Development of a modeling concept to show brown rot prevalence in the Dutch potato production chain over time, in relation to the control strategy applied

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Introduction Potato brown rot (caused by *Ralstonia solanacearum* race 3, biovar 2) is a quarantine disease that can be very destructive to potatoes. In the Netherlands, where potatoes comprise the most important cash crop [1], direct yield losses due to brown rot are limited but strict prevention and sanitation measures yearly lead to high economic losses. Moreover, the disease forms a threat to the production of Dutch seed potatoes, which covers 65% of the world trade [4]. The Dutch government applies a stricter control policy than prescribed by the EU Directives [3]. This has resulted in a reduction of infestations to less than 0.01% of all tested lots yearly, but no complete eradication has been reached yet [2]. It remains unclear how the remaining infestations can be prevented, at a reasonable cost level. Obtaining more insight in the epidemiology of *R. solanacearum* and the relative importance of risk factors is essential for determining which control measures are worth implementing.

Objective The aim of this paper is to present a modeling concept to analyze the effectiveness of different brown rot control strategies. The model should allow for: i) explaining brown rot prevalence and dispersal in the Dutch potato production chain, under different control policies, and ii) determining the relative contribution of risk factors to total brown rot dispersal.

Method To quantify brown rot prevalence in the potato production chain, a state-transition model was developed. State-transition models provide a convenient method to show changes in the distribution of a population among different states over time and allow for analyzing the relative importance of different variables. Transition probabilities are based on the major risks of brown rot infestation defined in the EU Directives (surface water, machinery and clonal relationships).

Results The model concept describes the introduction and dispersal of brown rot in and between potato lots in the Netherlands. Modeling at this level has the advantage that potato lots can be followed through the whole potato production chain over several years. By changing parameters and input variables, the effects of different brown rot abatement strategies on brown rot prevalence are quantified.

References

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