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Cercospora: your FAQs

At the various BBRO online events and in the many grower conversations we have had so far this season, Cercospora is among the most frequent topics. In this article we review and answer your questions.

Why was there such a serious problem last season, and why in some areas and not in others?

Cercospora has been present in crops for many seasons but usually at relatively low levels although quite a lot of symptoms were seen in later lifted crops in 2019. Therefore, we know there are levels of inoculum in the background. However, the epidemic we experienced in some areas in 2020 was unprecedented. We believe this was mainly due to the extremely warm and humid conditions in the middle of August. You may remember that there were days when it stayed over 20°C at night. This triggered massive and rapid growth of the disease. In areas where temperatures were particularly high (especially inland areas such as Cambridgeshire), this resulted in proportionally more disease. Unfortunately, this outbreak also occurred when many of our crops were between their first and second fungicide sprays or even before the first spray, and crops may not have been adequately protected allowing the disease to rapidly develop.

Where does the disease come from?

Well, as mentioned above, we have background levels of inoculum established in the UK and the disease will survive and carry over between crops on leaf debris as well as other host

beet crops such as AD and fodder beet, and of course on any leaf growth on spoil heaps or clamps. There are some weeds reported as hosts, but this has not been looked at closely in the UK. In countries where Cercospora is more established, there is a focus on reducing the green bridge between crops adopting practices such as a minimum three-year break between crops, ensuring infected leaf material is either ploughed down or deep tilled, and not left near or on the surface and avoiding planting crops within 100m of fields which were infected the season before. Any infected leaf material will allow the fungus to over winter and in warm and humid conditions produce conidia which are then spread, mainly by the wind, to infect other crops. Symptoms develop from 5 to 21 days after infection, depending on weather conditions. Unfortunately, as we witnessed in some crops last season, infection can cause canopies to turn brown very rapidly.

What conditions favour Cercospora and did virus yellows increase susceptibility?

The fungus needs warmth and humidity, especially moisture on the leaf surface. Disease development is relatively gradual, up to about 25°C, but growth goes into exponential increase at higher temperatures. Cercospora development is relatively suppressed at low humidity, even when temperatures are quite

warm. However, when we start getting days with humidity of more than 90% for 10-15 hours per day, the disease become more active, even at lower temperatures (see Fig 1).

As for the question about whether the presence of virus yellow increases susceptibility to Cercospora, it is difficult to find definitive data specific to virus yellows and Cercospora but there are reports of susceptibility to other foliar disease being increased by virus. Additionally, logic tends to support the theory that any plant compromised by one factor such as virus yellows will be less resilient and unable to defend against other pathogens.

How predictable is Cercospora and can we utilise an early warning system like potato growers do for potato blight?

Yes, we can, and we are doing this for 2021. In countries such as Spain and North America where Cercospora is a more established disease and threat, a prediction model has been developed. This is based on the interaction of temperature and humidity and estimates a daily infection value (DIV). The DIV is related to the likelihood of symptoms developing in the crop. The DIV has been extensively validated by assessing early Cercospora symptoms (categories ranging from no spots per leaf to >50 on a sample of 100 plants) in relation to temperature and humidity in commercial crops. Analysis of the temperature and humidity recorded in the UK last season in relation to outbreaks of Cercospora indicate a similar relationship, and this is the basis of the system we will be using in 2021. Fig 1 below shows how the DIV is calculated in relation to temperature and humidity. This is just some selected values from a much larger table!

Let's consider an example:

Two days at 20°C/10 hours high humidity has a DIV (summed over two days) of 4.

Two days at 24°C/15 hours high humidity will have a DIV (summed over two days) of 8.

DIVs range from 0 to 7 for each day. When the sum of two-day DIV values exceeds 7, the risk of symptoms developing in the crop are considered high.

It is important to remember that this is a very useful way of forecasting the risk of an initial outbreak of Cercospora and is not primarily designed to predict severity where the disease is already established. This is how we will use it, communicating any warnings which will effectively be telling you that your crop is at high risk of infection and symptom development, therefore needing to be checked as soon as possible for early symptoms.

