my technical brief

frontier

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News and crop production advice from Frontier

In this issue

Spring cropping for weed control

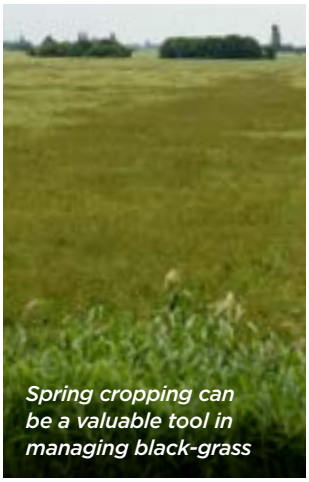
Weed control is vital for good quality crops, high yields and preventing the spread of pests and diseases. In a landscape of fewer active substances and a need to protect water and manage herbicide resistance, technical support manager Christine Lilly examines how to deal with weed challenges across the rotation.

When it comes to controlling weeds, managing the seed bank, cultivation technique, crop choice, drilling date and effective application are all important factors. Since winter wheat yields can be reduced by up to 0.5t/ha where black-grass populations are around 12-17 plants/m^2, spring cropping is becoming increasingly popular.

Trials prove spring cropping benefits

Over the last four seasons, work at Frontier's 3D Thinking Development site at Staunton, Nottinghamshire has shown the benefit of including spring crops in the rotation. Where three consecutive spring crops were followed by winter wheat, the return over the rotation was £1,991. In a winter wheat and oilseed rape rotation, it was just £373. This considerable difference was due to black-grass competition reducing yields in the winter crops.

In harvest 2014, when the black-grass population was in excess of 1000 heads/m^2, spring wheat was significantly higher yielding than winter wheat at 7.5t/ha compared to 5.5 t/ha. By 2015, when the black-grass population was much lower at 10 heads/m^2, winter wheat was higher yielding at 10t/ha compared to spring wheat at 7t/ha.



Spring cropping can be a valuable tool in managing black-grass

Establishment is key

Poor establishment is the biggest risk to spring cropping and seedbed condition can make a vast difference. Barley establishment in a good seedbed, for example, is typically between 80% (early sown) and 95% (late sown) but in poor conditions this can fall to 55% and 70% respectively. Seed rates may need to be increased to 400 seeds/m^2.

After growing cover crops over winter, options for spring crop establishment include direct drilling into a standing crop or cultivating and then drilling. Direct drilling can be successful as the cover crop provides a surface to support the tractor, but patience will be required if the cover crop has collapsed and soil is wet underneath. Take advice to determine the best course of action for your specific circumstances.

Product use

Where spring cereals are planned, herbicide options are fewer than for winter crops. Some pesticide products are granted an Extension of Authorisation for Minor Use (EAMU) which allows them to be applied to a crop that is not approved on its label. These are more common in minor crops; ask your local advisor for the latest authorisations and usage dates.

If black-grass is an issue, drilling should be delayed for as long as possible and seed rates kept up. Depending on crop species, residual herbicides such as flufenacet, tri-allate, pendimethalin and diflufenican should also be applied. Conditions are important as activity will be poor if it is too dry at or after application; again, talk to the experts to determine the most appropriate products and timings.

Crop drilling dates should be noted to avoid breaches of use. For crop protection products, crops sown up to the end of January should be classified as winter crops and those sown from 1st February as spring crops. Products labelled for use on winter crops can therefore be applied to those drilled up to the end of January in the year of harvest and those drilled from February onwards can only be treated with products authorised for spring use on the label.

"Four seasons of trials have shown spring cropping to provide a considerably higher return where black-grass competition is reducing winter crop yields."

Christine Lilly
Technical support manager

Managing output and lodging this spring

The unseasonably warm winter has resulted in some crops being more forward than we would like. Combined with above average rainfall in many areas, the risk of root based lodging could be significantly increased. Crop production specialists Dr Paul Fogg and Paul Cartwright explain how to counteract this and use plant growth regulators (PGRs) to manage crops and maintain yield potential.

Lodging is defined as the permanent displacement of plant stems from the vertical and it can reduce yields by as much as 35% (Fisher and Stapper 1987). On average, it occurs once every four years in UK wheat crops, reducing the yield and bread making quality of grain (Berry 1998). Risk of lodging depends on several factors, including varietal susceptibility, yield potential, size of canopy, weather, soil type, sowing date and seed rates.

