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Next generation crop-pest model: A case study on Blackleg disease (*Leptosphaeria maculans*) and canola (*Brassica napus*)

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Background:

Improving farm management decisions targeting pest-induced yield loss necessitates a better understanding of pest dynamics within the farming system. The association of pest incidence/severity with seasonal conditions and management led to the development of integrated crop-pest models, allowing management decisions to be predictive. However, existing models account for the biophysical impact of pests often based on a yield reduction approach via external visual symptoms and their respective physiological crop mechanism counterparts which fail to capture the pest response to agro-ecological conditions. The process-based modelling approach is more suitable for capturing a realistic representation of pest-host interactions in the field as it highlights the biological modelling of the pest lifecycle.

Objective:

The aim was to develop an integrated pest-crop-weather-management model within the APSIM Next Generation framework using the economically important Blackleg disease (Leptosphaeria maculans) and canola (Brassica napus) as a case study.

Methods:

The study centres on the monocyclic phase of disease development, showing the key lifecycle stages starting from inoculum production and maturation in infected crop debris, followed by leaf lesion development (necrotrophic phase), biotrophic hyphal growth through the petiole and stem, to the development of yield-limiting canker at the crown. Each disease development stage interacts seamlessly with the environment, crop and preventive measures imposed in the APSIM Next Generation framework.

Conclusions:

The improved knowledge on integrated crop-pest modelling exemplified by the linkage of a blackleg disease lifecycle model and a canola crop model contributes significantly to the advancement of existing farming systems models in addressing biotic constraints for crop productivity. The modelling approach used in this study has broad application to different plant pathosystems.