

A scoring method to evaluate the environmental contamination of chemical crop protection treatments, applied to weed control in sugar beet

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Introduction

Progress is being made to harmonise the pesticide registration in Europe. This is being done according to Council Directive 91/414/EEC of 15 July 1991, also called the 'Uniform Principles'. These principles will be applied to their full extent within a couple of years.

Because of capacity problems within the registration authorities it is unclear when all the required dossiers will have been studied. The exact date for the complete introduction of the Uniform Principles is therefore not known.

In advance of the application of the Uniform Principles throughout Europe, the Dutch authorities are already trying to apply these for their country. New products and new formulations of older active ingredients are evaluated according to the criteria formulated in the Uniform Principles. Also in farming practice these principles are applied to some extent.

CLM, the Centre for Agriculture and Environment, has developed a yard stick, a scoring system (1) with which it is possible to demonstrate (2) to what extent the application of pesticides is exceeding the environmental criteria set in the Uniform Principles.

In this contribution the scoring system will be described and then applied to some weed control treatments to demonstrate what effects these treatments have on the environment.

Finally conclusions will be drawn on the effect of the introduction of the Uniform Principles on the possible availability of weed control products in Europe.

Scoring system

The scoring system on the environmental effects of pesticides includes effects on three characteristics of the environment:

- a. water organisms in surface water;
- b. soil organisms;
- c. the risk for contamination of deep ground water.

In the scoring system the limiting values for registration in Europe for each environmental characteristic is set to 100. The actual values for these effects, supplied by the producers to the registration authorities are used to calculate the deviation from 100. As an example: the limiting value for registration of a product is a concentration in surface water of 0.1 mg/l of water. This scoring value is 100. If a certain product has a probable concentration of 0.05 the score is 50 and if the estimated concentration is 2.0 mg/l the score is 2000. The scores are assessed per treatment, which means that the values for components of tank mixes are added. As the limiting value for registration in the future will require values of 100 or less, a score with a maximum of 100 per environmental characteristic is regarded as acceptable. Once the Uniform Principles are fully operational in Europe, no values above 100 will be possible and the scoring system will not be required anymore.

In the recommendations for crop protection in the Netherlands the scoring system is used to demonstrate to farmers the extent the products they intend to apply are contributing to an environmental contamination. In a restricted number of cases retailers of e.g. potatoes and vegetables are asking growers to use only crop protection products or product mixes with scores lower than 100 per treatment.

Weed control in sugar beet

In Europe a reasonable number of herbicides are available on the market for weed control in sugar beet. These herbicides are used both alone and in tank mixes. In table 1 the scores of some herbicides are presented.

Table 1. Environmental scores of herbicides for sugar beet per kg or liter of product.

product	active ingredients(s)	water organisms	soil organic matter content			
			1.5-3%		3-6%	
			soil organisms	deep water	soil organisms	deep water
Avadex BW	tri-allylate	12	0	0	0	0
Betanal	phenmedipham	1	0	31	0	1
Betanal Progress OF	desmedipham/ ethofumesate/ phenmedipham	11	6	61	5	1
Betanal Trio OF	ethofumesate/ metamitron/ phenmedipham	7	2	27	2	0
Focus Plus	cycloxydim	0	0	130	0	10
Fusilade	fluazifop-p-butyl	1	0	100	0	18
Gallant	haloxyfop-p-methyl	1	1	1800	2	600
Goltix	metamitron	14	2	7	2	1
Lontrel	clopyralid	0	0	550	0	520
Pyramin	chloridazon	14	1	330	0	1
Safari	triflusaluron-methyl	4	1	5200	1	3500
Targa Prestige	quizalofop-p-ethyl	0	0	0	0	0
Tramat	ethofumesate	13	4	60	4	0

From table 1 it is clear that some products have environmental scores which are very high. To enable an assessment of the applications which exceed the critical level of 100, it is very important to have the score of some tank mixes. In table 2 this score is given for some commonly used tank mixes for broad leaf weed control.