How PGRs work

Plant growth is regulated by a balance of different hormones within the plant, as shown in table 1. To mitigate the risk of lodging, PGRs can be used to manipulate the plants hormonal system in order to modify growth. Modern day PGRs influence the balance of gibberellins or stimulate the release of ethylene within the plant. As day length increases, this triggers an end to "foundation" growth stages and an increase in the biosynthesis of gibberelic acid. It is the increase in gibberellins that stimulates cell division and elongation. PGRs that can alter gibberellins biosynthesis may also alter the balance of other hormones within the plant, triggering numerous side effects including delayed senescence, increased resistance to environmental stresses and improved rooting.

Plant growth regulators can be grouped by their biological effect. Chlormequat chloride and mepiquat chloride both inhibit the early stages of gibberellin biosynthesis, where as prohexadione calcium and trinexapac-ethyl both inhibit the later stages. Ethephon (2-chloroethylphophonic acid) blocks auxins and triggers the release of ethylene.

Natural hormone	Produced in	Effect
Cytokines	Roots and shoots	Cell division and enlargement, stimulation of cell multiplication in roots and tillers, flowering and senescence, inhibits auxin.
Gibberellins	Young tissue	Stimulation of growth. Cell elongation and division. Inhibition of root and shoot growth.
Auxins	Top of plant	Stimulation of stem elongation, especially stems. Apical dominance.
Ethylene	Whole plant	Blocking of auxins, contributing to cell wall thickening and maturation. Stress is stimulated.
Abscisic acid	Grain, shoots and fruit	Closes stomates, inhibits plant growth – ripening.

Table 1: Natural hormones in a plant and their impact on growth

Lodging occurring in unsprayed wheat in Frontier PGR trials.

"Understanding varietal weakness and crop potential enables the PGR programme to be tailored to meet specific needs."

Dr Paul Fogg
Crop production specialist

Some crops are more forward than we would like at this point in the season.

Cereal PGR strategies for this spring

Canopy manipulation as cereal crops approach BBCH 30 is influenced by the timing and amount of nitrogen applications, early season disease control to prevent loss of tillers and the use of PGRs.

Early season applications will be key to maximising anchorage strength this year, for example chlormequat + trinexapac-ethyl (1.0L/ha + 0.15-0.2L/ha) or mepiquat chloride + Prohexadione calcium (0.3 L/ha). Mitigating root based lodging is all about increasing root plate spread and depth. Clearly soil type and condition also has a key influence. On forward wheat crops, split applications based on BBCH 30 and then again at BBCH 31-33 have proved effective. On backwards crops where tiller numbers need to be maximised, a slightly longer split, starting mid-tillering, has worked well. However, check that specific labels support use pre BBCH 30.

Pre BBCH 30	BBCH 31 – 33	BBCH 37-39
Enhance rooting – better access to water and nutrients	Reduce apical dominance/tiller retention	Shorten upper internodes
Stronger crown roots - reduce risk of stem based lodging	Shorten and thicken internodes	Reduce stem leverage
Enhance tiller survival	Strengthen base – reduce stem lodging	

Table 2 PGRs: Key timings and aims

1. Berry, P. 1998. Predicting lodging in winter wheat. Thesis submitted to University of Nottingham for the degree of Doctor of Philosophy.
2. Fischer, R.A. and Stapper, M. 1987. Lodging effects on high yielding crops of irrigated semi dwarf wheat. Field Crops Res 17:245-258.

In summary, effective canopy management is essential to building yield. Maximising shoots per square metre is a fundamental building block of yield, as is optimising the plant population to increase light interception and the utilisation of available nutrients. Understanding varietal weakness and crop potential enables the PGR programme to be tailored to meet specific needs. PGRs are an insurance and in some years, retrospective analysis may suggest that their use may not be justified, but with yield losses of up to 35% possible in one year in every four, the benefits of using PGRs are clear.

PGR strategies for oilseed rape

The structural requirements of an oilseed rape canopy to achieve high yield potential are well documented. A green area index (GAI) of around 3.5 at flowering will improve light penetration, moderate pollination success means fewer but potentially bigger pods are set and some later-applied nitrogen will ensure that crops fill pods rather than growing excess foliage late in the season.

