UNIVERSITY OF COPENHAGEN FACULTY OF LIFE SCIENCES

Department of Agriculture and Ecology

Introduction to round-table discussion

Unifying parameters in mechanical weed control research

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Agenda for the roundtable discussion

Introduction

- Previous roundtable discussions
- Why unifying parameters?
- Examples from own work

Discussions in groups

Summing up

Roundtable discussions in the EWRS working group - status

- Roundtable discussions since group establishment in 1994
- Comprehensive guideline paper in 2004 for flame weeding, weed harrowing and intra-row cultivation
  - Use and adjustments of mechanical tools
  - Recording of impact factors that affect weeding performance
  - Recording of effectiveness
  - Experimental designs
  - Underlying conceptual models

European Weed Research Society
Physical and Cultural Weed Control

Home
Objectives
Weeder Photos
Proceedings
Research Guidelines
Publications
Links
Contact details

Zaragoza Workshop
3rd Circular

8th Workshop
Payment and Confirmation of payment
Venue
Accommodations
Programme
Abstracts - Proceedings
Deadlines
Organising committee
3rd Circular (pdf)

Guidelines for physical weed control research

Some members of our working group have started a collaboration on writing a manuscript titled: «*Guidelines for physical weed control research: flame weeding, weed harrowing and intra-row cultivation*» which they presented at our 6th Workshop in march 2004. The manuscript that they wrote is available below (it is also available in the full proceedings which are available here).

The reference for the manuscript is:
P. Vanhala, D. Kurstjens, J. Ascard, A. Bertram, D.C. Cloutier, A. Mead, M. Raffaelli & J. Rasmussen. 2004. Guidelines for physical weed control research: flame weeding, weed harrowing and intra-row cultivation. Proceedings 6th EWRS Workshop on Physical and Cultural Weed Control, Lillehammer, Norway, 8-10 March 2004. pp. 208-239. (Click here to download a pdf version, 637 Kb)

There was a roundtable discussion on *Guidelines for physical weed control research at the Lillehammer Workshop*.

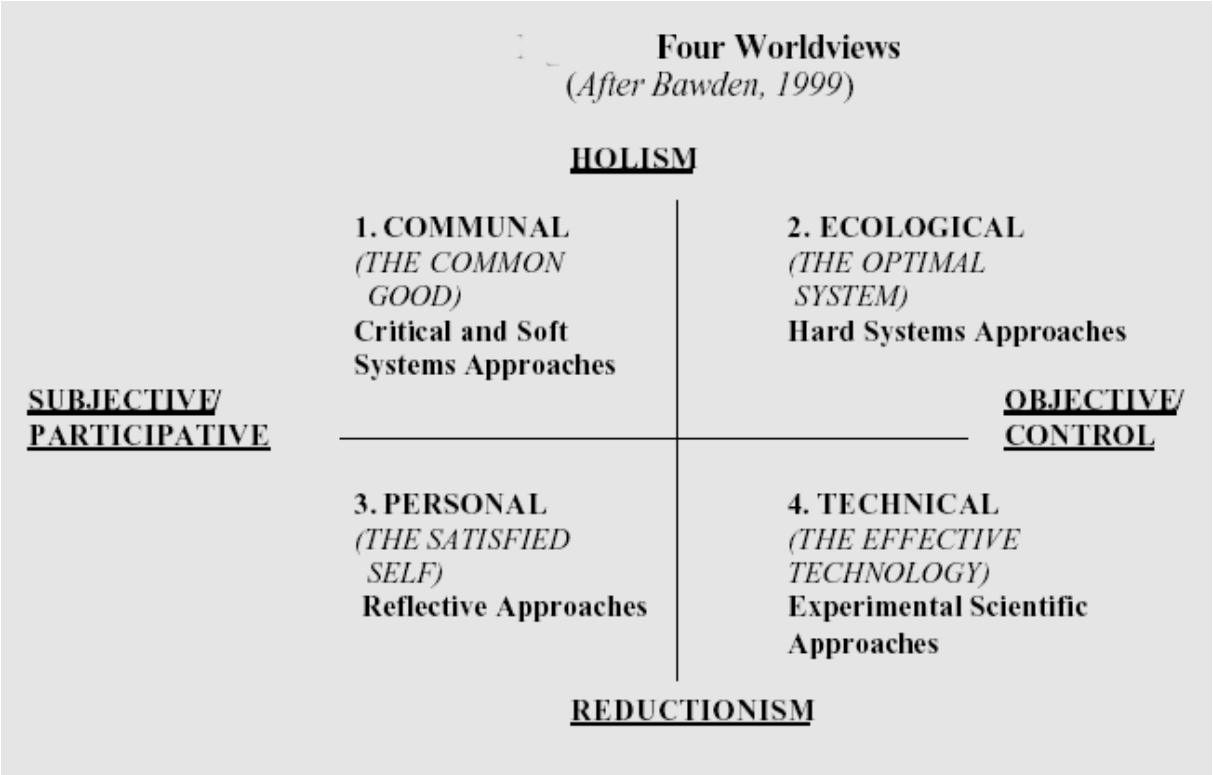
Click here to see the report of this roundtable.

