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Integrating sustainability criteria into performance testing new criteria under study for the assessment of pest tolerance in rapeseed

Background:

In the past, evaluating rapeseed cultivars for their performance in integrated pest management schemes has hardly ever been approached. This could have been due to the broad availability of insecticides and the complexity of phenotyping plant responses to insect activity. However, recent changes in the regulatory framework related to the withdrawal of conventional insecticidal products and the evolution of insect resistance to classes active compounds call for sustainable crop protection.

Objective:

There is a need for varieties with multiple insect tolerances, for which further research on insect and rapeseed varieties interactions is crucial. To better characterize the impact of insects on rapeseed varieties, new criteria must be identified and readily available. This study is focusing on the recent developments in Switzerland to implement insect tolerance criteria into performance testing.

Methods:

On-farm variety trials were used as case studies to understand complex interactions between insects and rapeseed varieties. The consistency of data collection was ensured across the trial network. Trials included hybrid, inbred lines and HOLL varieties. They were analysed together and not individually, which provides a better understanding of the specific characteristics of each variety.

The direct measurement of insect activity in the field is considered a key step in determining varieties tolerance to arthropod pests. Thus, it was evaluated by counting bites from the stem flea beetle complex, rape stem flea beetle larvae present in the crop stems, rape stem weevil oviposition punctures and pollen beetles per plant for each variety. In order to target traits conferring insect resistance, links were established with varietal specificity such as early vigour, biomass before and after winter, spring vegetation recovery, glucosinolates content and types, collar diameter, stem elongation, healthy plant proportion or yield.

Results:

A principal component analysis was used to identify correlations. We evidenced a good correlation between autumn biomass and ground cover rate in spring. In addition, a high ground cover rate in autumn was correlated with a higher stem elongation rate in spring. Finally, a low density in autumn was correlated with a greater spring biomass and collar diameter.

It appeared that varieties with higher biomass in autumn had more flea beetle larvae per plant. Also, varieties with higher biomass in spring had more pollen beetles per plant. Furthermore, varieties with a high elongation rate showed a high number of rape stem weevil oviposition punctures per plant.

Conclusions:

We found no correlation between yield and pest damages or number of pests per plant. In our study, we tend to find a positive correlation between plant vigour and insect activity. Vigour could also lead to better yield in spite of insect damages, through a phenomenon of compensation. Variety specificities in terms of vegetative growth still appear as key for future prospects - early vigour in autumn and spring vegetation recovery. New scientific insights into insects and rapeseed interactions will allow to identify promising parameters to assess tolerance of varieties to prevalent insects.