



**National
Registration
Authority**

for Agricultural and
Veterinary Chemicals

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Efficacy and crop safety

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8-1 INTRODUCTION

These instructions describe the general requirements and the format to be used for submitting efficacy and crop safety data in support of the registration of a new agricultural chemical product. The NRA invites applicants and other interested parties to suggest improvements to the document. Any comments should be sent to the Manager, Agricultural and Veterinary Chemicals Evaluation Section and will be considered when the document is next updated.

Applicants are expected to be able to show that when their product is used according to label directions, it is effective for the purposes claimed and that application to the indicated plant or situation will not cause any unintended effect.

In most cases, applicants will need to submit the results of properly designed and conducted laboratory and field studies that prove the efficacy and crop tolerance of the product. Data produced under Australian conditions are required in most cases, but relevant data from overseas may also be provided.

Applicants should note that if the data submitted does not adequately support registration, additional data will be requested. This data may be categorised as a supplementary application as defined in the NRA policy on subsequent submissions (*NRA Gazette: Commonwealth of Australia Agricultural and Veterinary Chemicals Gazette*, NRA 9, 3 September 1996).

8-1.1 Reference materials

The details of documents referred to in these instructions (including codes and standards) are given in the References section. Bibliographic details and, where appropriate, ISBN and purchase information are given. Applicants should be aware that many of these documents are updated regularly (hence dates are not supplied in the text). It is therefore important to ensure that the latest editions of reference materials are obtained.

8-2 GENERAL INSTRUCTIONS**8-2.1 Minimum data standards**

It is the responsibility of the applicant to present adequate data to support any claims made in applications for registration or label changes for agricultural chemical products. Claims for major pests must be supported by statistically analysed data. Some concession may be considered for minor pests on a case-by-case basis. Supporting data may come from sources such as government agency studies, semi-commercial evaluation, published papers and books. However, it is the responsibility of the applicant to collect and present the data to adequately support the claims being made for the product. Copies of any reference publications should be provided. The NRA cannot be expected to locate these.

It is difficult for the NRA to prescribe rules to cover all product types. However, applicants should follow the general rules shown below.

- Efficacy should be demonstrated for every host and pest claimed on the label (limited extrapolation to other pests and hosts may be accepted).
- Studies should demonstrate the optimum application rate for each host and pest combination.
- Any recommendations should reflect current application technology (for example low-volume application methods in horticulture) and good agricultural practice.
- For each pest claimed on the label, at least three rates should be tested:
 - lower than the proposed maximum commercial rate;
 - the proposed maximum commercial rate; and
 - double this maximum rate.
- Studies should be carried out over at least two seasons. Atypical weather conditions and/or substantially reduced pest pressures may also require further studies.

- Study sites should represent the major regions and environmental conditions where the product is proposed for use. For example, for cereals: Western Australia, southeastern cereal zone (South Australia, Victoria, Tasmania and southern New South Wales), northern cereal zone (northern New South Wales and southern Queensland).
- Statistically valid study designs should be used, with appropriate analyses, i.e. sufficient replicates to allow statistical analysis of data.
- Untreated controls and/or relevant standards should be included.
- Product should be tested over a suitable range of pest pressures.
- Yield data should be provided; ideally 'pest free' yield data should be included to enable conclusions to be drawn.
- When data are conflicting, additional experiments should be carried out until 'weight of evidence' allows satisfactory conclusions to be made.

If any of the above is considered by the applicant not to be appropriate, relevant scientific arguments against the need for the information should be provided.

Extrapolation may be acceptable in some situations but this needs to be supported by sound argument. For example, extrapolation of efficacy from an aqueous suspension formulation at a given rate to a wettable powder formulation at the same rate may be accepted, while comparative bioequivalence data (see Section 8-2.5) will be required when changing from an emulsifiable concentrate to a water dispersible granule or dry flowable formulation.

