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How changed farming practices changed blackleg disease expression causing additional yield losses

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Background:

Blackleg of canola causes crown cankers in canola plants - the canker limits the uptake of water and nutrition to plants. The cankers develop in the plant crown which is the intersection between the stem and the roots. However, in 2011 cankers were also observed on the plant stems and upper branches, this type of infection was named Upper Canopy Infection (UCI). Research since 2016 has shown that UCI regularly causes up to 20% yield losses.

Objective:

The object of this work was to determine the causes of UCI and to identify possible solutions.

Methods:

Experiments were undertaken in the glasshouse where stems and branches were individually inoculated, and in the field allowing natural infection to occur.

Results:

The primary cause of UCI is direct infection from blackleg spores landing on the plant's reproductive parts, developing lesions and then invading the vascular tissue. This process is the same as the infection process for crown canker. UCI has occurred in recent years due to changed farming practices and technologies. Crops in Australia are sown on average 30 days earlier than 20 years ago, early sowing results in increased crop biomass and yields. The early sowing has been made possible due to improved sowing technology, hybrid cultivars and new herbicide tolerant cultivars. The main blackleg infection period in Australia is from late May to September, twenty years ago most crops commenced flowering in early September which avoided the worst blackleg infection period, many crops now commence flowering in late July.

Upper Canopy Infection can be controlled by managing the crop to ensure that flowering commences in late August, and by the application of fungicide at around the 30% bloom crop development stage. A number of fungicides are now registered in Australia for UCI control. Recent research has also found links between host genetic resistance and UCI severity. Effective major genes are effective throughout the entire life of the plan and completely control UCI. Unfortunately, in Australia major genes have a very limited lifespan and are normally overcome within 5 years of deployment. However, quantitative resistance is now also understood to reduce the severity of UCI. Experiments in both the glasshouse and the field have clearly shown where qualitative resistance reduces crown canker severity the same qualitative resistance also reduces UCI severity. In Australia all cultivars are screened for blackleg resistance and are allocated a blackleg resistance rating, farmers use this rating when determining which cultivar to purchase and where to apply fungicides. There is currently an effort in Australia to produce UCI blackleg ratings for all cultivars.

Conclusions:

UCI can be controlled my targeting the date of first flower, fungicide application at 30% bloom and deploying both major gene resistance and quantitative resistance. The decision support tool UCI BlacklegCM App was release on the App store and Google play store in 2022.