FAR-consult

Computerised assistance for weed control and weed identification in sugar beet

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1. Introduction

Nowadays, assistance for sugar beet growers is available through different information channels, for example conferences, information meetings, published articles, internet,... Most of the time, the information is spread in a very general way, without going further into specific individual problems of each grower. For several aspects of the beet crop, and especially for the weed control, a more individual assistance could be useful.

Although low dosage herbicide treatments in sugar beet are very efficient and used on a large scale, they remain relatively complicated because they imply a large number of combinations of products at various dosages. Also the identification of weeds in an early stage, important for the efficacy of the weed control, may not be easy.

With this goal, the IRBAB has developed in 1999 a computer program for weed control assistance in sugar beet, named FAR-consult, that allows the user to look up the optimal solutions to his own weed problems, for example the control of a specific weed species in a certain development stage. The information is updated regularly in function of the evolution and the results of further research. The whole system was programmed in Microsoft Access.

In the spring of 2000, a first version of FAR-consult was launched. The program contained a database with the registered products and the most common weed species in Belgium, general recommendations for weed control in sugar beet, a table for the post-emergence control of grasses and an interactive system for individual and adjusted advice for the post-emergence control of dicotyl weeds.

Since the FAR-system for weed control is based on the principle of treating young weed plants, the identification of the weed species in the field can be a problem. The weeds have to be recognised having at most 4 to 6 real leaves and most often in the cotyledon or two-leaf-stage.

At this moment, a number of determination keys are available, but most of these keys are based on fully developed plants or on plant characteristics that are not easily recognisable in the field. For that reason, and on request of several FAR-consult users, the IRBAB has also developed a user-friendly module to identify the most common weed species in the Belgian sugar beet fields.

2. Weed control assistance in FAR-consult

Through different windows, the user can :

- Obtain information on the used terminology and methodology in the system ;
- Obtain information about the products and active ingredients : technical and commercial information on the product type, its action mode (total herbicide, graminicide, dicotyiicide, ...), active ingredient content, formulation, holder and registration number ;
- Obtain information about weed species : names in different languages, family, characteristics, distribution, images, general recommendations for the control ... ;
- Identify weeds with the aid of an identification key and of images in different development stages :
- Obtain general information on the FAR system ;
- Ask for personalised advice for weed control in function of the present weeds in the field.

2.1 The weed control database

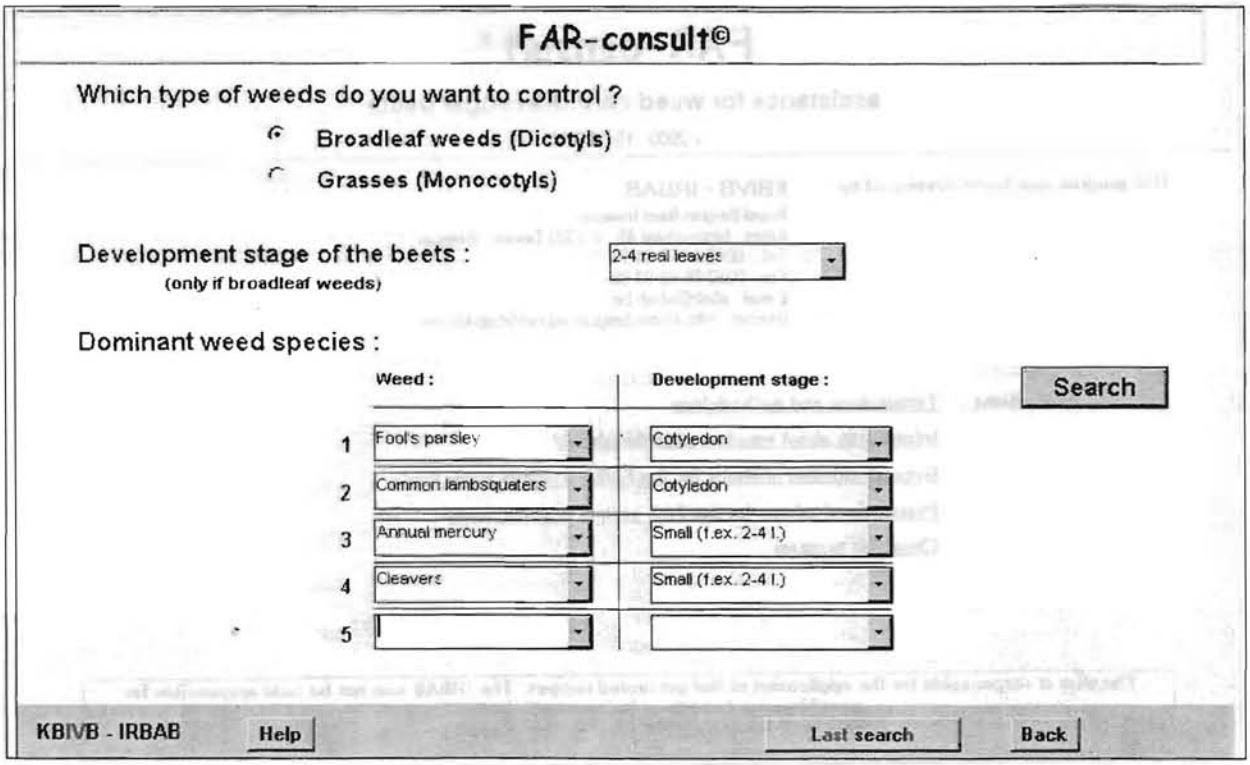
For weed control assistance, FAR-consult is based on a relational database containing on one side information about the principal weeds, the registered active ingredients and commercial products in Belgium and on the other side the results of experiments on weed control in sugar beet of the IRBAB.