The condition of oilseed rape crops varies around the country, but growth throughout the winter months means many are faced with large, forward crops, some of which entered the stem extension phase before Christmas. With PGRs, growers are able to manage the risk of these crops lodging, as well as improving yield potential by avoiding over-development of the upper canopy that competes with itself for light and starves the more productive primary and secondary branches.

When evaluating PGR requirements, growers should consider the condition of roots alongside stem strength and varietal standing power on a field-by-field basis. Regulating the development of the main raceme, also known as apical dominance, will promote rooting and encourage growth of the primary branches to improve yield potential.

Fungicides containing tebuconazole (e.g. Corinth or Orius P) will combine valuable light leaf spot and phoma protection with growth regulation when applied at the stem extension timing. Specific growth regulators based on metconazole (i.e. Caryx) will add PGR activity to fungicides such as Refinzar or Prosaro, if required.

"With PGRs, growers are able to manage the risk of forward OSR crops lodging, as well as improving yield potential."

Paul Cartwright
Crop production specialist

Achieving the ideal balance of nitrogen and sulphur in the soil

Weather conditions have been variable across the country this winter, with above normal soil temperatures and extremes in rainfall affecting the likely levels of mineralised nitrogen and sulphur in our soils. These nutrients make a major contribution to the total nutrition of our crops, so their availability within the soil should be carefully evaluated. Fertiliser technical development manager Mike Slater describes the current situation.

The yield potential of many crops will depend on the vitality of their root systems as spring progresses. Any crops that have suffered a long period in waterlogged soils could have reduced yield potential unless remedial action is taken, but with help, these crops can still deliver good yields.

Higher than average soil temperatures mean that mineralisation of organic matter will have continued for much longer over winter than usual. Soil temperatures always vary widely across the country in autumn and winter, but this season they only fell below 5°C for a very short time in the south and Midlands, delivering more mineralised nitrogen and sulphur.

In areas of excessive rainfall, leaching will have been higher too. In early mineralised nitrogen testing in moderate rainfall areas, total nitrogen in the soil is around 10kg N/ha higher than average, at 65kg N/ha, but at least a third of this is below 60cm depth. This will be out of reach for many crops in early spring. Conversely, the amount in the top 30cm is only around 20kg N/ha, which is insufficient for early crop growth. Affected by previous crop, soil type, temperature and rainfall, these levels will vary widely.

Field by field assessments should be made and especially where the previous crop is likely to have left a high nitrogen residue, or where manures and other organic materials have been applied, mineralised nitrogen testing can be a very helpful guide to indicate future nutrition requirements. Later drilled crops will require support as soon as conditions allow, especially in the north. Early nitrogen for winter barley and backward oilseed rape crops should be prioritised.

"Higher than average soil temperatures mean that mineralisation of organic matter will have continued for much longer over winter than usual."

Mike Slater
Fertiliser technical development manager

Winter barley	40 to 60kg N/ha
Winter oilseed rape	40 to 60kg N/ha
Winter wheat	40 to 50kg N/ha

Table 1: Likely first top dressing quantities

Excessive rainfall has led to some soil being anaerobic and lacking oxygen. If crops remain in these conditions for a considerable time, it will cause roots to degenerate and yield potential to reduce. In soils with a low phosphate status or where no phosphate was applied in the autumn, an application of DAP (Di ammonium phosphate) at 150kg/ha should be considered. This will provide water soluble phosphate and non leaching ammonium nitrogen to stimulate rooting and early crop growth, which will help to recover yield potential and minimise the eventual costs of production per tonne.

Sulphur is equally as leachable as nitrate nitrogen. Released from soil organic matter along with nitrogen during mineralisation, total releases could be higher this year, but outweighed by losses from leaching, there is a high risk of sulphur deficiency. Sulphur should be applied to all responsive crops, especially oilseed rape and milling wheat. Light to medium soils and those with low organic matter and no manure applications will be high risk.

	Oilseed rape	Winter cereals (especially milling wheat)
High risk fields	110 – 120	45 - 60
Moderate risk fields	80 – 90	40 – 50

Table 2: Recommended sulphur applications (Kg SO3 per ha)

A review of the likely availability of soil nitrogen and sulphur will be important to achieve the correct balance with fertilisers. An additional review in spring before the last planned top dressings is vital to achieve the correct nutrient balance and optimum yields.

