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Net blotch severity is best assessed at early grain filling with respect to its effect on grain weight of spring barley

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In organic barley production, net blotch (Pyrenophora teres, picture 1) is one of the most widespread and destructive seed-borne foliar diseases. To obtain a realistic picture of the importance of the disease under particular field conditions, there is a need for adequate disease assessment methods and parameters reflecting whole-season disease severity levels. Such methods and parameters should be simple and robust yet biologically meaningful and yield-related to ensure relevance. In the present study we examined methods and parameters for assessing disease severity and varietal resistance related to net blotch prevention and management in organic farming. Also, we looked at the issue from the perspective of breeding of net blotch resistant cultivars that are suitable for organic production. The work reported here has been part of the DARCOF II research program.

Picture 1. Severe net blotch infection on a susceptible cultivar after flowering

A range of scenarios of net blotch severity (% net blotch-diseased leaf area) was created in field plots of the spring barley cultivars Brazil, Goldie

and Punto by: 1) not inoculating them, 2) inoculation with net blotch-infected straw after emergence and 3) inoculation with a conidia suspension at around mid-tillering stage. Net blotch severity was determined over time by visual assessments of the whole plot as well as of individual leaves of single main tillers. Disease severity measures such as the area-under-disease-progress-curve (AUDPC), mean disease severity and disease severity levels at specific growth stages were derived from the data. Their relations to thousand-grain weight (TGW) and their inter-correlations were examined by means of linear modelling procedures.

Disease progress curves obtained for individual leaf layers of the main tiller reveal that the contribution of each leaf layer to the total disease severity changes over time and that a substantial fraction of the total disease is being removed during the course of an epidemic due to senescence of the lower leaf layers (**Figure 1**). While the curves describing disease progress on the upper three or four leaves or on the whole main tiller appear very similar, the progress curve derived from whole plot assessments assumes substantially higher values than the other curves towards the end of the season for the susceptible cultivar Goldie (**Figure 2**). All net blotch severity measures were positively correlated with each other and negatively with TGW (**Figure 3** showing TGW and some representative disease variables). However, disease parameters derived from whole-plot assessments gave a slightly better explanation (higher R2) of TGW than parameters derived by assessing single main tillers (**Table 1**, column A). Of all disease variables, net blotch severity at gs 70 of whole plot assessments yielded the highest adjusted R2 (0.43) while the adjusted R2 values resulting from using the same parameter of assessments of the upper three, four or all leaves of single tillers were between 0.34 and 0.35. The degree of correlation between net blotch severity and TGW decreased, the earlier the growth stage at the time of disease assessment (Tab. 1; shown in Fig. 3 only for net blotch severity on the three upper leaves of the main tiller at early heading [gs 50] as an example). The residuals of TGW of linear models that only used disease covariates from whole-plot assessments and variety effects as independent variables exhibited less pattern related to other sources of variation (treatment, replication, variety · treatment, variety withing replication, treatment within replication) than residuals of models that used single-tiller-based disease covariates (results not shown). This is captured in column B of Tab. 1 by relatively low R2 values of whole-plot assessments (upper part of the table), compared to single-tiller assessments (lower part of Tab. 1). Results from whole-plot assessments thus seem more generally applicable than those from single-tiller assessments.

The results indicate that disease assessments at gs 70 are appropriate to reflect whole-season severity levels of net blotch. In this respect, the time-consuming single-tiller method is not superior to the simpler whole-plot method. However, assessing individual leaf layers of single tillers allows to observe the epidemic development and thus to examine the dynamics of epidemics in much greater detail than assessing whole-plots.