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IMPROVEMENT OF A WHEAT PEST MANAGEMENT SYSTEM

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Background and objectives

EPIPRE is a centralized computer-based warning system for pests and diseases in winter wheat in The Netherlands. Participating farmers are provided with field-specific recommendations on monitoring and spraying, based on cost-benefit analysis. Monitoring is carried out by the participants themselves with an efficient standard procedure. Population growth and development is predicted 1-2 weeks ahead using simplified versions of explanatory simulation models. A spraying recommendation is given when losses calculated as a function of expected yield, exceed costs of pesticide application (Rabbinge and Rijsdijk 1983).

Decision procedure

The EPIPRE decision criteria do improve pest management in wheat, but they do not necessarily provide the best (i.e. most economical) solution. Dynamic programming (D.P.) is a technique that can efficiently determine optimal control policies for complex management models of the wheat ecosystem (Shoemaker 1981). This method transforms the problem of making a series of N decisions during a growing season into the more easily solvable problem of making one decision in each of N stages which together represent the whole season. The algorithm is suited for optimization of deterministic and stochastic models containing up to six variables describing the state of the system and a large number of complex management decisions.

Results and discussion

From several D.P. models developed for yellow stripe rust and cereal aphids it became clear that this technique can be a powerful tool in optimizing control recommendations of EPIPRE. As a result of accurate timing of applications, the number of recommendations to treat with a pesticide was reduced. A deterministic model combining the effects of yellow stripe rust and aphids showed lower economic thresholds than when only aphids or yellow rust was present.

Future efforts will be directed towards incorporation of stochastic variables, e.g. crop development stage and sampling errors, in such a way that an estimation can be made of the risk associated with a recommendation.

References

Rabbinge, R.; Rijsdijk, F.H. (1983) EPIPRE: a disease and pest management system for winter wheat, taking account of micrometeorological factors EPPO Bulletin 13, 297-305.

Shoemaker, C.A. (1981) Applications of dynamic programming and other optimization methods in pest management IEEE Trans. Automatic Control 26, 1125-1132.

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THE MATHEMATICAL PREDICTION OF THE MAIN PESTS OF FRUIT IN GEORGIAN SSR

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A system for storing and using information characterizing the relationships of plants and their pests is described. The system mainly depends on climatic data which are stored in an index-successive file for DOS of an EC computer. This file contains daily temperatures, rainfall, humidity, also phenological data on fruit tree development and information on pests.

In a series of programmes it has been possible to sum temperatures, rainfall and humidity and work out hydrothermic coefficients for given phenological periods. This information is used in programmes of multiple regression analysis which enable the significance of varying certain factors to be determined.

Regression models are examined in three ways: as linear models, nonintrinsically nonlinear models, and nonlinear estimation.

The system enables a satisfactory prediction to be made of fruit pests in different regions of Georgia.