The database contains more than 100 weed species, 30 active ingredients and nearly 150 commercial products, classified in 51 product types. The product types are combined in no less than 715 weed control recipes (mixtures). Each recipe has an evaluation of its efficacy against 38 common weeds, each in 4 development stages, as well as an evaluation of its selectivity towards the sugar beet, in 4 development stages. In this way, more than 112.000 evaluation values are included, based on more than 150 trials realised by the IRBAB during the last 13 years.

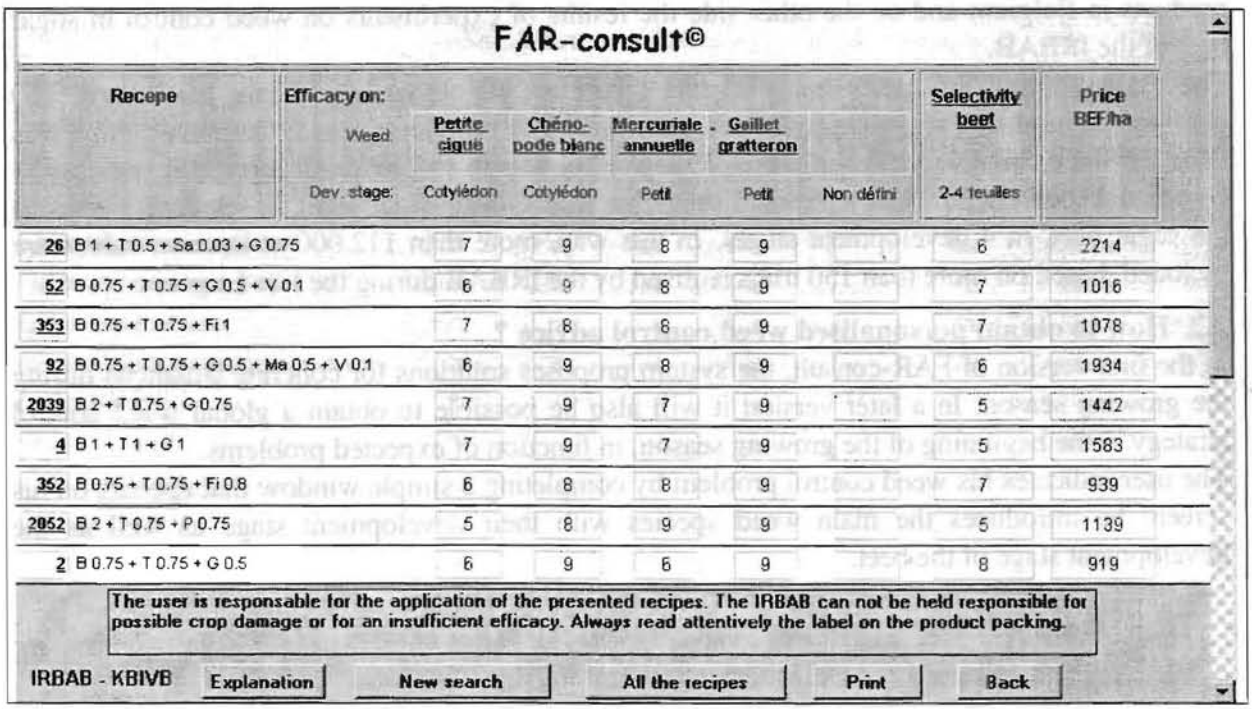
2.2 How to obtain personalised weed control advice ?