http://www.ewrs.org/pwc/research_guidelines.asp

Improving mechanical weed control

Do we need more research to improve our knowledge about single control tactics?

Should we rather focus on broader perspectives – systems approaches?



Unifying parameters

1. Narrowing the focus
2. Aim
    1. Scientific context
        - to improve knowledge about single control tactics
        - to improve comparability among experiments
        - to speed up the accumulation of knowledge
    2. Applied context
        - to develop decision support systems (bridging the gab between scientific work and practice)

A parameter
A constant in the equation of a curve that can be varied to yield a family of similar curves

If asked to imagine the graph of the relationship $y = ax^2$, one typically visualizes a range of values of x, but only one value of a. Of course a different value of a can be used, generating a different graphical appearance. The a can therefore be considered to be a parameter: less variable than the variable x, but less constant than the constant 2

http://en.wikipedia.org/wiki/Parameter

Why unifying parameters?

1. The era of quantitative experimental approaches comes to an end (goodbye ANOVA!)
   - Are treatments different?
2. Qualitative experimental approaches takes over
   - How are treatments related to crop and weed responses?
3. Priority to “meaningful” parameters
   - The primary aim is not to “just” to describe crop and weed responses to cultivation
   - The primary aims are to
     - Estimate meaningful parameters which are easily compared among different studies and fit into models that may facilitate decisions support
     - To make “meaningful” explicit

Own work: Weed harrowing

Own work: intelligent intra-row tools in row crops

Cycloid Hoe 'Osnabrücker Querhacke'

Examples from own work

Three key parameter

1. Resistance
2. Weed control
3. Tolerance

Protocols for estimation, test and use

Rasmussen J, Bibby B & Schou AP (2008) Investigating the selectivity of weed harrowing with new methods. *Weed Research* **48**, 523-532

Rasmussen J, Nielsen HH & Gundersen H (2009) Tolerance and selectivity of cereal species and cultivars to post-emergence weed harrowing. *Weed Science* 57 (in print)

Resistance parameter

Definition: Resistance is the ability of the crop to resist cultivation. Assessment shortly after cultivation before recovery takes place.

$L = L_0 * \exp(-b*I)$

Parameter *b*: Resistance parameter expresses the relative decline rate of L relative to I. L could be leaf cover or density; L_0 is leaf cover or density in untreated plots. I is the cultivation intensity – could be number of passes