8-2.2 Format

Applicants should present the efficacy and crop safety section of their application in the format set out in Table 8.1 below. Using this format, applicants are expected to use the results of studies to build an argument in support of the use of the product as recommended on the label. Detailed reports of individual studies should be included as appendices to the efficacy

Table 8-1: Format of efficacy and crop safety section

Part 8 Efficacy and Crop Safety
Overall summary
Table of contents
Introduction and justification for use
Efficacy
Summary
Study design
Experimental conditions
Analysis of study data
Study validation
Applicability of study data
Conclusions
Resistance management
Compatibility with farming systems
Phytotoxicity and crop safety
Summary
Safety to target crops
Safety to following crops
Safety to nontarget crops
Other related studies
Summary
Organoleptic tests
Effects of residues on subsequent processing
Animal welfare
Safety to nontarget animals
Effects on other industries
Any other relevant issues

section. A list of all studies submitted in support of the application must also be included.

The aim of the efficacy section is to enable the reviewer to evaluate an application for approval without the need to refer back to the applicant for clarification or further information. The submission should therefore represent a comprehensive summary of the work undertaken, including what the applicant considers to be the most relevant conclusions, which should be incorporated on the product label.

Applicants should provide a clear and concise explanation and justification for the text of the label for which approval is sought by providing a combination of study data and an explanation of how the studies support all the proposed uses and

recommendations. In particular, it is important that the text that is proposed to be used in all sections of the label is justified.

The format suggested is only for guidance. It is not a protocol that must be followed slavishly nor is it intended to limit the flair of the applicant to effectively present and discuss the data presented in the submission as a whole. The wide diversity of product uses, study methods and registration history, requires flexibility in the structure, layout and presentation of results.

8.2.3 Guidelines for specific product groups

Specific guidelines for data requirements apply for various types of agricultural chemical products. These are given in Appendix 1

8.2.4 Overseas data

Performance data from overseas countries are acceptable to support an application. However, it is expected that field studies have been carried out under typical Australian conditions to confirm that the results are at least equal to those obtained elsewhere. Field studies should be carried out in localities typical of the most important fields of use and preferably where the parasites, pests, weeds or diseases occur under their optimum, rather than marginal, conditions.

Use of overseas data may be acceptable in controlled climate situations, e.g. glasshouses, commercial premises and homes. For home gardens, however, overseas data need to be supported by confirmatory Australian data as environments may be very different.

Overseas studies must be provided in English. If a study has been translated from another language, the name and credentials of the translator should be included with the report.

8-2.5 Efficacy and bioequivalence data

Efficacy data are generated specifically to demonstrate the effect of varying rates of application of a product when compared to untreated controls or reference standards.

When a product is similar to a registered product, the NRA may accept bridging data that compares the action of the new product at label rates with that of a registered product (known as the reference product). This type of data is often referred to as 'bioequivalence data'.

Bioequivalence data is appropriate for some new formulations of a registered chemical, for example categories 24 and 25 (see the NRA's *Ag Manual*). In the case of a product containing a new chemical, full efficacy data is required.

Testimonials from government organisations provide useful support for data packages in registration applications, but they do not stand alone. Grower testimonials are of very limited value except in unusual circumstances.

8.3 OUTLINE OF DATA REQUIREMENTS AND APPLICATION LAYOUT

8.3.1 Data checklist

A checklist of data requirements for Part 8 (Efficacy and Crop Safety) of an application for agricultural chemical products, and the way in which they should be set out, are shown in Table 8.1. Note that the format used supersedes that described in Appendix E of the NRA's *Ag Manual*.

8.3.2 Overall summary

Each application should include an overall summary of the efficacy and safety data relating to the product, which concisely deals with each aspect of efficacy and safety studied. Normally, the summary will not extend beyond a few pages. Tables are favoured as a means of condensing data. Studies reported in the summary should be cross-referenced to the reports in the main application.

An explanation must be given of how the data are considered to support the proposed label claims (or why certain reservations should be discounted). A suggested approach to the presentation and interpretation of results is to explain and justify the label claims in the order that they appear on the label. Each section of the label could be reproduced

exactly as it is on the draft label, followed by tables of study results and an explanation of how the study results, references or extrapolations support the label text. It may be useful to annotate the draft label to indicate where to find the sections in the overall summary to support the individual label claims.

