CLUBROOT RESISTENCE INCREASINGLY IMPORTANT

The oilseed rape disease clubroot is a particular problem in the traditional oilseed rape growing areas in northern Germany. For this reason, clubroot-resistant varieties are grown on around 25 to 30 % of the oilseed rape area here. However, infested areas have been reported from other regions. The risk of spread increases with moist and warm conditions after sowing into autumn and winter. The clubroot resistance of the variety material is of decisive importance for economical oilseed rape cultivation on infected sites. Especially because there are new pathogens.

Clubroot - races and resistances

Clubroot (Plasmodiophora brassicae) is a plant disease caused by a soil-borne parasite (protozoa). The pathogen can survive in the soil as a resistant permanent spore for up to 20 years. The disease is characterised by the formation of abnormal growths (galls) on the main and lateral roots, which prevent the plant from receiving nutrients.

The clubroot pathogen is divided into several races, with races P1 and P3 being the most common in Germany. There are varieties with mendel resistance (CROMAT and CROCODILE) against the pathogens of these races, so that oilseed rape cultivation on infested areas is possible without restriction. However, there are already clubroot varieties in which this mendel resistance is no longer effective. Plant breeders have responded by developing varieties with enhanced clubroot resistance (CRE1). Varieties with CRE1 clubroot resistance can now be grown in many locations where mendel resistance is no longer effective. In addition, new clubroot races are constantly being discovered against which no variety resistance has yet been identified. This extract from a master's thesis provides an impression of the occurrence of the races

Germany-wide clubroot monitoring

At the beginning of 2023, the Neubrandenburg University (Prof. Dr Becke Strehlow, Professor of Plant Diseases and Plant Protection) carried out a Germany-wide clubroot monitoring on suspected or contaminated areas as part of a master's thesis. The aim of the monitoring was to quantify the distribution of aggressive or mendel- virulent clubroot races across Germany in order to derive the suitability for cultivation of oilseed rape varieties with extended (CRE1) clubroot resistance (e.g. CREED or CREDO).

Testing of the samples

Using a greenhouse biotest, a simplified differential set consisting of a susceptible control (PiCARD), mendel resistance (CROMAT) and extended CRE1 resistance (CREED) was used to determine whether the plant and soil sam-

FIG. 1: CLUBROOT SCORE

0 = no infection

1 = weak infestation with scattered small galls

2 = small galls on the secondary and main roots

3 = heavy infection

Score 0-3 based on example images (Source: N. Zamani-Noor, JKI)

ples contained aggressive clubroot races. In the first step, valid results were available from 60 farms.

Provoked infection: to what extent does resistance work?

The infestation index (also known as DSI) of the susceptible variety was used to determine the infection potential of the soil samples analysed and the stability of the respective clubroot resistance of the selected varieties. If the variety CROMAT did not show any root changes in the form of galls, it could be determined that the standard mendel resistance used against clubroot was effective. If CROMAT showed root galls, this was a sure sign that the mendel resistance was no longer providing sufficient protection against clubroot. As soon as the variety CREED, which has extended clubroot resistance, showed root changes, it became clear that in this case even the extended clubroot resistance did not offer sufficient protection, as mendel-virulent clubroot races were present. In general, a variety is considered sufficiently resistant if the DSI is < 0.25 (threshold value of the JKI classification for the granting of clubroot resistance as part of the variety authorisation).

To what extent does the Extended resistance have an effect?

The evaluation of all samples analysed showed the following picture (see Fig. 3): Of a total of 60 locations, only 20 % had no clubroot. The remaining 80 % showed clubroot contamination. In 55 % of the samples with clubroot, the Mendel resistance (CROMAT) was very high (DSI < 0.25). No symptoms were visible on the roots. In the other half of the samples infested with clubroot, in which the mendel resistance was no longer sufficient, an outbreak of clubroot could be prevented in 67 % of cases by the extended clubroot resistance in the CREED variety. Conversely, however, this also means that oilseed rape cultivation may be at risk on 33 % of all sites despite the cultivation of a variety with extended resistance - a result that was not necessarily to be expected in advance.

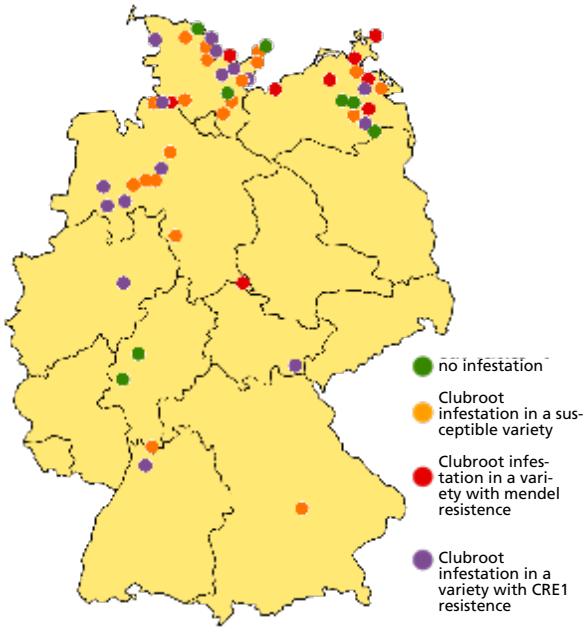
High infection rate only under favourable conditions

At first glance, these figures look concerning. However, when interpreting the results, it must be taken into account that the greenhouse test was carried out under conditions in which the clubroot pathogen can optimally infect the plants. This situation rarely occurs under natural conditions on field plots. The severity of the infection then depends on the soil moisture and temperature as well as the spore concentration in the soil, the crop rotation and the microbial soil life, so that in practice only a mild infection may occur.

RAPOOL field trials carried out in the past, for example, showed no infestation despite proven clubroot pressure on the trial area.

This could be due to a low usable field capacity (< 60 %) after oilseed rape sowing or to low soil temperatures (<1 5 °C).

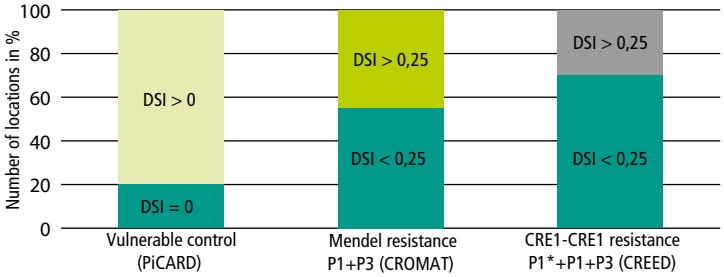
FIG.2: RESULT-OF-THE-CLUBROOT-MONITORING



Conclusion

Greenhouse biotests are well suited for an objective assessment of the resistance stability of different varieties. However, they only reflect a possible course of infection on field plots to a limited extent, as clubroot infection depends on numerous influencing factors. The results show that Mendel and especially CRE1 resistance was effective on the majority of the areas tested and that oilseed rape cultivation with existing clubroot resistance remains possible on many variety breeding against aggressive clubroot races is being intensified.

FIG. 3: PRESENTATION-OF-THE-INDIVIDUAL DSI-VALUES-IN-CLUBROOT-INFESTATION CLASSES



The higher the infestation index (DSI), the higher the infection potential in the analysed sample

DSI = 0 → no infection
DSI = less than 0.25 → sufficiently resistant
DSI = ggreater than 0.25 → clubroot infestation

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