spawn and other methods, but several significant correlations were also found. The ANOVAs considering the whole data set show that the genotype differences are highly significant and the genotype × environment (years, isolates, methods) interactions are much smaller than the main genotype effects for all traits.

This means that the genotype ranking will be influenced to some extent, especially at lower infection severities, but any of the methods can be used when the ecological risks can be treated well. For this reason in drier climate conditions the spray inoculation method combined with polyethylene bag covering seems more reliable, in other areas the other two methods can also be applied successfully.

Keywords: Fusarium head blight, wheat, inoculation method

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EXAMINATION OF RESISTANCE LEVEL OF MAIZE HYBRIDS AGAINST FUSARIUM SPECIES

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Several fungal genera are pathogens, able to infect maize in the field and cause various disease symptoms. Many of their members also produce mycotoxins, secondary metabolites, which are harmful to animals and humans. Contaminated grain also affects international economy, regulatory, and trade policies. The most problematic mycotoxins in maize are aflatoxin, which is mainly produced by the fungus *Aspergillus flavus,* fumonisins produced mainly by *Fusarium verticillioides,* trichothecenes and zearalenon produced by several *Fusarium* species like *F. graminearum*.

Field test included 37 hybrids, inoculated by one-one isolates of each species of *F. graminearum, F. culmorum* and *F. verticillioides*. Three replicated random block designs were used with four row plots of 5 m length. Both toothpick and silk channel resistance tests were applied. *Aspergillus flavus* infection was rated only in 2012 from natural infection. Non-inoculated rows served to evaluate natural infection. 15 ears per row were individually rated for coverage by the fungi as percentage values.

The inoculation results were at medium level, the hybrid differences were well expressed and the resistance to different species was also clearly differentiated. The kernel resistance test (toothpick method) gave 10.75 mean severity (range 5.79–16%, LSD 5% 2.14), the silk channel test only 2.76 (range 0.68–6.54%, LSD 5% 1.07). This latter test differed the genotypes much less effectively. The interannual correlations were only moderate. The silk channel and kernel resistance data showed a medium level correlation ($r = 0.46$). However, there were genotypes that showed susceptibility in kernel resistance and

good resistance in silks, others behaved in the opposite way, and several produced similar data at different resistance or susceptibility levels. It seems that the two resistance mechanisms occasionally correlate well; therefore both methods have significance for breeding. In relation to *Aspergillus* only one year data are present, further data will be necessary to draw solid conclusions.

A selected set of genotypes was subject of toxin analysis, which is in progress.

Keywords: *Fusarium, Aspergillus,* maize, resistance, inoculation method

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DESIGNING HIGH-YIELDING WHEAT IDEOTYPES FOR A CHANGING CLIMATE

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Global warming is characterised by shifts in weather patterns and increases in climatic variability and extreme events. New wheat cultivars will be required for a rapidly changing environment, putting severe pressure on breeders who must select for climate conditions which can only be predicted with a great degree of uncertainty. To assist breeders to identify key wheat traits for improvements under climate change, wheat ideotypes can be designed and tested in silico using a wheat simulation model for a wide range of future climate scenarios predicted by global climate models. A wheat ideotype is represented by a set of cultivar parameters in a model, which could be optimised for best wheat performance under projected climate change. As an example, high-yielding wheat ideotypes were designed at two contrasting European sites for the future 2050(A1B) climate scenario using the Sirius wheat simulation model. Simulations showed that wheat yield potential can be substantially increased for new ideotypes compared with current wheat varieties under climate change. The main factors contributing to yield increase were improvement in light conversion efficiency, extended duration of grain filling resulting in a higher harvest index, and optimal phenology.

Keywords: wheat, crop modelling, climate change impacts, Sirius, LARS-WG

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