Contribution of allelopathy and competition to weed suppression by winter wheat, triticale and rye

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Abstract

Above-ground competition and allelopathy are two of the most dominant mechanisms of plants to subdue their competitors in their closest surroundings. In an agricultural perspective, the suppression of weeds by the crop is of particular interest, as weeds represent the largest yield loss potential worldwide, if not controlled. In view of the current increase in the cases of herbicide resistance and no indication of new modes of action becoming available to the market in the next decade, the crop's inert ability to suppress weeds have become more important. This study aims to identify the contribution of competitive traits, such as early vigour, crop height and leaf area index and presence of phytotoxic compounds of the group of benzoxazinoids to weed suppression. Four cultivars of each of the winter cereals wheat, triticale and rye were grown in field experiments at two locations. Soil samples were taken in early spring 2016, extracted with a Dionex ASE350 Accelerated Solvent Extractor and analysed in the multiple reaction mode with an Applied Biosystems 4500 Q Trap LC-MS/MS for benzoxazinoid concentrations. Weed biomass of the natural weed population present in the plots was measured in the end of June 2016. Competitive traits were measured throughout the growing season. Partial least squares regression with weed biomass as response variable was used for modelling. Competitive traits, as well as benzoxazinoid concentrations contributed significantly to the models on winter wheat, winter triticale and winter rye data and explained 63, 69 and 58% of the variance in weed biomass in the first two components, respectively. Consequently, it can be concluded that competitive, as well as allelopathic traits, contributed significantly to weed suppressive outcome in winter cereals. This knowledge is of significant importance for future breeding programs aiming at increased weed suppressiveness of winter cereals.

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