

 **O.24 - Decision support systems (DSS) for weed control in Europe – state-of-the-art and identification of ‘best parts’ for unification on a European level**Rydahl, P.¹, Berti, A.², Munier-Jolain, N.³¹ Aarhus University, Faculty of Agricultural Sciences, Flakkebjerg – Slagelse, 4200, Denmark² Dipartimento di Agronomia Ambientale e Produzioni Vegetali dell'Università di Padova, Agripolis, 35020 Legnaro (Padova), Italy³ INRA Centre de Dijon, 17 rue Sully - B.P.86510 - 21065 Dijon Cedex, FranceContact: per.rydahl@agrsci.dk**Abstract**

A survey has been conducted of decisions support systems (DSS's) for weed control in Europe. 9 DSS's representing 7 countries were studied. These were all targeted at farmers, but they differed in decisions supported, in number of crops covered and in demonstrated impact. At a workshop in Denmark in March 2008, a set of 'best parts' / 'building blocks' from these DSS's suitable for unification on a European level was identified. These could form the basis for building and validating DSS's on a European level that meets requirements for robustness in production lines and which hold some potential for reducing dependency and / or use of herbicides. When some robust and potent DSS concepts have been identified, the production and exchange of data that support integrated decision algorithms and calculation models of such DSS should be co-ordinated on a European level.

State-of-the-art

A common data form was developed to conduct a survey on existing DSS's for weed control in EU-countries and Switzerland. The survey included the following main questions:

- Which decisions are supported?
- Which modeling approaches have been used?
- How is communication with users being done?
- Have the DSS's demonstrated some impact?
- Have opportunities for integration been identified?
- Are procedures for updating been followed?
- Have potentials for unification been identified?
- Are there restrictions regarding ownership?
- Has feedback to research been demonstrated?
- Have some 'best parts' been identified locally?

Results from the survey were presented on several DSS's at the pan-European workshop held in Flakkebjerg, Denmark in March, 2008. The objectives of this workshop were to present existing DSS's for crop protection and to identify some 'best parts' suitable for unification on a European level.

Data are available on 9 DSS's from 7 countries (Denmark, France, Germany, Italy, Netherlands, Sweden and UK).

The DSS's were developed and disseminated for different crops, for different geographical conditions and for differing objectives. Consequently, common traits and differing traits have been identified. A common trait is that the DSS's identify treatments best suited according to some criteria targeted for farmers. A common shortcoming is lack of data supporting the specific decision algorithms and calculation models that have been integrated in the DSS's.

Considering differing traits, the following aspects were identified:

- Economic evaluations
- Environmental impact
- Dose optimisation

- Weather effects
- Optimization of spray technique
- Herbicide resistance
- Support for weed identification

An evolution trend has been that DSS's have developed from considering only a few aspects of weed control, e.g. bio-economic evaluation of weed control options, spray/no spray approaches, to DSS's that often include decision algorithms and calculation models that integrate more aspects, e.g. optimum dose rates, weather conditions, environmental issues, implementation of treatments and the emerging problem of herbicide resistance development. Some DSS's include only a few crops and weed species, while other DSS's are fully functional for major crops and weeds on national/regional scales. Some DSS's have demonstrated impact in terms of reduced environmental impact or increased economic net return for farmers.

Considering communication with end users, most DSS's do not allow end users to interact with decision algorithms and model parameters. Consequently, the scientific basis of recommendations delivered by the DSS's are rarely transparent to the end users. Some DSS's have already been implemented in different countries, but only 3% or less of the farmers in different countries are using the systems.

Identification of 'best parts' suitable for unification on a European level

On the pan-European workshop in Flakkebjerg in March 2008, a set of 'building blocks' representing 'best parts' of existing DSS's, were identified. Building blocks were identified in the following domains:

- Quantification of the need for control:
 - Weed density equivalents
 - Crop rotation aspects
 - Integration of different aspects
- Efficacy of herbicides:
 - Cross tables
 - Dose/response functions/Additive Dose Model
 - Site-specific evaluations
- Environmental impact of herbicides:
 - Risk factors
 - Treatment Frequency Index (TFI)
- Climatic conditions:
 - Long term conditions
 - Short term conditions

Suggestions for 'next moves'

Having identified building blocks suitable for unification on a European level, specific characteristics of building blocks should be identified too. Different DSS concepts that consist of different building blocks should be developed, adjusted and validated for national/regional conditions. Initially, priority should be given to a limited number of crops, nations/regions and building blocks. Special considerations should be given to needs for decision support among farmers and advisors.

If such concepts demonstrate suitable robustness in the production line and some potentials, e.g. in one or more of the following domains:

- Justification of the use of herbicides
- Reduction in the dependency on herbicides
- Reduction of the use of herbicides
- Reduction of environmental impact of herbicides

Co-ordinated efforts could be made across the European level to produce and exchange specific data that support decision algorithms and calculation models in the selected DSS concepts.

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