Estimation by linear regression

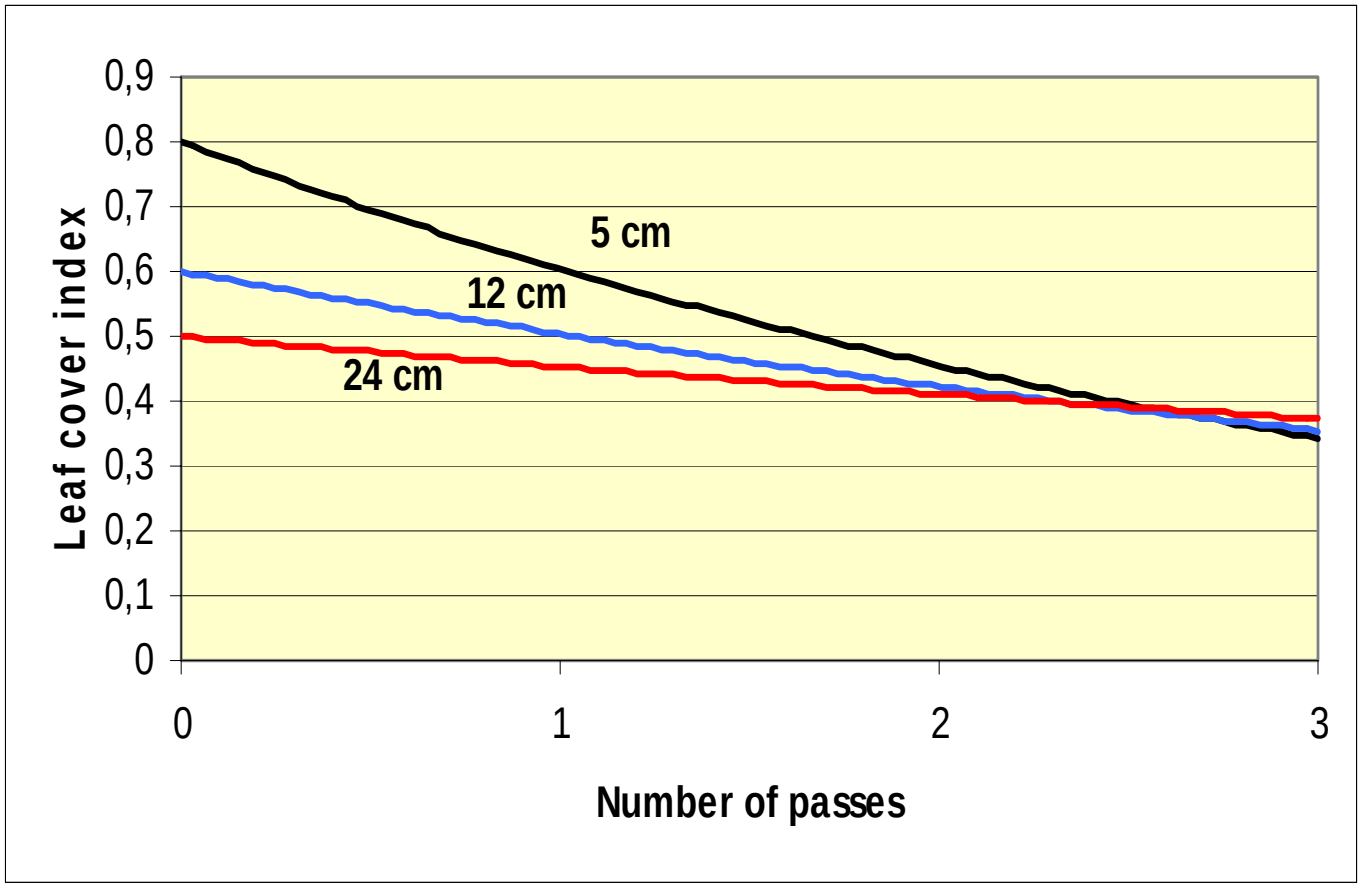
$\ln(L) = \ln(L_0) - b*I$

The percentage of crop soil cover (CSC) is expressed as

$CSC = 100 * (1 - \exp(-b*I))$

Resistance parameters – barley

Influenced by row distances



Research **48**, 523-532

Weed control parameter

Definition: Weed control is the decline in weed density immediately after cultivation

$W = W_0 * \exp(-d*\ln(I+1))$

Parameter *d*: Weed control parameter expresses the relative decline rate of weed density (W) relative to I. W_0 is weed density in untreated plots; I is cultivation intensity

