

Buffering weather impacts on yield

“The biggest factors driving drought impact are soil type and root length density.”

Technical Research Briefing

New research has revealed that improved root growth at depth plays a vital role in buffering the oilseed rape crop from yield variation caused by adverse weather factors. *CPM* finds out more.

By Lucy de la Pasture

One of the biggest problems with oilseed rape is the variability in its performance year-on-year. The average yield in the UK remains well below its genetic potential, though Yield Enhancement Network (YEN) growers have proved higher yields are achievable, points out ADAS head of crop physiology, Dr Pete Berry.

In 2018, two YEN growers recorded OSR crops in excess of 6t/ha, he says. “Even though last season was a topsy-turvy one, OSR crops generally performed above the long-term average.”

A new BASF-funded study sheds some light on why 2018 proved to be a successful year for OSR where many other crops struggled.

“The aim of the research was to investigate which weather factors are associated with high or low OSR yields and then explain the weather/yield correlations physiologically,” explains Pete.

By comparing average UK OSR yield data from Defra over 39 seasons (1979-2017) and overlaying this with the

monthly mean weather data from the Met Office, the ADAS researchers were able to quantify the long-term yield trend through time. They were then able to investigate the associations between monthly weather actors and yield deviations from this long-term trend in yield.

Yield variation

“We identified five factors, which together accounted for 37% of the yield variation from the long-term trend and this was statistically significant,” says Pete. “The key weather influencers were a high maximum temperature in Oct, a dry Dec, a high minimum temperature in March, a sunny/dry April and a wet/cool/dull May.”

So how do each of these factors influence the OSR crop's growth? The important part

of the crop's early growth is good rooting so it can maintain yield potential later in the season, explains Pete.

“A dry, mild autumn is likely to equate to increased early root growth, resulting in vigorous/strong plants entering the winter. Our analysis showed that in Oct, an increase in the average temperature of 2°C was associated with a national yield increase of 0.17t/ha. “We think that a dry Dec helps avoid water-logging over the winter which inhibits root growth. We found that if rainfall was 50mm below average, this corresponded with a yield increase of 0.11t/ha,” he explains.

In the spring, weather factors which influence the size of the canopy come into play and researchers found that in a warm March, an increase in min temperature of 2°C was associated with a yield increase of 0.10t/ha.

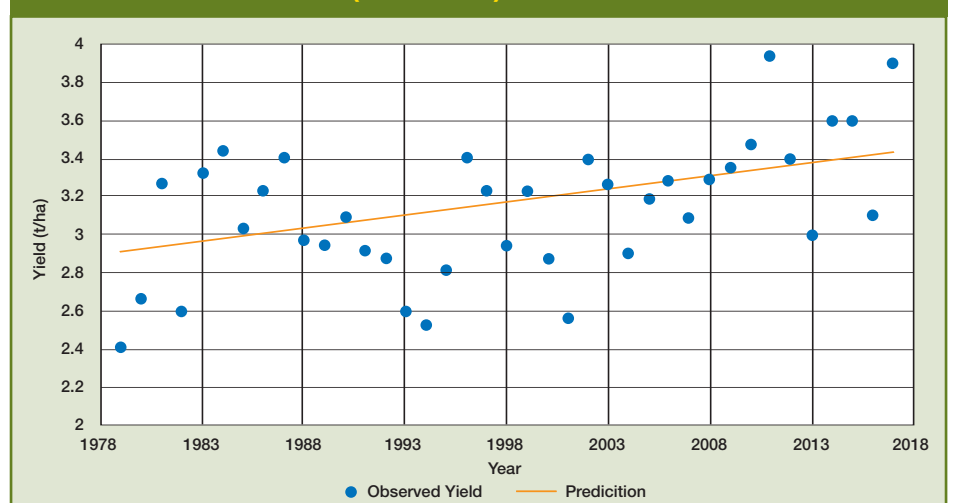
“This association may be due to an earlier onset of spring growth, without any checks or interruptions in growth and a reduced risk of frost damage,” he says.

The benefit of a dry, sunny April is likely to be due to drier conditions delaying N uptake, explains Pete. “This helps avoid an over-large canopy and sunny weather has the effect of increasing pod and seed set in early crops. We found a reduced rainfall of 50mm was associated with a yield increase of 0.20t/ha.”

He also points out that dry weather during flowering in April may lower the level of sclerotinia infection in early flowering crops, which may account for some of the yield increase seen.

For May, the highest OSR yields are ▶

OSR National Yield trend (1979-2017)



Source: ADAS, 2018



Total Crop Nutrition

● **Solution**
fertilisers

● **Suspension**
fertilisers

● **Foliar**
fertilisers

Quality liquid fertiliser for all crops. Fast delivery even during peak periods. **Speak to our specialists today.**



Call **01526 396 000**

Visit www.omex.co.uk

 /OMEXCompanies

 @OMEXCompanies



A good root biomass at depth is often the thread linking a lesser impact from adverse periods of weather on OSR crops, says Christina Clarke.