Table 2. Environmental scores of some commonly used dosages of products or tank mixes.

product/ mix	dose (l or kg/ha)	water organisms	soil organic matter content			
			1.5-3%		3-6%	
			soil organisms	deep water	soil organisms	deep water
Betanal Progress OF + Goltix	0.75 + 0.5	15	6	49	5	1
Betanal Progress OF + Pyramin	0.75 + 0.5	15	5	211	4	1
Betanal Progress OF + Safari	0.75 + 0.03	8	5	202	4	106
Betanal Trio OF	2.0	14	4	54	4	0
Betanal Trio OF + Lontrel	2.0 + 0.3	14	4	219	4	156

From table 2 it can be seen that the only problem which exists is the risk of leaching, resulting in unacceptable concentrations in deep water. However, the rate at which the critical level of 100 is exceeded, a factor 2 on soils with low organic matter content is not very high. In the case of soils with less than 1.5% organic matter, problems are occurring. As a result of the future European legislation, products with really high scores have already been removed from the market, e.g. prophan and lenacil. This last active ingredient scored up to 39,000 for deeper water on soils with 1.5-3% organic matter.

With grass weed control Gallant (doses up to 1.0 l/ha), Focus Plus (doses up to 6 l/ha) and Fusilade (doses up to 2.5 l/ha) all cause some problems. However at lower doses, effective for the control of most annual grasses, the environmental scores of most products remain below the critical level. In cases where high doses are required to control perennial grasses, Targa Prestige is an alternative with a low score.

From tables 1 and 2 it becomes clear that most of the products available for sugar beet in the Netherlands as well as in many other European countries have acceptable levels of environmental scores. Some countries however have still registrations for products like lenacil or high doses of clopyralid, the active ingredient in Lontrel 100.

Future availability of products

A large comprehensive EU review programme has to be carried out before the year 2003, in which new data for almost all active ingredients data has to be presented and assessed.

Producers of crop protection products have already notified to the authorities which products they would like to defend under the new legislation. The EU has published lists of:

- a. active ingredients already registered under EU legislation (active ingredients put on annex 1 of the EU Directive).
This is necessary to be able to market products in an EU member country. On this list there are no sugar beet herbicides.
- b. active ingredients not admitted to annex 1.
Propham is included on this list.
- c. older active ingredients being assessed under the new legislation.
This list contains the active ingredients clopyralid, desmedipham, ethofumesate, metolachlor and phenmedipham.
- d. new active ingredients with a provisional registration being assessed.
Dimethenamid, haloxyfop-p-methyl and tepraloxymid are on this list.
- e. older active ingredients for which assessment is requested.
For weed control in sugar beet the following products are listed: chloridazon, clethodim, cycloxydim, fluazifop-P-butyl, lenacil, metamitron, quinmerac, quizalofop-P-ethyl, triallate and triflusaluron.

Most products, now being used or developed for weed control in sugar beet are mentioned in the lists under c and e. This means that the producers have requested EU registration and that they expect their products can fulfil the new criteria. It is unclear what the chances of a product like lenacil has on list ad e. If the producer does not supply very positive data on leaching, this product might have no chance. For all the other products, the actual values calculated with the described scoring system and the critical values of the EU legislation do not differ very much. The studies required for the new registration might very well result in a listing on EU annex 1. In the long term it is expected that a reasonable number of herbicides will remain available for weed control in sugar beet, and in some countries new herbicides might become available.

The above description is kept separate from a discussion of the availability of herbicide resistant sugar beet. Both glufosinate-ammonium and glyphosate are on list ad c. The environmental scores of these products are listed in table 3.

Table 3. Dose and score on environmental contamination of some present and possible future weed control systems in sugar beet (maximum score for one environmental characteristic per treatment)

weed control system	dose (l or kg/ha)	soil organic matter	
		1,5-3%	3-6%
Betanal Trio OF	2.0	54	4
Betanal Progress OF + Goltix	0.75 + 0.5	49	5
glyphosate	2.0	2	0
glufosinate-ammonium	2.0	58	58

From table 3 it can be seen that with glyphosate the environmental contamination is lower than with the other products, although the level of contamination from the other products is also very acceptable.

Final remarks

The scoring system on the effect on some environmental compartments gives a good impression of the environmental quality of crop protection products. In the transition period towards the full introduction of the EU legislation on the registration of crop protection products, it can be used as a temporary tool to help to decide on the selection of products where a number of products with the same efficacy are available. If the latter is not the case, and because of the environmental effects priority is given to less effective products, these products would have to be applied several times, possibly resulting in a higher total contamination of the environment. Another consequence of a very strict application of the scoring system might be that a very small number of active ingredients is used with increasing danger for resistance.

The application of the scoring system and an analysis of the EU review lists suggests that we can look forward to continue future availability of crop protection products for sugar beet in the Netherlands and some other EU countries.

References

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