ASSESSING PESTICIDE RISKS TO NON-TARGET TERRESTRIAL PLANTS

CONCLUSION

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Assessment of risks to non-target organisms from pesticides is required by European Directive 91/414, but at present, there is no agreed method for non-target plants. The use of indicator species has been considered by EPPO, but selection of suitable species is difficult because highly sensitive ones might cause an over-estimate of pesticide damage to non-target species, and vice versa. An alternative approach, and the subject of this Report, is to identify species of plants which could become targets during pesticide application, as well as to evaluate effects on those species which are important to herbivorous insects, birds and mammals.

This Study has succeeded in demonstrating that the value of plant species to provide food and shelter for insects and animals can be broadly identified, in a qualitative sense, from published information. Implications for risk assessment and management are considered, as well as the potential sources and types of impact from pesticides. Forty species of wild plants were originally selected, and these have each been evaluated for their importance in the food chain and for providing shelter.

At the same time as considering a new approach to pesticide registration, the Study has raised certain issues which may need to be addressed before existing schemes can be revised. These are:

- Was the original list of 40 plants reasonable?

Bramble (*Rubus fruticosus*) may require inclusion, in spite of taxonomic problems, as it is clearly an important food source for many birds and mammals.

- Are the responses of plants to pesticides well-enough understood for the general approach to be realistic?

Many aspects of the dose response of plants to pesticides are poorly understood, and reliable data are in short supply. Questions of sensitivity of different growth stages and effects on reproduction, especially seed production, are largely unanswered. Also, the predicted growth promotion by very low doses of herbicides, known from laboratory experiments but never reported in the field, needs clarification.

- Are tests based on laboratory studies suitable predictors of field behaviour?

Flexibility to design specific tests for particular products and non-target species for higher regulatory tiers, seems to be the sensible way to cope with the many unknowns and uncertainties with assessing pesticide effects on non-target plant species. In view of the differences between pot tests and effects in the field, mesocosm or full field experiments are warranted for higher tiers. Extrapolation of the results of pot experiments to normal field conditions is difficult and may be inappropriate, as tests of non-target impacts in pot-grown material are not necessarily the same as those in natural plant communities in the field

- Do present toxicity testing methods need re-evaluation?

Toxicity testing endpoints for plants need evaluation. Some methods, such as rate of leaf extension are more sensitive than others, such as dry matter production. Different herbicides are active in different meristems, so both root and shoot assessments may be required. The period between application and measurement also needs examination, as recovery by the plant can be an important feature. Whether or not some crop and weeds are sufficiently closely-related to important non-target plants so that tests on the former could be used to indicate effects on non-target species is presently unclear.

- In the field, pesticide impacts may be repeated both within one season and for successive seasons.

There is very little information on the longer-term impacts of drift events on subsequent flowering, seed production and vegetative propagation of non-target species. There is also a need to investigate the effects of cumulative non-target contamination with pesticides on individual plants.

Effects of pesticides on regeneration in plant species require further study. Following non-target contamination with herbicides, monocarpic species that do not set seed are thought likely to re-establish from the seedbank. Polycarpic species that are not killed are thought likely to recover the following season, but these assertions need confirmation. Further work is required to refine which are the key plant growth stages that affect subsequent recruitment.

Although the amounts of pesticide reaching non-target plants can be predicted in many instances with reasonable certainty, its biological effect both at species and community level is uncertain.

- Identification of about 10 plant species for use in toxicity testing and risk assessment.

A strong *caveat* must be made in the light of the lack of information on the dose response of plants and to the sensitivity of different growth stages and effects on reproduction. The following list of plant species are representative of several plant families and are important to a range of fauna, but merely constitutes suggestions on which to focus.

Species	Important for invertebrates	Important for birds	Important for mammals
Corylus avellana	✓	✓	✓
Rubus fruticosus	✓	✓	✓
Chenopodium album		✓	
Alliaria peteolata		✓	
Vicia sepium	✓	✓	
Urtica dioica	✓	✓	✓
Leucanthemum vulgare	✓	✓	
Heracleum sphondylium	✓		
Brachypodium sylvaticum	✓	✓	✓
Dactylis glomerata	✓	✓	✓

- Role of adjuvants in risk management

The importance of adjuvants in risk management to non-target plants is unclear. On the one hand, adjuvants may enable many pesticides, especially herbicides, to be used at doses lower than the recommended ones; on the other hand, such doses have similar phytotoxicity to the full dose alone. There are not enough data to show clear conclusions, but it appears that the low dose with adjuvants would, in many cases, be specific to certain weeds, and thus could have reduced phytotoxicity to non-target species (Dr David Coupland, personnel communication). Unfortunately, such effects cannot be predicted, but can only be determined by experiment in most cases.

- Alternative food sources are a problem; if one plant species is not available to herbivores, can they use others?

Other points raised by the Study include:

- This Study is essentially qualitative; a case could be made for extending some aspects to include quantitative data. For example, damage to one plant species might reduce the population size of a herbivorous species.

- This report concentrates on spray droplet drift as the commonest form of non-target contamination. Other forms of pesticide contamination, including vapour drift, could be examined separately.

- Many new herbicides are now used commercially which have not been subject to tests on non-target species

- The possibility that some plant species are unexpectedly sensitive to pesticides at certain stages of growth appears to be remote, although it is not well investigated. Questions of plant size and sensitivity may relate to pesticide interception more than to biological effect. Again, precise data on effects of growth rate and morphology on sensitivity are not available, even for common weeds.

- The approach used here has used selected plant species as a basis for examining their importance to herbivores; however, it would be possible to select herbivores of interest and identify the plant species that are important to them for food and shelter.

Regarding regulatory implications:

- The assessment of risk to non-target plant species must take account of the varied modes of action (novel ones, as well), the different growth forms and families of plants, the different life history stages that may be exposed, the effects on recruitment and interactions within communities.

- With regard to the regulatory framework, it is sensible to have a tiered system and to utilise as much information that is generated during pesticide development as possible.

It should be possible to cover a wide range of species and plant families from initial screening data. It should also be possible to know the mode of action of the active ingredient and the phases it is active in. These ought to give indications of the likely risks for non-targets and indicate the needs for further tests/tiers.

- Beyond initial screening at a single dose plus controls, all regulatory tests need to be dose-response tests, from which ED_{10} etc. and zero response doses can be demonstrated.

- As there are large gaps in our knowledge of non-target impacts and interactions within off-target communities, it is essential that flexibility be built into the regulatory framework.

- As regards higher tier tests, it is important to examine effects on the adult plant, on seed production, on vegetative propagation of relevant species, on seed viability, seed germination and seedling growth. Test protocols for these need to be repeatable, relevant to field use conditions and exposure patterns, relevant to the modes of action of the active (N.B. phloem-mobile pesticides are likely to have higher risk to non-targets, than others), and realistic or at least interpretable from an ecological viewpoint.