unless you are on naturally calcareous soils, liming is required on a regular basis to neutralise the acidification which occurs through normal crop production, so check soil pH at least every 4 years.

For those using direct drilling or minimal disturbance systems, it's essential to be ahead of the natural acidification because studies have shown it can take 2-4 years longer for surface applications to these soils to reach the same pH as where soils are mixed.

Variably applying lime using precision techniques should always be used where possible because it targets the liming products to neutralise the areas of acidity, but also avoids over liming areas of fields, which can induce nutrient lock up.

## Importance of phosphate and potash

Both phosphate and potash are essential for healthy crop growth. Phosphate is required for strong root development and potash is needed for water management, but both also provide many other vital functions within the plant.

Before considering crop removals, it's important to understand peak uptake. This is the level of maximum uptake when the crop has its highest demand for nutrients. For phosphate, this level isn't significantly above the amount removed by the crop at harvest but for potash it is staggeringly higher. For example, a 10t/ha wheat crop might contain over 350kg/ha K2O in early June, but at harvest only 56kg/ha K2O (15% of peak) would be removed in the grain and even baling the straw would only take it to 104kg/ha (30% of peak).

So why does this matter? If your soil doesn't contain enough available potash to meet peak demand it will limit the crop's potential.

## Target indices

To reduce this risk, we have target soil indices for both nutrients. For arable crops this is Index 2 for phosphate and Index 2- for potash. To maintain the soil supply at this level, you need to accurately account for the nutrients removed by the previous crop. Clearly yield has a massive

| Crop | Yield (t/ha) | | P2O5 offtake (kg/ha) | K2O offtake (kg/ha) |
|---|---|---|---|---|
| W Wheat (grain only) | 8.0 | RB209 | 62 | 45 |
| | 12.0 | | 94 | 67 |
| W Wheat (grain + straw) | 8.0 | RB209 | 67 | 83 |
| | 12.0 | | 101 | 125 |
| OSR (grain only) | 3.5 | RB209 | 50 | 40 |
| | 5.0 | | 70 | 55 |
| Sugar Beet (roots only) | 60 | RB209 | 48 | 102 |
| | 100 | | 80 | 170 |
| Forage/Energy Maize (30% DM) | 40 | RB209 | 56 | 176 |
| | 65 | | 91 | 286 |
| Hybrid Energy Rye (36% DM) | 6* | RB209 | 50 | 70 |
| | 50 | | 94 | 288 |

*only grain rye is shown in RB209

*Table 1: Difference in crop removals according to average yields*

The recent PAAG report showed that 27% of arable soils were at the target Index 2 for phosphate and 32% were at the target index 2- for potash. However 21% were below target for phosphate and 31% were below target for potash.

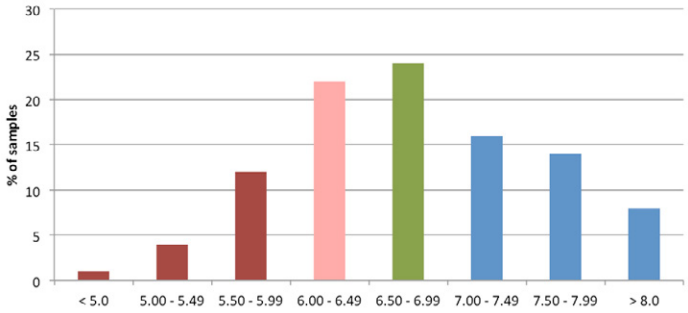



*Figure 1: Distribution of soil pH values – arable soils (Soil sample results from 2016 PAAG report)*

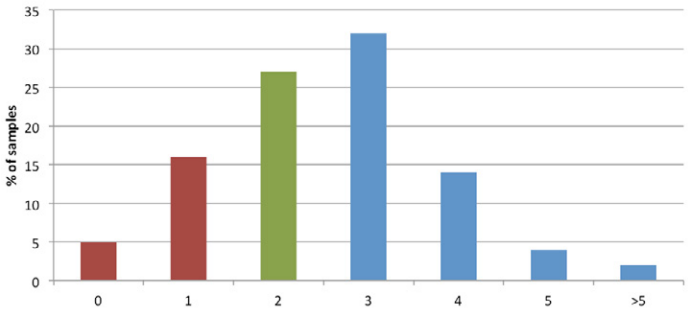



*Figure 2: Distribution of soil P index values – arable soils (Soil sample results from 2016 PAAG report)*

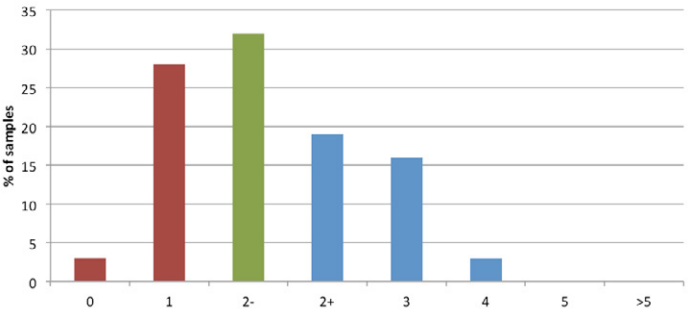



*Figure 3: Distribution of soil K index values – arable soils (Soil sample results from 2016 PAAG report)*

