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Modelling Pest Immigration into Rape Seed Crops under Past and Future Climate Conditions

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Abstract : Oilseed rape (Brassica napus L.) is one of the most important crops throughout Europe, but pressure due to pest insects and pathogens can reduce yield amount substantially. Therefore, the usage of pesticide applications is outstanding in this crop. In addition, climate change effects can interact with phenology of the host plant and their pests and can apply additional pressure on the yield. Next to the pollen beetle, Meligethes aeneus L., the seed-damaging pest insects, cabbage seed weevil (Ceutorhynchus obstrictus Marsham) and the brassica pod midge (Dasineura brassicae Winn.) are of main economic impact to the yield. While females of C. obstrictus are infesting oilseed rape by depositing single eggs into young pods, the females of D. brassicae are using this local damage in the pod for their own oviposition, while depositing batches of 20-30 eggs. Without a former infestation by the cabbage seed weevil, a significant yield reduction by the brassica pod midge can be denied. Based on long-term, multisided field experiments, a comprehensive data-set on pest migration to crops of B. napus has been built up in the last ten years. Five observational test sides, situated in different climatic regions in Luxembourg were controlled between February until the end of May twice a week. Pest migration was recorded by using yellow water pan-traps. Caught insects were identified in the laboratory according to species specific identification keys. By a combination of pest observations and corresponding meteorological observations, the set-up of models to predict the migration periods of the seed-damaging pests was possible. This approach is the basis for a computer-based decision support tool, to assist the farmer in identifying the appropriate time point of pesticide application. In addition, the derived algorithms of that decision support tool can be combined with climate change projections in order to assess the future potential threat caused by the seed-damaging pest species. Regional climate change effects for Luxembourg have been intensively studied in recent years. Significant changes to wetter winters and drier summers, as well as a prolongation of the vegetation period mainly caused by higher spring temperature, have also been reported. We used the COSMO-CLM model to perform a time slice experiment for Luxembourg with a spatial resolution of 1.3 km. Three ten year time slices were calculated: The reference time span (1991-2000), the near (2041-2050) and the far future (2091-2100). Our results projected a significant shift of pest migration to an earlier onset of the year. In addition, a prolongation of the possible migration period could be observed. Because D. brassiace is depending on the former oviposition activity by C. obstrictus to infest its host plant successfully, the future dependencies of both pest species will be assessed. Based on this approach the future risk potential of both seed-damaging pests is calculated and the status as pest species is characterized.

Keywords : CORDEX projections, decision support tool, Brassica napus, pests
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