Estimation by linear regression

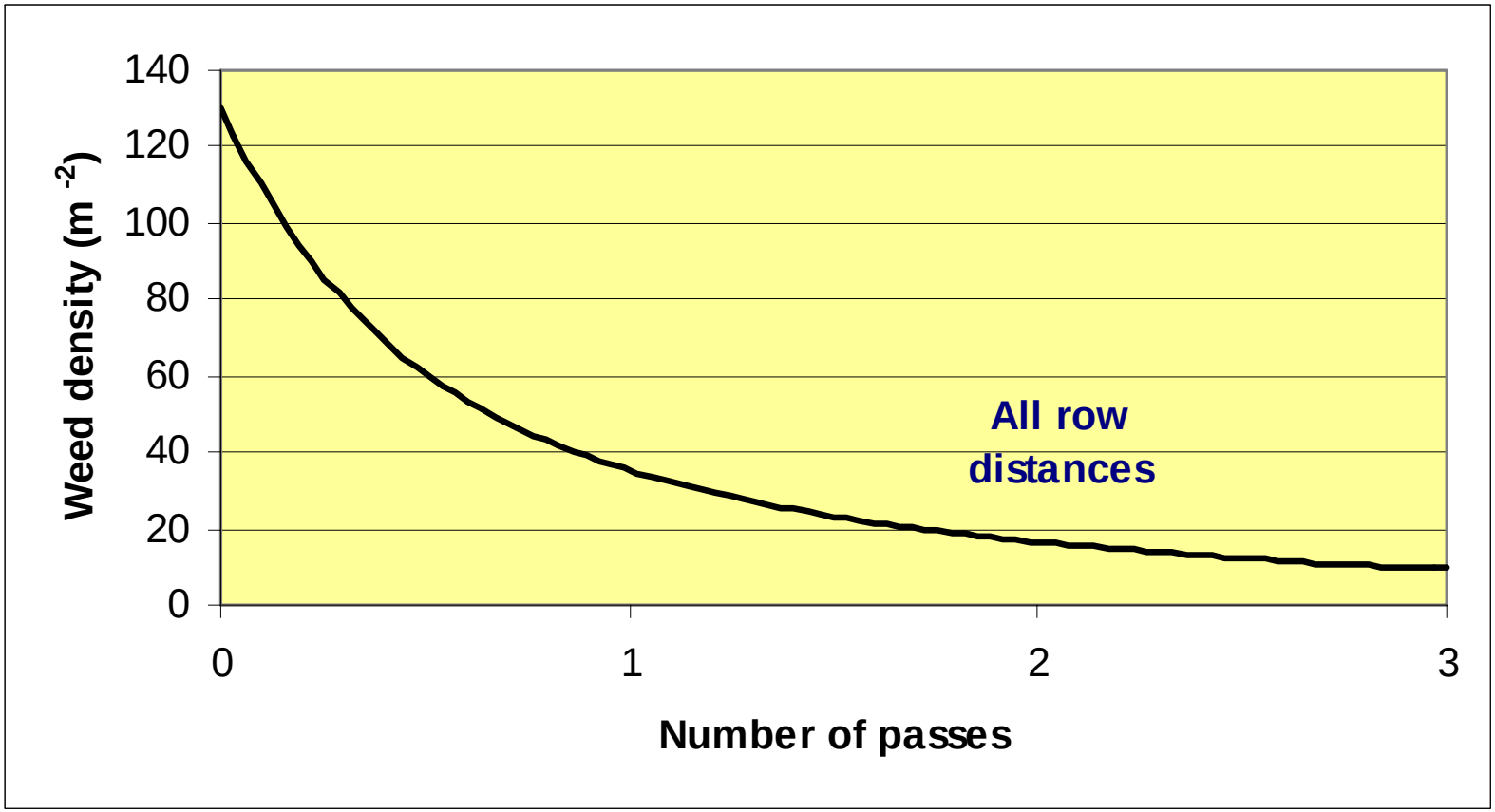
$\ln(W) = \ln(W_0) - c*\ln(I+1)$

The percentage of weed control (WC) is expressed as

$WC = 100 * (1 - \exp(-d*\ln(I+1)))$

Weed control parameter – barley

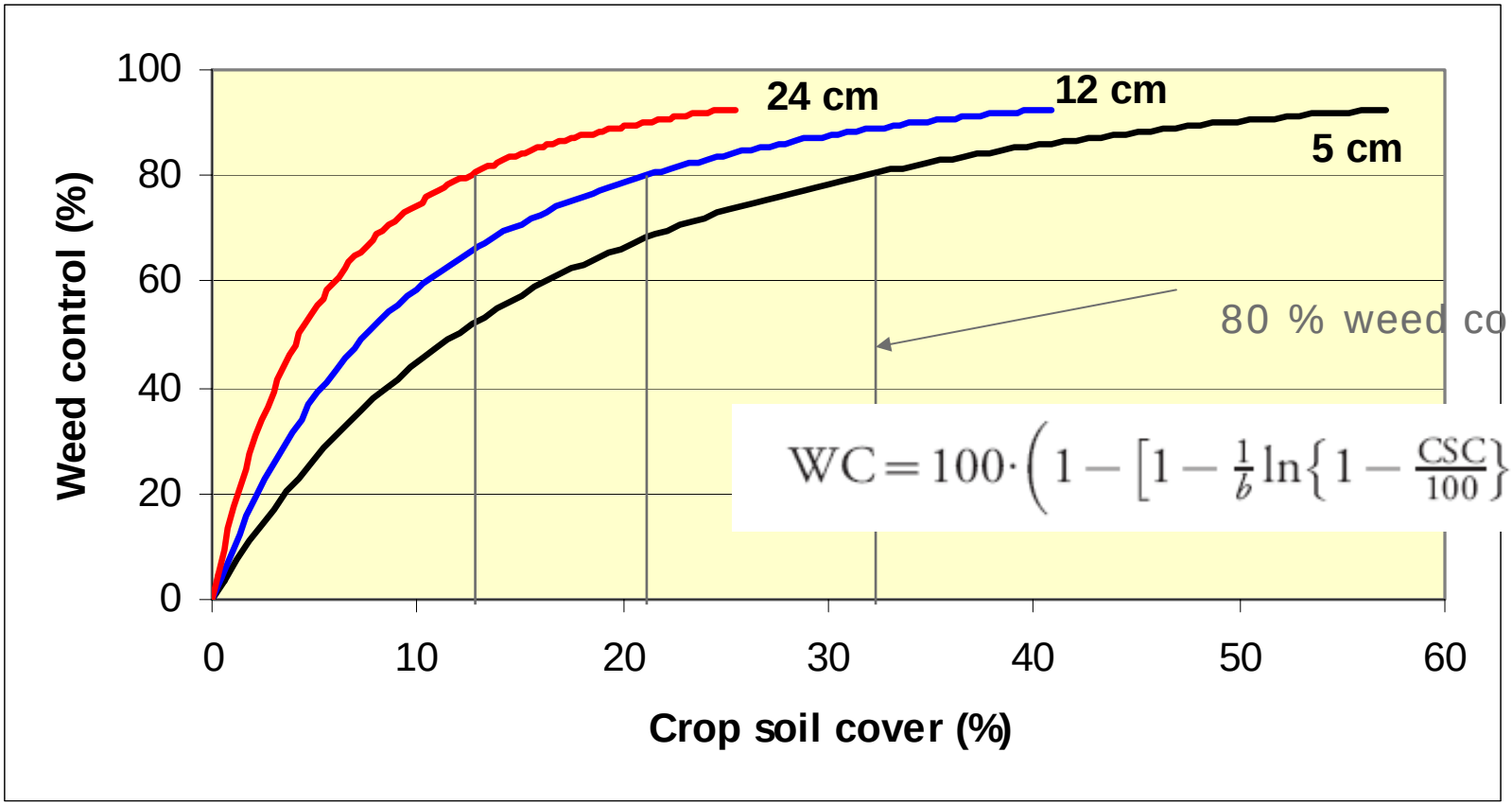
Not influence on row distances



Research **48**, 523-532

Selectivity

Estimated from resistance and weed control parameters



$$WC = 100 \cdot \left(1 - \left[1 - \frac{1}{b} \ln\left\{1 - \frac{CSC}{100}\right\}\right]^{-d}\right)$$

Research **48**, 523-532

Tolerance parameter

Definition: Tolerance is the ability of the crop to avoid yield loss from cultivation in the absence of weeds

