



REPORT OF THE
3rd WORKSHOP OF THE EWRS WORKING GROUP:
CROP - WEED INTERACTIONS

27-28 April 2001
Wageningen, The Netherlands

Crop and Weed Ecology Group, Wageningen University
Haarweg 333, Wageningen

Organizers:

Jet Drenth (Local organizer-Wageningen University)

Lammert Bastiaans (WG Coordinator-Wageningen University)

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**Program of the Workshop organized by the EWRS-WG
Crop-Weed Interactions
27-28 April 2001**

Venue
Crop and Weed Ecology Group
Department of Plant Sciences
Wageningen University
The Netherlands

Friday 27 April

- 09:15 h Workshop opening
09:30 h Common experimental approach – history and future
10:30 h *Break*
11.00 h Role of modelling weed competition in the new UK Weed
Management Support System for winter wheat – **Peter Lutman (UK)**,
Jonathan Storkey and John Cussans
11:30 h A programme of ecophysiological study to support the UK Weed
Management Support System – **Jonathan Storkey (UK)**, Peter
Lutman and John Cussans
12:00 h Expected use of image analysis techniques to the study of early growth
of weeds - **Louis Assemat (Fr)**

12:30 h *Lunch*

14.00 h Estimating an index of the competitive ability of winter wheat varieties –
Preben Klarskov Hansen (Dk)
14.30 h Tillering capacity of *Oryza sativa* does confer competitive ability against
weeds – **Lammert Bastiaans (NL)**
15.00 h Crop competitive ability as a key to the diffusion of reduced to nil
herbicide use control strategies - **Roberto Paolini (It)**, Roberto Petretti
15.30 h *break*
16.00 h Working Group issues (I)
17.00 h Close

Saturday 28 April

- 09:00 h
09:30 h Combining mechanistic and descriptive modeling for design and
optimization of cropping systems – **Lammert Bastiaans (NL)**, Daniel
T. Baumann, R. Akanvou
10:00 h Potentia contribution of preventative measures in Weed management
– Paula Westerman, **Bert Lotz (NL)**, Roel Groeneveld
10:30 h *break*
11:00 h Weed management through soil coverage – **Roel Groeneveld (NL)**,
Bert Lotz
11.30 h Working Group issues (II)
12:30 h Close

Abstracts

Role of modelling weed competition in the new UK Weed Management Support System for winter wheat

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A new collaborative project involving weed researchers, the chemical industry and computer experts has recently been established in UK. Its aim is to create a computer based Decision Support System to improve weed control decision making. A key part of the project is to predict the need for weed control by linking predicted yield losses to the cost of treatment. To achieve this users have to input either assessments of weed density or relative ground cover into the system which will then predict yield loss on a probabilistic basis. The model is based on the standard hyperbolic yield loss responses proposed by Cousens for weed density and Kropff & Spitters for weed relative vigour. Further models are endeavouring to predict the longer term consequences of weed control strategies by linking weed population dynamics information to the competition models.

A programme of ecophysiological study to support the UK Weed Management Support System

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The application of empirical models of yield loss, which play a key part in the UK Weed Management Support System (WMSS), relies on a detailed knowledge of the effect of the environment on early crop and weed growth. This information will be incorporated into the WMSS via a simple simulation model for growth in the potential production situation. A number of ecophysiological parameters required by the simulation model have been identified; including initial green area, maximum relative growth rate, base temperature, timing of competition, photosynthetic efficiency and leaf area ratio. These parameters have been derived for winter wheat and three UK weed species from a combination of controlled environment and field work. Future work is planned to develop efficient screening techniques for a wider range of species. The aim is to construct a database of the ecophysiology of a selection of different species in the UK weed flora to support the WMSS. It may also be possible to identify functional groups within the UK weed flora on the basis of their ecophysiology.

Expected use of image analysis techniques to the study of early growth of weeds.

Louis Assémat

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We present current state of research concerning weed identification of seedlings done in our project. The same techniques may be used in a research perspective for measuring leaves and seedling growth in 2D or simple 3D dimensions. Such objective will be tested this spring on weed seedlings cover.