In the first version of FAR-consult, the system proposes solutions for concrete situations during the growing season. In a later version it will also be possible to obtain a global weed control strategy in the beginning of the growing season, in function of expected problems.

The user indicates his weed control problem by completing a simple window that appears on his screen: he introduces the main weed species with their development stage as well as the development stage of the beet.



Based on this information, FAR-consult proposes a list of weed control recipes, giving their efficacy against each of the selected weeds, their selectivity and their cost price. The results are presented in a user-friendly table.



FAR-consult©

Recepe	Efficacy on: Weed	Petite ciguë	Chéno-pode blanc	Mercuriale annuelle	Gaillet gratteron		Selectivity beet	Price BEF/ha
	Dev. stage:	Cotylédon	Cotylédon	Petit	Petit	Non défini	2-4 feuilles	
26 B 1 + T 0.5 + Sa 0.03 + G 0.75		7	9	8	9		6	2214
52 B 0.75 + T 0.75 + G 0.5 + V 0.1		6	9	8	9		7	1016
353 B 0.75 + T 0.75 + Fi 1		7	8	8	9		7	1078
92 B 0.75 + T 0.75 + G 0.5 + Ma 0.5 + V 0.1		6	9	8	9		6	1934
2039 B 2 + T 0.75 + G 0.75		7	9	7	9		5	1442
4 B 1 + T 1 + G 1		7	9	7	9		5	1583
352 B 0.75 + T 0.75 + Fi 0.8		6	8	8	9		7	939
2052 B 2 + T 0.75 + P 0.75		5	8	9	9		5	1139
2 B 0.75 + T 0.75 + G 0.5		6	9	6	9		8	919

The user is responsable for the application of the presented recipes. The IRBAB can not be held responsible for possible crop damage or for an insufficient efficacy. Always read attentively the label on the product packing.

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For each recipe, more information can be obtained about the application modalities and conditions, as well as about each of the proposed products (active ingredients, contents, registration,...).

3. Weed identification

3.1 The database for weed identification

For the weed identification, especially in young development stages (cotyledons, first real leaves), an identification key has been developed based on a database containing a great number of weed characteristics. The used characteristics have to be easily recognisable in the field.
The identification key is mainly based on the characteristics of the cotyledons and the first real leaves of de weeds, and is completed with photos of the weeds in different development stages and with schematic drawings of leaf shape, margin, implantation etc., to facilitate the difficult identification of some weeds.
In order to set up this database we consulted existing literature, but we also made observations on a great number of plants sowed in the greenhouse. We thank Mr. Thierry Vanderborght of the 'Jardin Botanique National de Belgique' in Meise and Professor Bulcke of the 'laboratoire d'herbologie' of the University of Gent for their contribution to our seed collection.