$Y = Y_0 * \exp(-c*I)$ og

Parameter *c*: Resistance parameter expresses the relative decline rate of Y relative to I. Y is crop yield; I is cultivation intensity – it could be number of passes

Estimation by linear regression

$\ln(Y) = \ln(Y_0) - c*I$

The percentage of crop yeild decline (Y_L) is expressed as

$Y_L = 100 * (1 – \exp(-c*I))$

Crop recovery
Estimated from resistance and crop tolerance parameters

$$Y_L = 100 \cdot \left(1 - \exp\left[\frac{c}{b} \cdot \ln\left\{1 - \frac{CSC}{100}\right\}\right]\right)$$

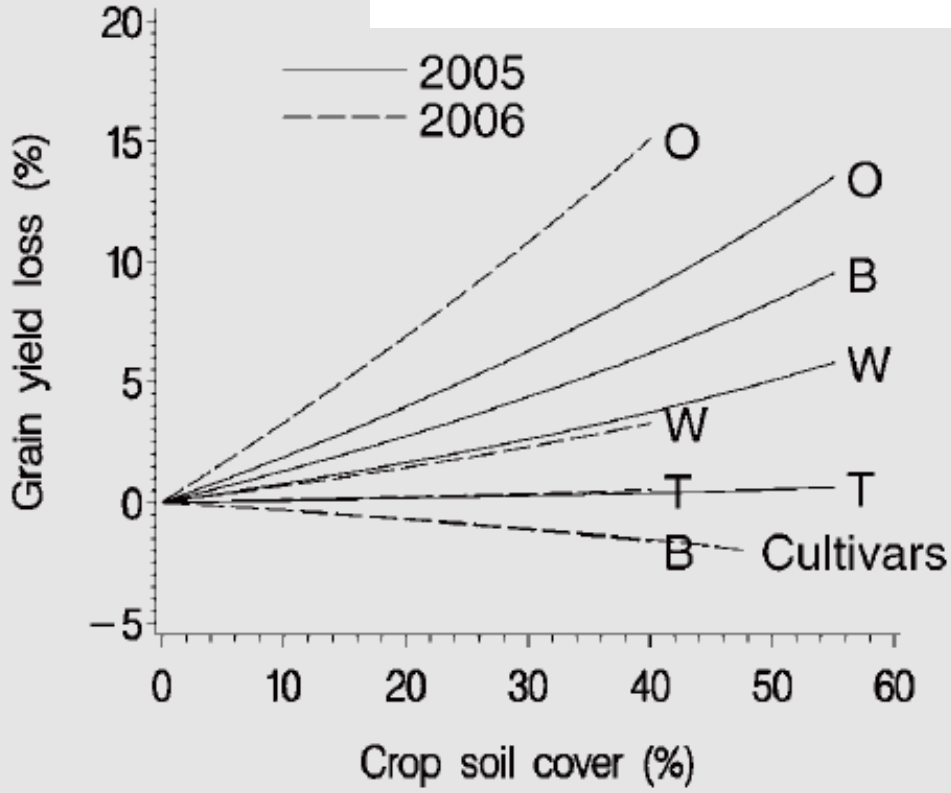
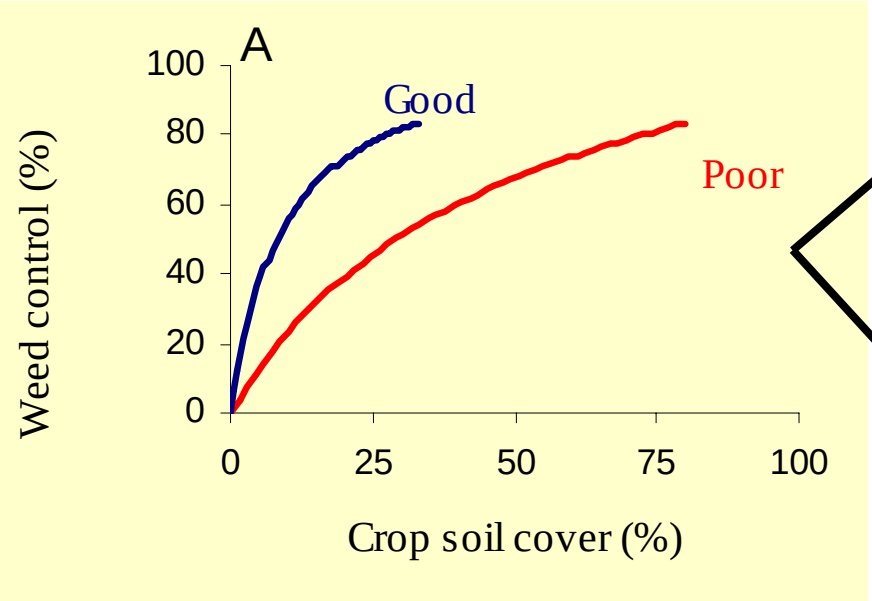