## Building indices

Where soil indices are below these target levels, the nutrients removed by the previous crop must be replaced but you should also apply extra to build these levels to meet peak crop demand. The standard recommendations in RB209 are an additional 60kg/ha at Index 0 and 30kg/ha at Index 1, but be aware that these are quite small additions, so soils could take 10-15 years to get back to target. More can be applied to speed up this process but this must be offset against cost, although if available, organic sources such as livestock manure, sludge and digestate can be very cost effective. Some materials on the market, for example recycled materials, including ash products, can appear good value based on their total nutrient content, but this value decreases dramatically when you consider the amount that will be available to the crop.

## So what's happening on farm?

Figures from the most recent British Survey of Fertiliser Practice suggest there has been a steady decline in the use of phosphate and potash fertiliser since the early 1980s. This has at least levelled off in the last five years, but at considerably lower levels, with 60% less phosphate and 50% less potash. Some of this decline is positive as variable rate applications target lower levels within fields and we're taking far better account of the nutrients applied in organic materials too. However, with the push for ever higher yields, it's important to recognise that both the crop requirement and the grain offtake are increasing, which means these nutrients must be replaced if soil levels are not to fall to yield limiting levels.

"If your soil doesn't contain enough available potash to meet peak demand it will limit the crop's potential."

**Edward Downing**
National crop nutrition technical manager

# Early OSR management

**Big OSR crops are lower risk, at least as far as early growth and development is concerned. Of the many potential stresses that can weigh on establishing OSR, there are few situations where a healthy, rapidly growing crop with a large root system will not help to protect yield potential. Crop production specialist, Paul Cartwright explains how to give your OSR crop the best start and the potential challenges to look out for.**

## Flea beetle

Cabbage stem flea beetle has occupied many headlines in recent years and current establishment strategies focus on rapid emergence and early growth promotion as a means of getting ahead of grazing pests. This has been successful in reducing the risk of crop losses and also reduces the reliance on a number of active ingredients that are under pressure, including pyrethroid insecticides from increasing resistance amongst pest populations and metaldehyde that is frequently detected in raw water above the Drinking Water Directive limit of 0.1 µg/l.

Insecticides still have a role to play, but must be used in response to damaging pest activity rather than applied 'just in case'. In addition to controlling or deterring flea beetle, pyrethroid sprays may be required to tackle other grazing species. For example, turnip sawfly larvae (pictured) have already been found defoliating volunteer OSR and brassica cover crops in southern counties this summer. Monitor crops and prepare to act quickly if the third generation appears in newly sown crops, as they are voracious feeders and can rapidly skeletonise plants if left unchecked.

## Rape winter stem weevil

This is an occasional pest whose presence from September may be less obvious. Eggs laid from October onwards will hatch before larvae burrow in through petioles to over-winter in stems. Stunted plants may appear in spring as stem extension begins. No insecticide resistance is known so control is possible if evidence of this pest is found.

## Biostimulant benefits

Late-drilled and stressed crops often call for help soon after emergence, with development possibly limited by smaller root systems, cooler seedbeds and prevailing weather less conducive to rapid growth, as well as damping-off and early mildew infections. Applying a biostimulant to young crops can lessen the effects of stress, but is equally justified in otherwise healthy crops to help push them through the most vulnerable early growth stages and avoid any negative impacts.

Tauron is a zinc-based stimulant proven to promote root development and should be applied once the crop has at least two leaves. Phosphite-based products such as Gro-Plan P should be applied from the four leaf stage. As well as encouraging plants to root in search of nutrients, increasing cell wall thickness makes plants less susceptible to fungal penetration and subsequent mildew development is reduced.

Biostimulants do not replace essential nutrients, but produce a growth response in the crop. Appropriate fertiliser is still required, particularly fresh phosphate to feed root growth, nitrogen to feed foliage and the breakdown of previous crop residues and boron for improved establishment and reduced winter losses.

## Dealing with disease

The wet start to August suggests early phoma infections could be a feature this season. The most at-risk crops will be smaller and slow growing when leaf lesions appear. Growth promotion using nutrients and biostimulants can delay the point at which treatment thresholds are reached, increasing flexibility around the first autumn fungicide application timing. Selecting a non-triazole fungicide with both phoma and light leaf spot activity, eg Refinzar, combines resistance management with the best disease protection.

"Applying a biostimulant to young crops can lessen the effects of stress, but is equally justified in otherwise healthy crops."

**Paul Cartwright**
Crop production specialist