SIMULATION OF A PEST AND A DISEASE OF POTATO: POPULATION DYNAMICS AND YIELD LOSS

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Explanatory comprehensive models were constructed to simulate the population dynamics of the potato cyst-nematode, Globodera pallida, and its effect on the growth of the potato; and to simulate the development of a Phytophthora infestans epidemic in potato. Parameters and rate variables were estimated from published data, and preliminary evaluations performed.

Despite a number of simplifications the model of potato cyst nematode is capable of making realistic predictions of a number of features of the real system's behaviour. The relation between initial nematode density and the annual multiplication rate, and the effect of nematode density on tuber yield, are simulated well. The predicted effects of early harvesting are similar to those reported in the literature; and the predicted seasonal changes in population age-structure are in reasonable agreement with field observations.

Because the structure of the potato nematode model closely reflects the structure of the real system, flaws or gaps in our understanding can be pinpointed.

The present models suffers from two main weaknesses. First, the potato is assumed to grow in conditions which are optimal with respect to its water balance. The precise effect of nematode invasion and growth on root die-back and efficiency must be reliably quantified before this aspect of the system can be modelled.
The second main weakness concerns the possible effect of nematodes on the timing of tuber induction and senescence.

The model of the Phytophthora infestans epidemic is in an even more preliminary phase. It simulates the polycyclic development of the disease and its dispersion in a potato crop well, but is still weak in the part concerning the systemic growth of the fungus in the crop.

Nevertheless, both models reflect the advantage of the development of combination models of crop growth and population growth, as it pinpoints research priorities and may thus help in the development of pest and disease control schedules based on sound biological insight and knowledge.

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