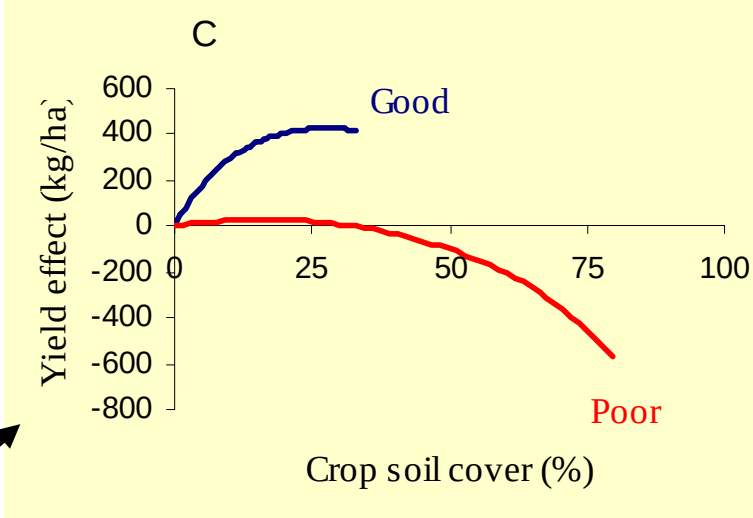
Figure 1. Crop recovery calculated on the basis of Equation 9 and parameter values in Table 2. O is oat, B is barley, W is wheat, and T is triticale. Cultivars denote average of four barley cultivars in 2006. *Weed Science* 57 (in print)

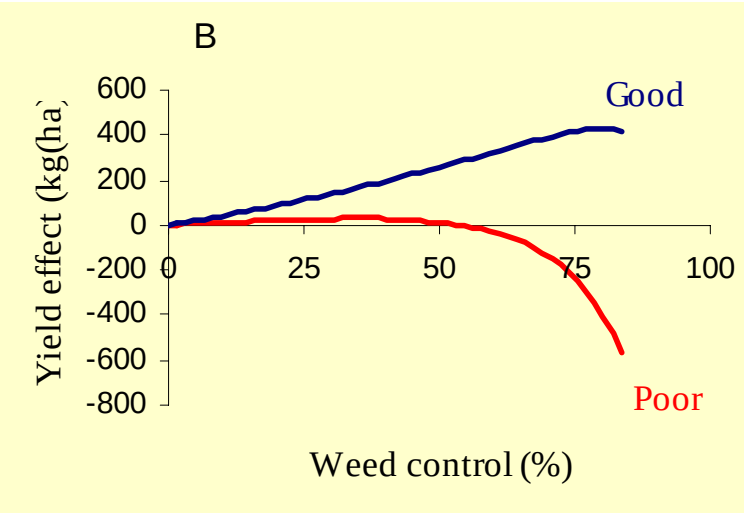
Decision support algorithm Example

Recording



Predicting





Roundtable discussion

Groups organization according to main interest:

Mechanical weed control in growing crops

1. Low selective methods
   - Full surface and intra-row cultivations
2. None-selective cultivation methods
   - Row cultivation

Mechanical weed control in stubble and other areas without growing crops

Others?

Decide which tools and which crops your discussion is about

Discuss the most important parameters in order to improve knowledge about using the tool

Give the parameter a descriptive name

Define what the parameter expresses

Describe the layout of relevant experiments in order to estimate the parameter

Evaluate the importance of the parameter