Remember, that symptoms can develop from 5 to 21 days depending on the weather conditions, so it is important to act quickly on any warning.



Fig. 2. and Fig. 3. Early symptoms of Cercospora.

BBRO Cercospora Risk Forecast 2021

BBRO will be using an extensive network of weather data as well as a network of in-crop sensors to monitor the risk this season. This will calculate the DIV and the risk of symptoms developing in crops. BBRO will communicate and provide additional information on Cercospora control to growers and agronomists in twice-weekly updates using additional SMS (text) messaging if required. Information will also be available via the BBROplus area of our website. Please make sure you are registered to BBROplus.

Hours/day >90% humidity	Temperature (degrees Celsius)			
	16	20	24	28
5	DIV = 0	DIV = 1	DIV = 1	DIV = 3
10	DIV = 0	DIV = 2	DIV = 3	DIV = 4
15	DIV = 0	DIV = 4	DIV = 4	DIV = 7
20	DIV = 0	DIV = 5	DIV = 6	DIV = 7

Fig. 1. Simplified matrix to show effect of temperature and humidity on daily Cercospora infection values (DIV). Crops are at high risk when there the sum of the DIV for the proceeding two days is seven or more. Based on Windels et al (1988) Plant Disease, 82, 716-726



Why are fungicides considered less effective on Cercospora compared to rust & mildew?

Unfortunately, we know from BBRO work that there are isolates of the fungus that are resistant to some fungicides. A recent BBRO study concluded that isolates collected in the Cambridge area showed resistance to strobilurins and some insensitivity to the triazoles. Experience has shown that of the triazoles, epoxiconazole has been the relatively more effective triazole but unfortunately this is no longer available. Whilst there are some new fungicides in trials with different modes of action that are proving to be a lot more effective at controlling Cercospora, it is not known at the time of writing whether any of these will be available for the crop this season. We will keep you updated on this.

However, BBRO trials have demonstrated that established fungicides will still help control Cercospora, but this is dependent on two key factors:

- 1) Acting at the first and early signs of symptoms and not letting the disease become too established before applying a fungicide.

- 2) Not allowing the interval between fungicide applications to become too long, especially more than 28 days. A shorter interval maybe required depending on the point at which a high risk was forecast after any previous application.

The objective is to always maintain a sufficient level of fungicide protection on leaves when the risk is high.

Experience from other countries where Cercospora is more established shows the following top five factors were identified as resulting in inadequate control. These are listed in order of declining importance (Windels et al, 1988, Plant Disease, 82, 716-726)

- 1) First application delayed
- 2) Interval between applications too long
- 3) Fungicides poorly applied
- 4) Varietal susceptibility
- 5) Fungicides rates too low

Do varieties differ in their susceptibility to Cercospora?

There appears to be some differences and we are beginning to gather information on this. As there is not a history of the high levels of infection we experienced last season, we do not have the benefit of several years' worth of data from the RL trials. BBRO have investigated the use of inoculated trials in the past but failed to get the disease established sufficiently as this is so dependent on weather conditions!

We have collected some information from un-replicated BBRO variety strip trials where Cercospora levels were high and these are shown below. Unfortunately, the 2020 RL Cercospora leaf infection values were much lower, and it is not possible to differentiate between varieties or validate those detected in strip trial, but you may want to use this as a guide, especially when checking crops for the first signs of symptoms.

Less severe symptoms	Average severity	More severe symptoms
Advena KWS	BTS 1140	Conger
BTS1915	BTS 4100	Evalotta KWS
BTS3325	Degas	Vixen
Cantona KWS	Lacewing	
Catriona KWS	Lightning	
Daphna	Philina KWS	
Eldorana KWS	Puffin	
Kortessa KWS	Sabatina KWS	
	Sancha KWS	
	SMART Rivetta KWS	
	SMART Janninka KWS	