8.3.3 Introduction and justification for use

The introduction is a vital part of the overview because it introduces the efficacy reviewer to the product, the background to its development, its projected role in the production of the crop and/or management of the pest.

Information about the value of the product and where it 'fits' in the field or practical situation should be provided, including the following information:

- identification of the product — if company codes are used to describe a product under test, they should be clearly referenced back to the product name or formulation to avoid confusion by the reviewer; as far as possible, product names should be used rather than company codes;
- mode of action of the product;
- the nature and economics of the pest, disease or other problem in Australia;
- current management tools — status, benefits and problems;
- benefits of the product to particular industries and specific farming or other use situations;
- performance of the product, according to prescribed label conditions and claims;
- the contribution of the product to risk reduction and sustainable pest management in the specific crop or resource production system;
- background information on the product — any previous relevant use of the product or active constituent(s) or use in other products; any overseas registration of the product or active constituent.

These factors will be taken into account in regulatory decision making. Potential unique or long-term benefits of a product to sustainable crop and pest management or risk reduction can be balanced against possible drawbacks or disadvantages.

8-4 EFFICACY STUDIES

8-4.1 Summary

A comprehensive summary of the efficacy studies should be included with an outline of the methods and a description and interpretation of the results. (Individual summaries should also be provided with each study.)

8-4.2 Study design

The test substance should be identical to the formulated product for which registration is sought. When data relating to a different formulation are to be used, this must be stated clearly and the relationship between the two formulations must be explained.

For a test to be scientifically valid, pesticide treatments must be compared to one or more control treatments. These include:

- an untreated (negative) control; and
- a positive control or reference product, when available.

Test objectives should be clearly defined and should include only treatments aimed at those objectives, plus adequate controls.

Efficacy tests must be designed so that valid and appropriate analyses of the data can be conducted. Treatment group sizes and number of replicates depend on treatment differences for each pest/crop/disease situation and may need to be determined in preliminary range-finding studies. Depending on the number of treatments, four replicates is the number most often used. As a general rule, at least 20 'degrees of freedom' should be available for analysis.

The product should be tested at various application rates, including levels above

and below those being suggested for commercial use. Development of an application rate range serves to determine the minimum and maximum recommended application rate.

Application rate ranges are also used to establish the likelihood of phytotoxic or other situational effects. The label must indicate the timing and rates of application, based on the studies conducted. Where multiple applications are recommended, the label should state the maximum number of applications per season.

The most widely used commercial cultivars of a crop should be tested. It is also desirable, because of varying degrees of resistance in commercial cultivars, to include both susceptible and resistant cultivars in some tests when available. Multivarietal screening at one or more sites can provide a valuable guide to potential varietal differences.

To reduce drift from one treatment to another, untreated buffer rows between treatments should be added to the experimental design. These rows may be of a taller or denser cultivar, or a more disease-resistant or spray tolerant species. Physical barriers such as plastic sheets can also be used. Plots may also be planted farther apart to provide a distance break.

It is essential to ensure adequate pest or disease pressure for tests to give meaningful efficacy data. In cropping situations, infection may be artificial or natural. Artificial inoculation methods should be described. Data showing the effect of treatment on yield of commodity are essential in most instances. Yield data under pest-free conditions is also desirable.

Application technology should address current industry practices and this should be reflected on the product label (for example, the trend to low volume application in horticultural crops). Study conditions must reflect label recommendations. If a product is proposed to be applied by air, then supporting data from aerial studies must be provided.

A statistician or a compendium of appropriate experimental designs should be consulted for suitable study layouts. Some Australian registration consultants have the capacity to design and carry out appropriate product evaluation studies. A list of consultants is available from the NRA.

Applicants who are unsure about the adequacy of their proposed study design are encouraged to apply under Category 50 for assessment of a study protocol (information on Category 50 applications will be included in the new edition of the NRA's *Ag Manual*, which is due to be published later in 1999; contact the NRA for details).

