# Inspired PGR strategies

> *"Each variety's characteristics will make it more or less susceptible to stem and/or root lodging."*

## Innovation Research briefing

**A crystal ball would be a useful tool to help make PGR decisions, but growers can now get a degree of foresight into the best PGR programme for different varieties using a new web-based decision support tool from Syngenta. *CPM* meets the scientist behind the variety trials and takes a peek at 'InSpire'.**

*By Lucy de la Pasture*

**Although the AHDB Recommended List produces lodging ratings for each variety, there's no way of distinguishing their susceptibility to the different causes of lodging. Syngenta have developed a web-based decision support tool, ready for this spring, to help tailor PGR efforts at the right timings for each variety to best protect it from lodging. The unique capabilities of the tool, named InSpire, are based on years of variety-specific research which has been carried out at Harper Adams University.**

Cereal lodging expert Dr Mitch Crook has been conducting the trials for Sygnenta for a number of years. Lodging is likely to be uppermost in many growers' minds this spring after last season, he says, when a dry spring turned into a dodgy summer with lodging a common problem. "Witnessing yield and quality potential disappear as a result is something most growers would like to avoid and PGRs provide a useful insurance policy.

### Bigger biomasses

"Modern varieties are high-yielding and the bigger biomasses they produce can increase the chance of lodging. Large, heavy ears are more difficult to support, and also exert greater leverage on the stem," says Mitch.

"The most common form of lodging is root lodging, where the stems remain straight and unbuckled but rotation of the plant within the soil causes root/soil failure, causing the plant to lean over. This occurs when the ears are heavy and after rain when the soil is weak," he says.

ADAS research also suggests that modern wheat varieties are inherently weaker rooting than older varieties, hence more susceptible to root lodging.

"Stem lodging is less common and involves the buckling of an internode. It often occurs after stems lean after some root lodging has already occurred, creating leverage on the stem," he adds.

Mitch has been evaluating the physical characteristics of different varieties that affect their 'standing power' in the field.

*Mitch Crook has been assessing the physical characteristics of varieties to help determine their lodging weaknesses.*

"The factors I've been looking at are plant height, stem strength, anchorage strength and the shear strength of the soil, which can all can be measured in the field to compare varieties for lodging resistance," he explains.

Plant height is the key factor when it comes to the toppling forces that cause lodging, with taller stems subject to more leverage when the crop sways. "Our tests show that wheat plants are very top-heavy, with a centre of gravity that's 70% up the height of the stem when the ear is at its heaviest.

"A plant's height affects the amount it will sway in the wind — with the degree of sway dependent on the cube of the crop's height.

*Moddus (right) can help thicken stem walls of varieties with weaker stem strengths.*

Sway tends to be a more important factor influencing lodging in barley crops than in wheat," he adds.

Plants get anchorage from their coronal roots and different varieties can have very different root architecture.

"Coronal roots are much more rigid than the thinner absorption roots responsible for nutrient and water uptake. They're formed early in the plants life and become fully developed by the time crops reach GS39," says Mitch.

This means there's a crucial phase in the spring when the coronal roots are still developing, he says, and can be adversely affected by soil conditions, particularly after a wet winter and in a spring where soils are very wet for a prolonged period.

"Anchorage is less than stem strength in wheat when the soil is wet and depends on both root and soil properties, so root lodging is most likely when the soil is wet (and anchorage is lowest)," he notes.

Soil type also has a key role to play, with clay soils rapidly wetting-up after rainfall, weakening root anchorage and making lodging more likely.

"The bulk density of the soil will also have an effect on rooting, with a value of around 1.35g/cm$^3$ ideal. Any denser can result in ▸

## Factoring in-field influences into PGR decisions

It's the work done by Mitch that enables InSpire to provide tailored variety guidance, explains the company's PGR campaign manager, Mel Wardle. "This unique tailoring of PGR strategy is possible because of the research conducted at Harper Adams. InSpire utilises this important new database for lodging risk, which factors-in the physical in-field influences.

"Each variety's characteristics will make it more or less susceptible to stem and/or root lodging. InSpire provides an on-line risk assessment of these and the many other interrelating factors that influence crop lodging.

"There's a vast number of factors to consider when making PGR recommendations, including sowing date, soil type, establishment and crop growth to date," explains Mel.

All of this data can be inputted into the InSpire tool which then takes them into account, along with environmental factors such as average rainfall and windiness, which will also affect lodging risk. The tool will assess whether a crop will benefit from a PGR application and then produces a guideline strategy. This includes how those applications should be spilt to best effect for a specific variety and its growing situation.

She explains that each factor carried a differently weighted influence on lodging risk, with today's bigger biomass varieties and potentially higher yielding large ears playing an increasingly significant role.

According to Syngenta field technical manager James Southgate, there'll be instances where crops are growing in good soil structures, and their PGR requirement may be limited.

"InSpire has been validated to only give best-use recommendations, as and where risk factors indicate PGR treatments are justified to give yield returns or harvesting security."