Crop competitive ability as a key to the diffusion of reduced to nil herbicide use control strategies

Roberto Paolini and Roberto Petretti

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Integrated chemical or non-chemical weed control is generally effective. Nevertheless, using non-chemical means often implies constraints and higher costs under farm conditions, which strongly limits the application of such strategies. This presentation supports the idea that husbandry choices enhancing crop competitive ability can represent “cultural” means giving a range of chances to reduce costs and constraints of weed control, in both low input and organic cropping.

Some typical cases are outlined, where cultural means can either integrate the effect of other chemical or non-chemical means applied in a cheaper way (herbicide treatments at reduced rate, or mechanical, less drastic or less frequent interventions), or even replace the effect of sometimes unreliable agronomic means (false sowing or cover cropping).

Limitations to the applicability of cultural means are also briefly outlined.

Estimating an index of the competitive ability of winter wheat varieties

Preben Klarskov Hansen

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Nine different winter wheat varieties have been tested for their competitiveness when grown in different densities of a mixture of cultural grasses. One of the experimental aims was to develop a simple and robust method to make an index of competitive ability against weeds.

Results have shown that the competitive variety of the varieties differed from 72% (Flair) to 123% (Yatch) of the mean weed biomass in experiments conducted at Research Centre Flakkebjerg in 1998 and 1999.

Further, the results showed that a measurement of reflectance ultimo April, the final canopy height medio June, and the leaf area index prime July could be used to calculate an index of the competitive ability against weeds of the varieties with a simple additive model. This index correlated with the measurements of the relative weed biomass in the experiments ($R^2=0.53$).

The model was validated with data from an experiment in 1999, situated at the plant breeding company Pajbjergfonden, with different soil type and weather conditions. The results from the validation in 1999, showed ranking of the competitive ability similar to the observed data. In 2000 data from an experiment at Research Centre Flakkebjerg was used as validation. The model classified the competitive ability satisfactory of the majority of the varieties, but a few varieties was misclassified.

List of Participants

Louis Assemat	INRA, Dijon, France
Lammert Bastiaans	Wageningen University, The Netherlands
Jet Drenth	Wageningen University, The Netherlands
Roel Groeneveld	Plant Research International, Wageningen, The Netherlands
Preben Klarskov Hansen	Research Centre Flakkebjerg, Slagelse, Denmark
Ans Hofman	Wageningen University, The Netherlands
Nick den Hollander	Wageningen University, The Netherlands
Martin Kropff	Wageningen University, The Netherlands
Bert Lotz	Plant Research International, Wageningen, The Netherlands
Peter Lutman	BBSRC, Rothamsted, U.K.
Roberto Paolini	Tuscia University, Viterbo, Italy
Jukka Salonen	Agric. Res. Centre, Jokioinen, Finland
Jonathan Storkey	BBSRC, Rothamsted, U.K.

Workshop-report

From 27-28 April 2001 a workshop of the EWRS-Working Group 'Crop-Weed Interactions' was held at the Crop and Weed Ecology Group, Department of Plant Sciences, Wageningen University, The Netherlands. Main objectives of the workshop were to exchange recent research results and scientific ideas in the field of Crop-Weed Interaction, to set a clear time frame for finalization of manuscripts based on the results of earlier conducted common experiments, and to discuss the future direction of the Working Group. Thirteen participants from 6 European countries attended the workshop.

Scientific program

Main topics of the workshop were early growth of weed and crop plants, competitive cultivars and preventative measures. In the common experiments of 1999 and 2000 early growth of crop and weed plants was the central theme. Main question raised was the stability of RGR and the stability of differences in RGR between plant species in different environments. These data are currently being analyzed (Sartorato). A detailed ecophysiological study of early growth of different weed species and wheat was presented (Storkey). This research is supportive to the development of a computer based Decision Support System to improve weed control decision making in wheat in the UK (Lutman). Apart from the Biological models, this DSS contains an encyclopedia of weeds and herbicides, herbicide dose responses and decision models. Also the population dynamics of weeds is considered. The current state of research concerning identification of weed seedlings (image analysis) was presented and potential use of this technique in research as well as in weed management was discussed (Assemat).

