

Modelling effects of *Barley yellow dwarf virus* on growth and yield of oats

Tomas Persson

Akademisk avhandling som för vinnande av agronomie doktorsexamen kommer att offentligens försvaras i Loffets hörsal, SLU, Uppsala, torsdagen den 23 mars 2006, kl. 09.00.

Abstract

Barley yellow dwarf (BYD) is a viral disease caused by a group of viruses that infect plant species within the family *Poaceae* and cause grain yield losses in cereal crops worldwide. The viruses causing the disease are divided into two groups, *Barley yellow dwarf virus* (BYDV) and *Cereal yellow dwarf virus* (CYDV), which are further divided into species and isolates. The viruses are spread from plant to plant only by grass feeding aphids.

A growth model describing oats (*Avena sativa*) infected with BYDV was formulated. Driving variables for the model are air temperature and solar radiation. The model consists of three sub-models, one describing plant phenology, the second development of green plant area and the third plant growth and biomass allocation between vegetative tissues and grains. Green plant area determining parameters, radiation use efficiency (RUE) and allocation parameters were calibrated against data from a greenhouse experiment. The model was modified, and RUE recalibrated to fit field data from an experiment with artificial BYDV infections in oats carried out at the Swedish University of Agricultural Sciences south of Uppsala (59°49'N/17°39'E), in 2002. The reductions in RUE calibrated against BYDV-infected plants were tested against grain yield data from another experiment carried out in 2003 at the same geographical site with the same oat cultivar and same virus isolate as in the experiment from 2002. To investigate the relative importance of air temperature and solar radiation in relation to other factors previously shown to influence the degree of grain yield reductions in B/CYDV-infected oats, grain yields from experiments in which cultivar, virus isolate and type of infection procedure differed from the Ultuna experiment 2002 were simulated.

The results of the model calibration show that green plant area determining parameters, RUE and allocation parameters are affected by a BYDV infection. In general, the test simulations of grain yield reductions differed considerably from those observed. Reasons for these differences and suggestions for model improvements are discussed in with help of experimental results on plant nitrogen changes in BYDV-infected plants.

Keywords: *Avena sativa*, BYDV, Barley yellow dwarf, plant growth, plant virus diseases, radiation use efficiency, RUE, simulation models

Distribution:

Swedish University of Agricultural Sciences
Department of Crop Production Ecology
SE-750 07 UPPSALA, Sweden

Uppsala 2006
ISSN 1652-6880
ISBN 91-576-7065-X