► favoured by conditions that allow a longer duration for the crop to set pods and seeds. The study shows an increase in rainfall of 15mm and a temperature 1°C cooler were linked to a yield increase of 0.12t/ha.

“Wetter conditions during May provide greater water supply for seed filling during the summer. It’s something we’ve seen in the YEN crops — that plants often need to be able to access sufficient moisture from depth in order to yield 6t/ha or more,” adds Pete.

“A cooler May extends the period of seed setting. All the highest yielding YEN crops have also had a longer period between flowering and desiccation, which enables a longer period for seed setting and seed fill providing the crop has rooted well enough to capture water.”

A good root biomass at depth is often the thread linking a lesser impact from adverse periods of weather on OSR crops. ADAS’s Dr Christina Clarke highlights recent ADAS research (White C A et al, 2015) which shows on average crops aren’t achieving

Relationship between phenotype and frequency of drought

Poor rooters (25% crops)	Medium rooters (50% crops)	Good rooters (25% crops)
Drought occurrence in 90% of seasons	Drought occurrence in 28% of seasons	Drought occurrence in 10% of seasons

Source: ADAS/BASF

critical root length density (RLD) below 40cm depth of soil.

“For a plant to capture adequate water and soluble nutrients, it needs an RLD of at least 1cm length per cm³ of soil, known as the critical RLD. So the implication for plants that don’t achieve this is they won’t have a big enough root biomass to extract sufficient water and won’t be unable to access it from depth,” explains Christina.

Adequate rooting

Given the importance of adequate rooting, in 2018 BASF commissioned ADAS to study the frequency of drought occurrence in OSR, to establish how often UK crops come under drought stress.

“We looked at weather data from 2002-2016 at specific sites chosen for spread of regions and different weather patterns; three different soil types to represent high to low available water capacity (AWC) and three different rooting phenotypes — poor, medium and good.

“We used a model which took into account crop growth and water extraction under the different scenarios to determine drought, defined as when the crop comes under water stress for more than five consecutive days,” she explains.

The results of the study showed very little regional difference, with all three regions experiencing a drought in 40% of seasons. Soil type was more of an influence, with the higher AWC silt loam soil having the lowest drought frequency (26%) and the lower AWC medium sand the highest (69%).

But it was the rooting phenotype of the crop that was by far the biggest determining factor as to how often a crop would come under drought conditions.

“There’s a cliff edge effect in drought frequency that results from a reduction in



Pete Berry explains the study identified five weather factors, which together accounted for 37% of the yield variation from the long-term trend.

Genetics gets OSR off to a vigorous start

Although the weather during autumn has been shown to be a key influence on how well the root system establishes, genetics also play a big part. Results of research carried out at the University of Nottingham by Dr Steve Rossall, demonstrates the differences in vigour between OSR varieties in germination studies under different conditions.

“We looked at germination under a range of temperatures (7°C, 10°C and 15°C) and found, as we expected, that as the temperature falls, the rate of germination slows down. But more importantly, some varieties can still perform well at low soil and ambient temperatures, which is of particular significance in the North and Scotland as soil temperatures drop more rapidly,” says Steve.

The study compared conventional varieties

Campus and Anastasia with restored hybrids and showed that generally hybrids are able to withstand lower temperatures. The less vigorous hybrids buck this trend, with Alizze (20% germination after 6 days) and Windozz (45% after 6 days) the slowest to germinate under the coolest conditions tested of 7°C. InV1035, InV1155 and DK Exalte were the top performers at the lower temperatures.

“It goes to show that low temperature performance can’t be predicted just on the basis of a variety being a hybrid. Low temperature germination testing could provide useful information to growers to help them find the right variety to get quickly away under less than ideal conditions,” he suggests.

A further glasshouse study investigated root and shoot development and results showed

hybrids had a greater biomass than in conventional varieties, even for Campus which is one of the more vigorous conventionals, says Steve.

“The effect of the genetics (hybrid vigour) was greater than the effect of seed treatments (Radiate and Take-off), though these both boosted root and shoot biomass. Anything that can help get the crop off to a good start is a bonus,” he comments.

The conclusion from the studies is that establishment potential is greater in a crop with high vigour, he adds. “There’s a suggestion that a vigorous plant can withstand more damage from cabbage stem flea beetle (CSFB) feeding. So by getting good establishment, it gives a greater opportunity for the crop to reach its yield potential.”

root length density. In the medium rooters, drought is predicted to occur in 28% of seasons whereas for the poor rooters, this occurred in 90% of seasons,” says Christina.