Soil nutrient levels are crucial to yields.

Choose fallow to maximise EFA potential

Greening rules state that growers with over 15ha of arable land must commit at least 5% to Ecological Focus Areas (EFAs). These areas can consist of a combination of features, including buffer strips, cover crops, nitrogen fixing crops and hedges. Managed carefully, they can bring great benefits to the farm business and wildlife, as well as meeting greening requirements. Kings technical advisor in Scotland, Alan Johnson, examines the opportunities offered by the fallow land option in particular.

While many interpret 'fallow' to mean bare land, this option actually offers the flexibility to establish a pollen and nectar or wild bird seed mixture, or grass, during the fallow period, from 1st January to 30th June in England and 15th January to 15th July in Scotland. Of all the EFA options available, fallow is the most favourably weighted too; see table 1 for the weightings attached to each option, determined by the perceived level of benefit to the environment.

EFA Type	Area	Weighting factor
Hedgerows	1 metre length of hedge	= 10sq m of EFA
	1000 metres length	= 1 ha of EFA
Buffer strips	1 metre length of buffer strip	= 9sq m of EFA
	1111 metres of buffer strip	= 1 ha of EFA
Fallow land	1 hectare of fallow	= 1 hectare of EFA
Nitrogen fixing crops	1 hectare of nitrogen fixing crop	= 0.7 hectare of EFA
	1430 ha	= 1 hectare of EFA
Catch or cover crops	1 hectare of a catch or cover crop	= 0.3 hectare of EFA
	3.333 ha	= 1 hectare of EFA

Table 1: Weightings for each EFA option in England. In Scotland, hedgerows are not an EFA option and 1ha of buffer strips or field margins equates to 1.5ha of EFA. All other options have the same weightings as in England.

Creating a rotational pollen and nectar mix under the fallow option is a great way to boost soil health and vitality in poorer fields and could improve crop performance when these fields are brought back into the rotation. These mixes also provide a fantastic habitat and food source for farmland wildlife and pollinators in particular.

A well established wild bird seed mixture has the potential to improve soil structure and create valuable habitat for game and farmland birds, supplying food through the winter months. These can be established during April and May as annual or biennial mixes which provide both cover and feed.

Establishing a short term nectar flower mix of oil radish, phacelia, berseem clover and vetch in late spring, for example, would fix nitrogen and create excellent rooting to benefit the soil structure too. Leaving this crop to grow until late August before topping and incorporating back into the soil would help build up organic matter, or for growers using a direct drill, the crop can be sprayed off before drilling a winter crop.

Where sporting interests and arable farmland sit side by side, both can benefit from the fallow option. Low yielding areas of arable fields next to woodland, for example, can be allocated to creating a wild bird seed mixture for game birds and wildlife.

The fallow option can also be used to enable access, since EFA rules allow fallow margins to be travelled on whereas this is actively discouraged for stewardship margins. Including an area at least two metres wide around arable field edges can therefore help with hedge cutting duties as well as helping to reduce pressure on arable crops from pigeons and rabbits.

With so many options and opportunities available, taking expert advice is vital to making the best decisions for your business.

Careful crop selection can benefit the farm and its wildlife under the fallow option.

"A flexible and favourably weighted option, fallow land can be a valuable feature if used to its potential."

Alan Johnson
Kings technical advisor in Scotland

Big data - the future for crop production?

What is big data?

Big data is a term used in technology to describe extremely large data sets that may be analysed to reveal patterns, trends, and associations which could not be computed from more limited analysis. These may then be used to benefit a business or organisation.

Combine data analysis with precision techniques to boost crops.

It feels that we can't pick up a magazine or go to a farming conference these days without reading or hearing how precision agriculture and 'big data' have arrived and are going to be the revolutionary answer to all of agriculture's challenges. The reality is that the use of precision technology and its resulting data in the UK is really more evolution than revolution. The full value of using precision techniques will only be truly realised as we build more comprehensive evaluation of farm data gathered over many seasons. Commercial director Simon Parrington explains how SOYL is using its own big data to help growers improve their crops.

Precision farming is still a relatively new concept, but SOYL started using precision techniques 20 years ago. We now have the benefit of a significant database spanning two decades and covering soil types, nutrient maps, yield potential and regional variances.

