

# A literature-based approach to estimate the effect of climate change on plant protection: The example winter wheat

Johanna Hemetzberger, Bernd Freier

Julius Kühn-Institut, Institute for Strategies and Technology Assessment, Kleinmachnow

Email of corresponding author: johanna.hemetzberger@jki.bund.de

Climate change not only affects crops directly, but also changes conditions for plant diseases, pests and weeds as well as their antagonists.

This contribution is part of the project “Konsequenzen des Klimawandels für die Nachhaltigkeitsziele beim Pflanzenschutzmitteleinsatz“ and aims to collect the current knowledge about these effects on the occurrence of pests, diseases and weeds of winter wheat as well as the resulting changes in plant protection strategies.

The diseases Septoria leaf spot, powdery mildew, brown and yellow rust, eyespot and Fusarium head blight as well as insect pests such as cereal aphids, wheat midges and cereal leaf beetles were covered in this study. In addition, the most common weeds of winter wheat were included. The focus of the literature survey was the effect of the expected warming, increased frequency of spring and early summer drought and heavy precipitation events. In the first step, predictions for future occurrence of the above-named pests were compared. The information was summarized in climate sheets for each pest including their climatic requirements and scenarios for their response to climate change.

In the next step, the expected changes in occurrence of diseases, pests and weeds were each classified into three categories (minor, medium and high

increase/decrease) based on the respective climate sheets.

In the third step, treatment frequency indices (TFI) were used to describe the intensity of the plant protection strategies. The TFI for the scenario 2050 were based on values for the reference period 2007 - 2013 and adjusted according to the findings from the literature survey. An expected minor, medium or high increase/decrease in disease, pest or weed occurrence was translated into a change of the TFI by 25%, 50% or >50% for fungicides, insecticides or herbicides.

Results of this literature-based analysis imply that especially rusts will benefit from future warmer conditions, while the occurrence of other diseases like eyespot and powdery mildew is likely to remain unchanged. Insect pests in general are expected to gain importance in winter wheat mainly due to warming. Weeds are diverse in their response to climatic change depending on their individual requirements.

Consequently the derived scenarios for future plant protection strategies imply that the intensity of fungicide and herbicide use will remain mostly unchanged, while a medium increase in insecticide use is expected.

The gained information on possible trends in plant protection is useful for the evaluation of ecological impacts of plant protection in the future.