“The largest difference between the root phenotypes occurred below 60cm where the high, medium and low phenotypes averaged 0.88, 0.68 and 0.23 cm/cm³. This shows the importance of high RLDs in deeper soil layers in order to access water later in the season when the upper layers have dried out.

“The importance of the work is that the risk of the crop coming under drought shouldn't be ignored even in a higher rainfall region, as the biggest factors driving drought impact are soil type and RLD, both influencing the ability to extract water from depth late in the season when the crop requires it for seed fill,” she explains. ■

Research Briefing

To help growers get the best out of technology used in the field, manufacturers continue to invest in R&D at every level, from the lab to extensive field trials. *CPM* Research Briefings provide not only the findings of recent research, but also an insight into the technology, to ensure a full understanding of how to optimise its use.

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

Based on a decade of R&D, in partnership with ADAS, BASF has identified three simple rules for spring management, for oilseed rape to yield profitably. The first is to get the light

into the canopy — by reducing lodging and creating an open canopy

— the PGR, Caryx, can be useful for this.

The second is to maintain water uptake — by increasing rooting at depth and preventing sclerotinia — Caryx, Filan and Pictor can help achieve these aims. The third is to keep the leaves green — by reducing light leaf spot and maximising Green Leaf Area Duration (GLAD) — Filan and Pictor have been proven to extend GLAD. For more details go to www.basfrealresults.co.uk/OSR



Using agronomy to mitigate the weather

Understanding the effects that weather events can have on yield provides the opportunity to manage crops to mitigate their potential impact as much as possible, says BASF's Clare Tucker.

“Although we can't do anything about the weather, there are agronomic tools which can help optimise the crop's yield potential for the season.”

This season crops are very variable coming into the spring but where crops got away, they've established well. There are also reports of high CSFB larvae in some crops, says Clare.

The next critical phase in the crop's life is to achieve the optimum canopy size, with the aim being a Green Area Index (GAI) of 3.5-4 at flowering. Dry weather during April can help restrict canopy growth naturally, but nitrogen applications and PGR applications are agronomy tools that can also be used to manipulate canopy size.

“Early drilled crops sown at a low seed-rate should be good rooters and generally have a lower risk of lodging, though they may still benefit from some canopy manipulation. OSR drilled at the same timing but at a high seed rate to mitigate CSFB damage, may be thick and will need some lodging protection as well as canopy manipulation,” she says.

Their rooting may also be poor due to interplant competition, she points out. “One of the benefits of Caryx (mepiquat+ metconazole) is the effect it has on rooting and, in trials, application has increased rooting at depth by 35%, compared with a 25% increase from metconazole and no effect on rooting from tebuconazole.”

“Later established crops will be poor rooters and their management will depend on their GAI just before stem extension. If GAI is less than 0.8 early nitrogen will be important, but at GAI's above the

threshold, Caryx can be used at stem extension.”

Trials confirm a GAI of 0.8 as a reliable threshold for treatment with Caryx. “We've put this to the test again over the last 2 years and found that once the threshold has been reached, Caryx application results in a yield increase of 0.21t/ha.

“Where there are worrying levels of CSFB

larvae in crops, these will move into the main stem and damage the growing point. Caryx applied, particularly at the later yellow-bud timing, increases secondary branching. This, along with late foliar N, may help the crop compensate for some of the damage but there is no direct trials evidence,” adds Clare.

Agronomy tips for managing OSR to protect yield

Tools to buffer a cold Oct

- Maximise autumn plant vigour by;
 - Maximising seed-soil contact
 - Timing sowing to maximise chance of sufficient soil moisture
 - Using varieties with high early vigour

Tools to buffer a wet Dec

General: ensure drainage system in good working order and minimise compaction

- Maximise autumn plant vigour by;
 - Maximising seed-soil contact
 - Timing sowing to maximise chance of sufficient soil moisture
 - Using varieties with high early vigour

Tools to buffer a cold March

- Early N to help stimulate early growth, depending on GAI.
- Minimise risk of Light Leaf Spot by optimising fungicide strategy
- Consider late developing varieties, low biomass in areas prone to late frosts, Caryx in autumn, to minimise risk of frost damage.

Tools to buffer a dull, wet April

- Delay N fertiliser to manage canopy
- Use PGRs at stem extension where GAI threshold exceeded
- Careful timing of fungicides to minimise sclerotinia

Tools to buffer a dry/hot May (and perhaps CSFB larval damage)

- Maximise photosynthesis & canopy duration using fungicides and late foliar N
- Use PGRs to stimulate lower order branching to increase number of pods and seeds

Source: ADAS/BASF