We use this long-term research – our own comprehensive set of farming 'big data' - to help us identify patterns and trends, develop new techniques and give growers the best advice for their specific situation, based on what we have learnt has worked, or indeed not worked, over the years.

What does 20 years' SOYL big data tell us about the 'typical' UK farm?

In 20 years the team at SOYL has:

- Taken 2.5 million soil samples to assess nutrition and health
- Taken satellite imagery of 14 million km^2 crops
- Assessed over 1 million hectares of land
- Worked with over 5,000 farms.

This is probably the largest UK database of information about soils and gives a reliable overview of our arable landscape and the level of variation we can typically expect to find within a farm, field or hectare. So what have we found?

This is a glimpse into the breadth of the agricultural data SOYL has built relating to UK soils. For a more localised picture and to find out how SOYL could draw on 'big data' to benefit your farm and help you make more profitable crop production decisions, get in touch with the team at SOYL; call 01635 204190 or email info@soyl.co.uk.

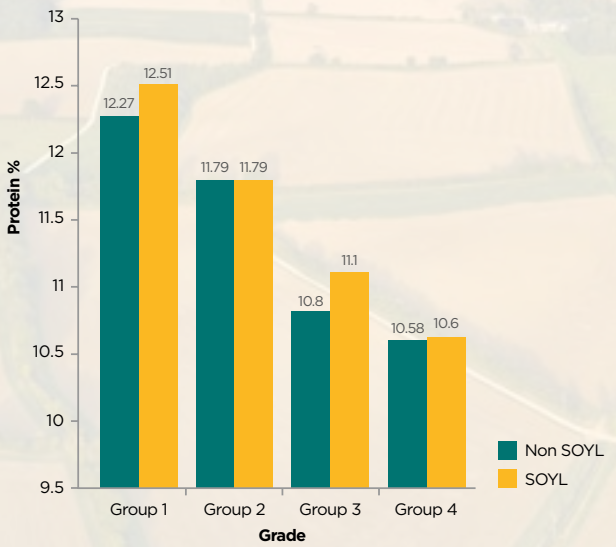
Soil types

A typical UK arable field contains at least five soil types and seven soil zones. This is probably one of the reasons why the UK leads the world in the practical use of precision agriculture. Our fields are reasonably sized and highly variable and so benefit from a more targeted approach.

Phosphorus (P) and potassium (K)

Variation in soil type: A soil type zone in SOYL's database typically covers between four and six hectares. Within these type zones we have found that P and K nutrient levels can vary significantly. An average zone has a variation range in excess of one index point for both P and K. More importantly, 45% of soil zones have variation well in excess of this range. This variation highlights one of the risks associated with the zone method of soil sampling which takes just one soil analysis to reflect a whole soil type.

All of SOYL's data points to P being the most variable of the base nutrients in the majority of UK arable fields. For a field to benefit from variable rate P and K, the variation within that field needs to span across at least two index bands. A huge 81% of fields measured by SOYL spanned at least two index bands for P, with differences of three index bands or more in 60% of the fields measured. Meanwhile, 83% of fields varied across two index bands for K, with 50% of fields spanning three bands or more.



26,729 wheat samples were analysed for protein. Growers using variable rate nitrogen achieved improved protein levels in 3 out of 4 groups.

Deficiency: As well as this in-field variation, nearly 40% of individual hectares measured by SOYL were found to be P deficient and 20% didn't have enough K to support optimum plant growth. It's important to note these deficiencies were within a hectare and so may reflect the situation in certain areas of the field. SOYL's data also shows that general deficiency is increasing year on year, probably fuelled by complacency around P and K applications, products which don't deliver the desired effect, or blanket applications with insufficient nutrients for some areas and wasted nutrition in others.

Acidity

Acidity is a common theme, with 22% of hectares measuring below pH 6.5 and a further 25% between pH 6.5 and 6.7. Left untreated this can cause visible signs of acidity in the crop while also restricting the availability of other essential nutrients.

Magnesium

Around 10% of hectares measured were at low enough levels to require an application of magnesium every three or four years, with deficiencies almost always showing only in part of a field. Where growers have consequently taken action to improve their management of magnesium, they have seen improved grain fill and thus bushel weights.