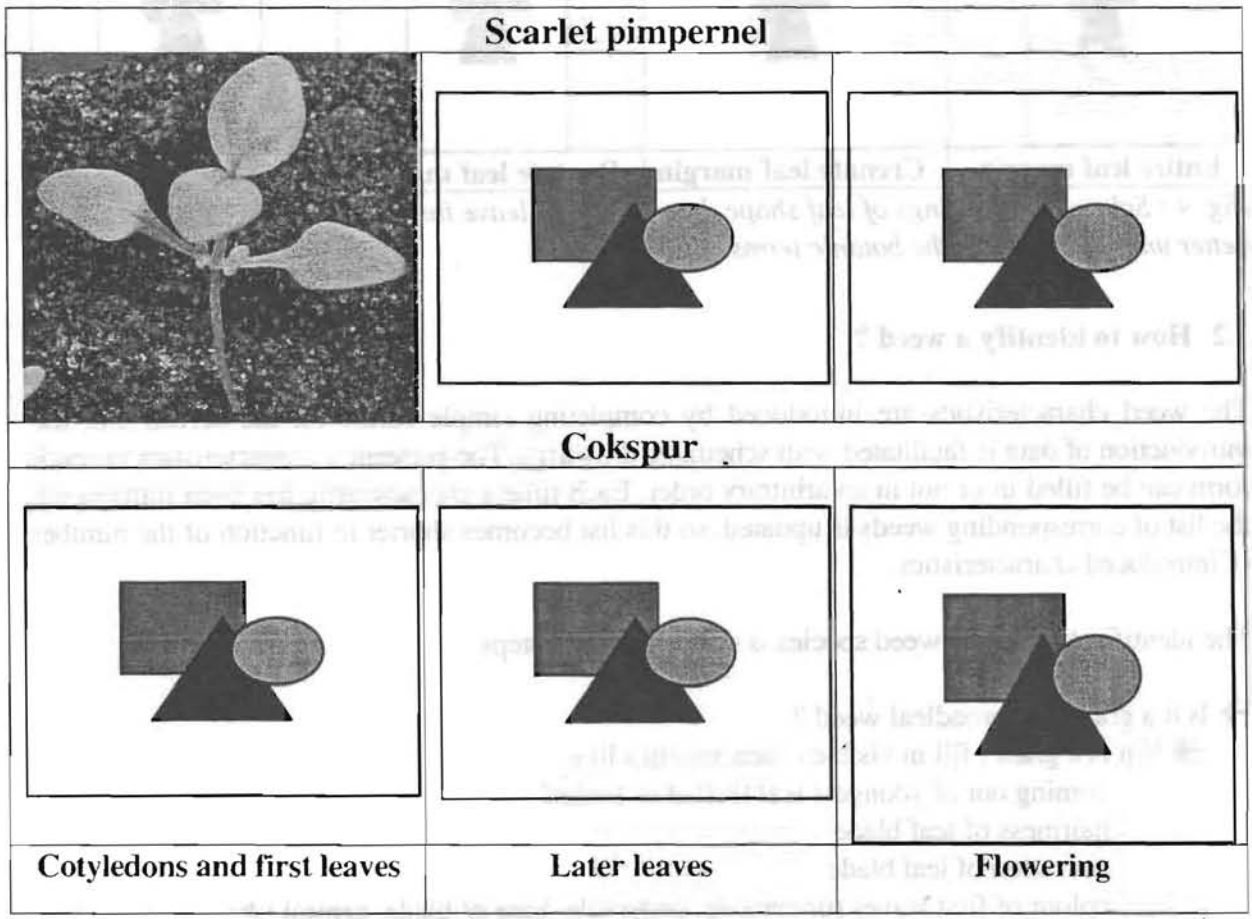

Fig. 3 : To improve the identification, the determination key is completed with photos in different development stages