With the increased attention for organic and low-input agriculture, crop competitiveness against weeds has lately received a lot of attention. In Danish research, which was conducted in close collaboration with breeders, the development of a robust index of competitive ability of winter wheat varieties against weeds, based on relatively simple observations, was the aim (Hansen). Close analysis of published results on competitive ability against weeds in rice indicated that interpretation of observed data should be done with care (Bastiaans). Apart from crop competitiveness, a range of agronomic measures can be taken to manipulate crop-weed interactions to the benefit of the crop. On the one hand these cultural measures represent opportunities to reduce herbicide input, but negative trade-offs sometimes hinder the unlimited application of these measures (Paolini). A matrix model was developed to estimate the potential contribution of various preventative measures to the reduction of the weed seed bank (Lotz). First experiences with the use of a novel product for soil cover to prevent emergence and establishment of weeds were presented and discussed (Groeneveld). The outline of a PhD-project on the use of clover as a cover crop was presented (den Hollander), and a methodology for optimization and design of intercropping systems was discussed (Bastiaans).

Finalization of Common experiments

During the last decade one of the successful elements of the Working Group on Crop-Weed Interactions was the comparison and validation of the predictive ability of two descriptive yield loss models: the density model of Cousens (1985) and the relative leaf area model of Kropff and Spitters (1991). This comparison was made possible through a common experimental approach. Identical competition experiments

between a model weed (white mustard) and two crops (sugar beet and spring wheat) where simultaneously conducted at a range of sites all over Europe. On the first series of experiments conducted in 1992 and 1993 a manuscript was presented in Weed Research. A draft paper has been produced on the second series of experiments conducted in 1995 and 1996. Data obtained from the third series of experiments conducted in 1999 and 2000 have been collected and screened by the coordinator of these experiments, Ivan Sartorato. Analysis is yet underway.

To finalize the two manuscripts before the end of this year, Bert Lotz and Peter Lutman and Ivan Sartorato will work on the manuscript of the second series of experiments. Jonathan Storkey and Lammert Bastiaans will support Ivan in the analysis of the third series of experiments.

Future direction of the Working Group

As stated earlier on, the common experimental approach has formed a major element of the Working Group on Crop-Weed Interactions, and has largely contributed to the success of this Working Group and the partnership among its participants.

Unfortunately, developments are such that the situation at home Institutes and Universities has changed, such that it becomes far more difficult to include the common experiments as additional experiments in the research program.

Consequently, the Working Group has decided to put more emphasis on the Working Group as a Platform for Discussion.

This choice has some consequences, as during the last workshops in Dijon 1997, Dijon 1998 and Wageningen 2001 the number of participants was between 10-20. Experiences from other Working Groups (e.g. Physical Weed Control) learn that 30-40 participants is an optimal number for a Discussion Workshop; large enough to have sufficient critical mass on a range of topics and small enough to allow for a very informal atmosphere. To obtain this number of participants a list with potential members will be formed, in which we aim at a good representation of the various European countries and a good balance between scientists working on fundamental and applied aspects of Crop-Weed Interaction.

Presentation of the Working Group.

The WG will present itself on the EWRS-web-page. Apart from the standard page a more fancy web-site, with more specific information on the WG, will be produced. A draft of the standard web-page was discussed during the workshop. Further the WG will present itself with a poster during the EWRS-Symposium in Wageningen 2002. For this symposium a review-paper will be produced with the draft-title: 'Preventative measures and the role of crop-weed interactions', for which Lammert Bastiaans will take the initiative. Furthermore, a presentation will be prepared to summarize the decade of common experimentation, with a main emphasis on the last two-years. Ivan Sartorato will be asked to take the lead in this matter.

Next workshop

Roberto Paolini from the Tuscia University in Viterbo offered to host the next workshop, which was scheduled for the late April 2003. The workshop will last two and a half day, starting on Thursday-morning and will include a field trip of half a day. The exact date of the Workshop will be set by the end of May 2001.