Optimisation of 2,4-D treatments for the control of common scab of potato (and related studies)

By Hannah Thompson

B AgrSc (Hons) University of Tasmania

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Declaration of Originality

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Hannah Thompson

University of Tasmania

February 2013

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Publications

Refereed Journal Articles


Conference Publications

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Poster Presentations

Tegg RS, Thompson, HK, and Wilson, CR, ‘Optimisation of rates, timing and assessment of new compounds for control of common scab disease of potato through foliar applied treatments’ *ACPP APPS Conference*, 26-29th April 2011, Darwin, NT.
Abstract

Common scab is an economically important disease of potato found in most growing regions of the world. There are few practical control methods and none that are both reliable and effective. Disease is minimised through planting resistant varieties, strategic use of irrigation, seed tuber treatments and late planting. Common scab is caused by pathogenic *Streptomyces* spp. that produce thaxtomin, necrosis-causing phytotoxins that are essential for pathogenicity. Previous research had found that 2,4-dichlorophenoxyacetic acid (2,4-D), a herbicide and synthetic auxin, controlled common scab symptoms when applied to the foliage of potato, but also resulted in undesirable phytotoxic effects. It has been demonstrated that when 2,4-D is translocated to potato tubers, it suppresses thaxtomin toxicity.

This study determined optimal rates and timing of 2,4-D application for control of common scab whilst minimising phytotoxic effects of the treatments. It found that treatment of potato plants as soon as 5 days after emergence provided greater protection against common scab and greater suppression of thaxtomin toxicity in harvested tubers than treatments after tuber initiation. Rates much lower than had previously been tested were found to reduce disease and induce toxin tolerance to levels similar to that obtained with treatments at near herbicidal rates, suggesting that maximum toxicity suppression occurred at very low tuber 2,4-D levels. These very low rates did not induce any noticeable phytotoxic symptoms, nor affect harvested tuber yield or quality, and resulted in 2,4-D residue levels well below maximum residue limits in tubers at harvest. Additionally, it was found that if seed tubers were treated prior to planting, daughter tubers would have some protection from disease and show tolerance to the toxin without an additional post emergence treatment.

This study also examined genetic variation in a number of somaclonal potato lines derived from Russet Burbank that showed a higher tolerance to thaxtomin than the parent line. In prior studies, enhanced tolerance to thaxtomin through reduced cellular uptake was identified in *Arabidopsis thaliana* mutants. Fine mapping showed mutations in the gene *TXR1* were responsible for the observed phenotype. In this study, *TXR1* potato homolog genes from selected thaxtomin tolerant somaclones were cloned, sequenced and analysed for variation to determine if toxin tolerance may be associated with mutations within this gene. The parent cultivar had only two
allelic forms, whilst the thaxtomin tolerant variants possessed an additional eight unique alleles. These mutant $TXR1$ alleles may have contributed toward thaxtomin tolerance in these variants.
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