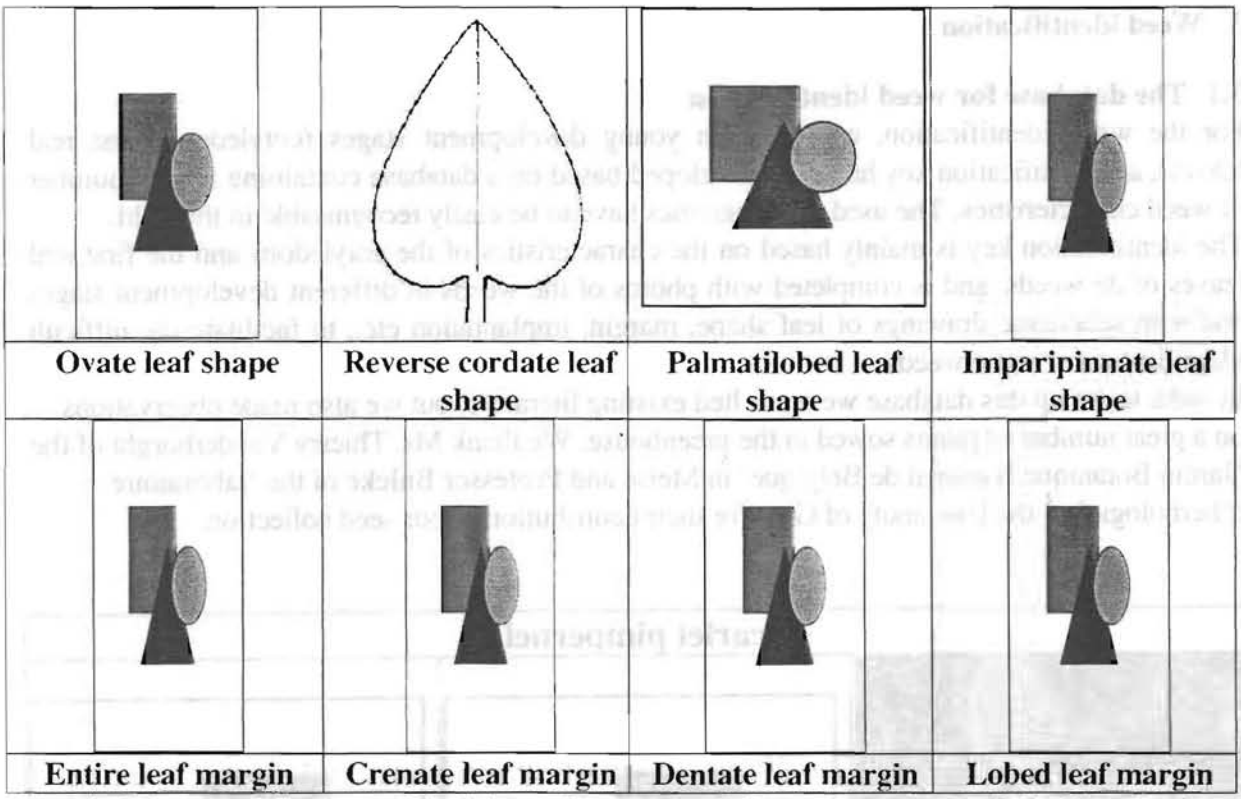

Fig. 4 : Schematic drawings of leaf shape, leave margin, leave insertion can help the users for a better understanding of the botanic terms.

3.2 How to identify a weed ?

The weed characteristics are introduced by completing simple forms on the screen and the introduction of data is facilitated with schematic drawings. The presented characteristics on each form can be filled in or not in an arbitrary order. Each time a characteristic has been introduced, the list of corresponding weeds is updated, so this list becomes shorter in function of the number of introduced characteristics.

The identification of the weed species is done in several steps :

→ Is it a grass or a broadleaf weed ?
- → If it is a grass : fill in visible characteristics like
  - coming out of youngest leaf (rolled or folded)
  - hairiness of leaf blade
  - nervation of leaf blade
  - colour of first leaves (upper side, underside, base of blade, central rib)
  - colour of adult leaves
  - aspect of the leaves (matt, shining)
  - ligule
  - auricle
  - ...
- → If it is a broadleaf weed : fill in growing type :
  - from germinated plants : introduce characteristics of hypocotyl, cotyledons, first true leaves, later leaves, stem

- from stolons etc... (pluriannual weeds) : introduce characteristics of adult leaves and stem
- volunteer plants : limited possibilities and easy identification;

→ Fill in visible characteristics like:

- hypocotyl : colour, hairiness
- cotyledons and real leaves: shape, colour, hairiness, nervation, insertion, special characteristics
- stem : colour, hairiness, thickness, section, core, branching, position
- colour of flowers

If there are several weeds corresponding to the introduced characteristics, the final identification can be done from the photos that appear by clicking on the name of the weeds.