Nitrogen

Throughout the growing season, SOYL takes between 10 and 15 images of a crop's canopy to assess variations in growth and then recommend appropriate variable nitrogen applications accordingly. Canopy imagery taken in early April often shows significant variation in progress across a single field. SOYL has found that where an application of 90kg/ha across the field was planned, satellite imagery enables fine tuning within that field, typically adjusting by -20kg/ha for those areas which are forward and +20kg/ha where crops need some help.

"Big data is a valuable tool for identifying patterns, developing new techniques and giving growers the best advice."

Simon Parrington
SOYL commercial director

Map your field boundaries with the MyFarm website & new MyRecs App.

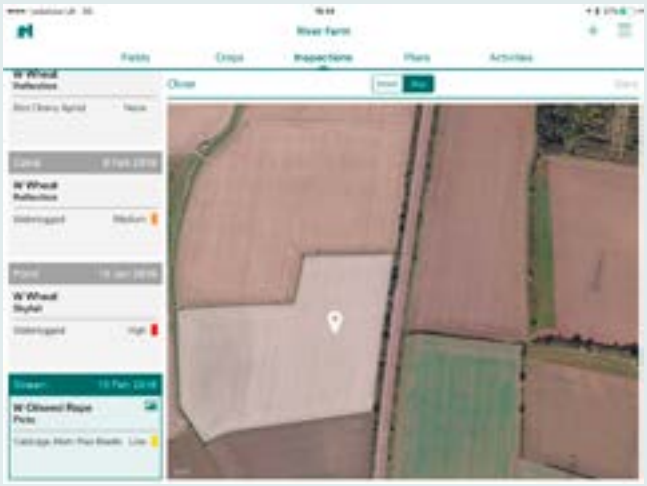
MyFarm: Making management easier

Free trials of MyFarm are currently available until January 2017. If you would like any further information on MyFarm or MyRecs, including any of the recent improvements, please contact us on 03330 141141 or email ITsupport@frontierag.co.uk.

With the busy spring season just around the corner, MyFarm project co-ordinator Jim Knight describes the latest updates to MyFarm and the MyRecs app and how they can help your business in the coming months.

The MyFarm system includes a range of tools which provide access to vital farm information while growers are on the move. Instead of being tied to the single computer in the farm office, everyone involved in the farm business can access MyFarm from any internet enabled device, including tablets and smartphones. This means that as well as a farm manager or secretary updating farm records in the office, a sprayer operator or agronomist can be simultaneously accessing plans or applications from another location.

With the associated MyRecs app for iPad and iPhone, growers can take their farm records out into the field to view and update field, crop, and application information from the cab. By recording spray applications straight into the app, and therefore also into the MyFarm system, sprayer operators can directly update the crop records rather than filling out paper sheets which have to be filed or re-entered at the end of the day. Growers using MyRecs over the past year have seen tangible efficiency benefits and are moving towards a truly paperless crop records system.



Users can now add in-field inspections using the MyRecs App. Add photos, comments and specific locations to target.

In time for the coming spring season, a number of features have been added to the MyFarm website and MyRecs app to further enhance the efficiency gains that the system can offer. Significantly, MyRecs is now available for iPhones as well as iPads and can be downloaded from the app store. Existing MyFarm users can contact us to request their MyRecs password.

The latest update to MyFarm brings a range of new field activities.

Field and crop mapping is now available in the MyFarm crop records tool as well as the MyRecs app. Users can plot the boundaries of specific fields or cropped areas onto a satellite map, providing accurate field or crop hectarage. Using the MyRecs app, geographical inspections and points of interest can then be added to field maps, including photographic evidence of weeds, pests or diseases. Inspections recorded using the app can be shared with anyone in the farm business, including your Frontier agronomist. The ability for all members of the on-farm team to record field problems and observations helps MyFarm growers to build a total farm view and spot challenges to crop production earlier, minimising yield loss and streamlining applications.

A range of activities can now be recorded in MyFarm, including cultivations, drilling, and fertiliser applications, enabling growers to build a comprehensive summary of crop production operations. These new additions will soon be added to the MyRecs app too, so that farm activities can be fully recorded on the go.

"The ability for all members of the on-farm team to record field problems and observations helps MyFarm growers to build a total farm view."

Jim Knight
MyFarm project co-ordinator