InSpire will also look at crop growth stages and application timing, assess variety lodging risk and direct PGR to the appropriate timing. Later drillings will likely have an emphasis on T0 to improve rooting and stem strength, and earlier drillings an emphasis on the later T1 timing to manage crop height, depending on varietal characteristics, crop development and yield potential.

InSpire will produce a whole range of suggested recommendations; from a straight chlormequat application for the lowest risk varieties, to Moddus between 0.1-0.2 l/ha, with or without chlormequat depending on the calculated lodging risk.

Another useful output from InSpire will be advice on PGR application when the crop is under stress, as many were during last spring when under dry conditions.

"Some growers were reluctant to invest in PGR programmes last year, with small crops coming out of the winter and a late spring for growth," recalls James. "However, the warning signs of small root structures and wet soils pointed to the risk factors for bigger crops at harvest — which certainly became evident.

"Once crops received rain, there was a large uptake of nitrogen and they bounced back from the stress. Often when early drought stress is followed by moisture it leads to an increased risk of lodging and these crops would have benefited from a PGR.

"Making Moddus applications earlier in the spring will help to set crops up to better withstand stresses of weather influences later in the season and protect yield potential. This is where using InSpire will help indicate where PGRs can have the best potential results," explains James.

Where there are other stress factors, such as BYDV and nutrient disorders, InSpire will highlight that the crop is likely to be regulating itself and no PGR should be applied while the crop is under these stresses. In contrast, where soils are waterlogged, root growth is likely to have been limited by the anaerobic conditions and the tool will suggest these crops will benefit from a PGR to promote root growth as soon as the soils are dry enough to travel.

The recommendations calculated by InSpire will be put into practice in trials on Syngenta Innovation Centres over the coming season and further trials are being carried out by Mitch at Harper Adams to improve the database.

"The results from different seasons will help refine the database," says James. "There needs to be an interpretation of the InSpire guidance to make allowances for crop nutrition information, like soil mineral nitrogen, organic manures and applied nitrogen rates, before reaching a final recommendation."

The InSpire decision support tool can be found at *www.syngenta.co.uk/pgr-decision-tool*

*Mel Wardle explains the InSpire tool takes factors such as drilling date and potential yield into account, along with environmental factors such as average rainfall and windiness, when assessing lodging risk.*

*InSpire suggests how PGR applications should be spilt to best effect for a variety and its situation.*

*Early Moddus application (right) at T0 can help increase the root biomass of plants.*

▸ rooting being restricted, and if less dense then the soil is too fluffy. Culturally rolling can be of benefit in the spring where the soil needs consolidating to assist root development and improve bulk density."

Wheat stems are stronger than wheat roots when pushed over, according to the testing Mitch has done, which is why in wheat stem lodging is less likely. In barley there's an increased chance of brackling or stem lodging occurring, he explains.

There's also a natural variation between varieties, with some developing thicker stem walls than others. But it's the taller varieties, which typically have extended intervals between nodes and tend to be weaker stemmed.

Measurements in the field using a lodging meter give a collective measurement of how all these four individual factors — height, stem strength, anchorage and soil strength — will stand up to the forces that cause lodging. Results have shown that very little force needs to be exerted on stems to cause a plant to fall over, with just 0.2-0.3Nm typical.

"Because of theses physical properties, lodging is most likely during grain fill — when roots and stem won't get any stronger but toppling forces are at their greatest, especially if they're subjected to high winds and heavy rain," he says.

But there are large seasonal variations in anchorage root strength and stem strength so it's important to assess growth in the Spring to make crop management decisions. Assessing biomass or Green Area Index at GS25 is the ideal time to assess how susceptible a crop may be to lodging, with higher biomass crops strongly linked to higher potential yields, advises Mitch. ■

*Mitch demonstrates how relative values for stem strength (left) and root anchorage for wheat varieties can be tested.*

## InSpire helps differentiate RL lodging risk

The RL produces a rating for lodging risk with and without PGR, but there's no way of distinguishing whether a variety is more susceptible to stem or root lodging, explains James Southgate.

"This is useful information as it helps us know which PGR timing is likely to be the most influential for a particular variety and this is where the value of the variety work really comes into play."

The RL rates Grafton as 8 for lodging risk, both with and without PGR, indicating a short, stiff-strawed variety, he points out. "The work Mitch has done shows Grafton has a good centre of gravity, so is unlikely to be subjected to large toppling forces but doesn't score well for anchorage. So the RL rating doesn't give any indication that there's likely to be a benefit from targeting PGRs at the T0 timing."

The situation with Revelation is entirely different, he says. "The RL rates Revelation as 7 for lodging risk without a PGR, and 8 where a PGR is applied. Mitch's work shows Revelation has good anchorage strength but has a weak centre of gravity, meaning the emphasis on PGR timing needs to be entirely different than for Grafton, even though the RL lodging risk scores are very similar."

*James Southgate points out that varieties with similar RL ratings for lodging may have a different risk for stem or root lodging and this affects the emphasis on PGR timing.*

## Research Briefing

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*CPM* would like to thank Syngenta for sponsoring this Research Briefing and for providing privileged access to staff and material used to help bring it together.

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