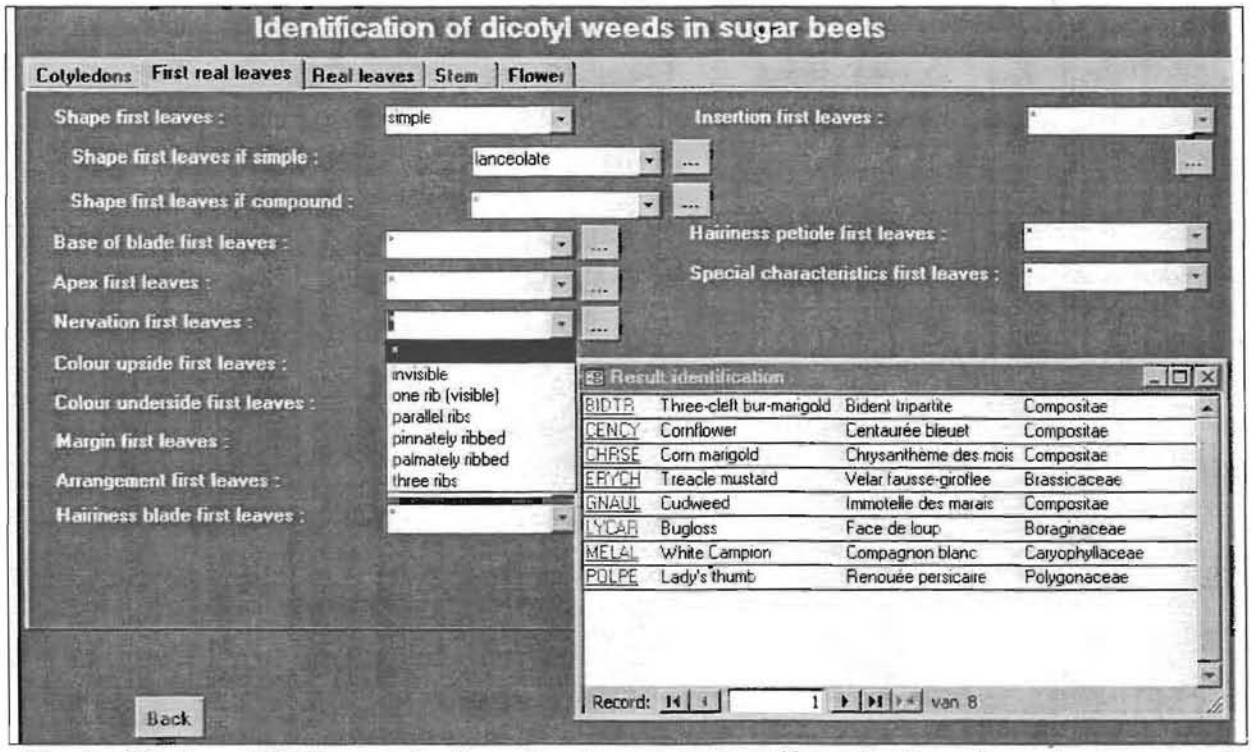

Fig. 5 : Window of FAR-consult where the characteristics of broadleaf weeds can be introduced

4. Conclusion

With FAR-consult, we have tried to make a simple, user-friendly assistance tool for weed control in sugar beets.

Because the weed identification key is mainly based on characteristics of cotyledons and first true leaves, weeds can easily be recognized in a young stage, which is, for most of the farmers and even for specialists, often very difficult.

The weed identification is made a lot easier by the fact that the user can introduce only the information he has, and is not obliged to follow a certain hierarchical order to input data.

The personalised advice for weed control doesn't propose one black-box solution, but gives a list of possible solutions, with for each solution sufficient information to permit the user to reason which recipe is most interesting for his situation. He can base his choice on the efficacy of each recipe against each of the present weeds, its selectivity for sugar beets, its cost-price, but also on the availibility of certain products, etc.

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