BATTLING THE BEASTIES

The answer to barley yellow dwarf virus

Linda Hahn · Lippstadt

Cereal aphids cause damage not only by feeding on crops; they often transmit viruses in the process. A mild autumn and early sowing combined with a non-tolerant variety provide the optimum conditions for a large aphid population and corresponding virus infection.

Aphids are specialised in transmitting barley yellow dwarf virus (BYDV). In addition to cereals, host plants for BYDV include maize, cultivated grasses and weed grasses such as black grass and couch grass. Aphids which feed on infected plants ingest virus particles and remain infectious for the rest of their life. The virus spreads through the crop through a combination of primary and secondary infection. Primary infection involves the infecting of individual plants by individual virus-laden winged adult aphids. Secondary infection occurs on a far larger scale; and involves their offspring; adult aphids produce larvae, but do not transmit the virus directly to them. Instead, they acquire it by feeding on infected plants. This creates pockets of diseased plants within the crop.

The first symptoms generally appear from March to April as the weather starts to warm up, but can appear in the previous autumn with early sowings. Typical symptoms include distinctive yellowing of the leaves or stunted growth. The yellowing usually starts at the edges and tips of the leaves and is accompanied by yellow spots on the leaf blade. Eventually the whole plant turns bright yellow, growth (including roots) stagnates and shoots fail to develop. Depending on the level of infection, this can result in yield losses or even total crop failure. Plants infected in autumn are also more susceptible to frost damage.

Increasingly mild winters in the past and the frequent absence of cool temperatures from November onwards mean that aphid activity is only partially inhibited, if at all. From studies we know that aphids can only transmit BYDV successfully at temperatures of 8 to 10° C. Secondary infections caused by diverse aphid populations can also lead to pronounced pockets of disease.

Early sowings are particularly at risk

The earlier aphids colonise the crop, the higher the rate of infection and the longer the period in which the virus can be transmitted and spread through the crop. A sustained period of favourable weather with high temperatures (up to 20° C) is particularly conducive. Volunteer cereals are also a risk factor since these plants provide a source of the virus. This ‘green bridge’ should therefore be promptly and systematically removed. Aphids often also migrate to barley crops from adjacent maize crops.

There is no direct means of controlling the virus in infected plants and insecticidal coatings to control virus-transmitting aphids which carry BYDV are not currently permitted. The use of insecticides to control vectors is currently the most effective method of controlling BYDV. However, infections can occur despite spraying since the insecticide works for a limited period only and

when aphid populations are high, more aphids continually join their ranks.

Outlook

The cultivation of virus-tolerant varieties is an environmentally friendly alternative that does not rely on chemical crop protection. The Deutsche Saatveredelung AG (DSV) has the ultimate innovation awaiting approval next spring for the winter barley market in Germany. Paradies is the first multiline variety in Germany which is both tolerant of barley yellow dwarf virus (BYDV) and resistant to barley yellow mosaic virus (BaYMV). The variety bred in-house by DSV offers farmers a high degree of yield stability and enables them to dispense with insecticides thanks to its unique combination of traits and tolerance to BYDV. PARADIES is already registered in Austria and the first certified seed will be available for the 2019 season.

Difference tolerance and resistance

The terms resistance and tolerance are often used interchangeably. Resistance refers to the plant's ability to completely prevent pathogen growth or to restrict it by detoxification (antonym = susceptibility). Tolerance is defined as the plant's ability to respond to the virus by producing no or few symptoms of the disease and/or little or no yield reduction (opposite = sensitivity).

Paradies in April 2015 in a BYDV-infected field in Poland (left). The non-tolerant variety beside it shows significant stunted growth, yellowing and crop losses. While the average yield during the trial was 3.07 t/ha, PARADIES produced an impressive 11.06 t/ha.

Stunted growth, yellowing and crop losses are typical symptoms of barley yellow dwarf virus.

Linda Hahn
Fon +49 2941 296 531