8-4.3 Study report

All studies must be fully documented as for a scientific experiment. Latin binomial names for any crops, weeds or living organisms discussed should be provided. Common names, though useful, are too imprecise and variable to be used exclusively.

(a) Location and personnel

Details of the research establishment, study coordinator, personnel, location and study reference number must be recorded.

(b) Methods

Study methodology must be described in full detail so that it is immediately clear to the reviewer how the results were obtained and how results from different studies can be compared.

Where different types of studies/tests were carried out in similar ways, e.g. efficacy and crop tolerance, the common technique should first be described for these studies followed by any additions (or variations) in techniques under appropriate headings.

A suggested format is as follows:

- *Sites* — Location details of meteorological information and agronomic details (e.g. soil type, cultivars, crop rotations) should be provided for both local and overseas studies. These details should be

presented in tabular format with each study as Appendix I.

- *Experimental design* — A summary of the following should be provided: experimental design (e.g. randomised block, large plot nonreplicated), numbers of replicates and plot size. (Full details should be included in Appendix II with each study).
- *Treatments* — A summary should be given of the test product(s) and of any standards or reference products included in the studies. Details, such as, product name/experimental code, active constituent name, active constituent content (e.g. g/L) and dose (e.g. L/ha) are all relevant.

If more than one formulation has been used in development studies, full formulation details and, where relevant, details of 'bridging' studies, must be presented. Where earlier formulations of the product or other products containing the same active constituent(s) are cited in supporting evidence, the relevance of this evidence to the current formulation must be justified.

The following application details should be presented.

- type of application equipment;
- application equipment details (e.g. nozzle type);
- carrier volume (L/ha);
- pressure (kPa, bar), if relevant;
- date of application;
- crop growth stage at application;
- pest population/developmental stage/infestation level at time of application;
- weather (e.g. dry, slight breeze);
- temperature (°C)

These details may be presented in an Appendix.

(c) Results

It is essential that all relevant data are presented and that individual values (numbers of weeds/pests or percentage

plants/plant parts affected by a disease) are reported correctly. Presentation of only a 'typical sample' of results is not acceptable.

Where negative or aberrant results have been recorded these should be included together with discussion as to how or why they may have occurred.

Results can be presented in many different ways depending on the particular use involved. Care should be taken to ensure that any particular piece of information that is important to the interpretation of results is included. Explanations must be given when individual control values differ appreciably from the majority. In such cases, comparison to a reference product can be particularly important.

Actual measurements should be presented. Wherever possible, standard units (for example weed numbers per square metre or per metre of row) should be presented. Alternatively, results can be given as a percentage control relative to the untreated control. In this case, it is essential to give the actual level of infection or infestation on the untreated controls and any other reference treatments. Each result must carry a reference to the report from which it was obtained.

Relevant results of statistical analyses should also be presented. These may include: standard errors, degrees of freedom, least significant differences, probability levels of significance and letter suffixes to denote significant differences between treatment means.

Assessments

Assessment methods should be summarised. These should include:

- date/interval after application/interval preharvest;
- crop growth stage key (e.g. Zadok's scale);
- efficacy assessment method (eg European Weed Research Council rating scale);
- sample size (e.g. 20 tillers per plot);

- sample method (e.g. at random, fixed plot)
- harvest date;
- harvest method (e.g. small plot combine);
- grain measurements (e.g. weight and moisture content);
- expression of yield (e.g. tonne/ha at 85% dry matter);
- explanation of any abbreviations used.

Statistical analysis

Full details must be given on the methods of statistical analysis used, including the method and probability level of separation of treatment means. Explanations should be given for the choice of method(s) used and any reasons for not carrying out statistical analysis.

An example of a description of statistical analysis is:

'All data were subjected to analyses of variance and treatment means were separated at the 95% probability level ($P \leq 0.05$) using Duncan's multiple range test. Treatment means in the same columns/rows followed by the same letter are not statistically different'.

Tank mixture recommendations (where appropriate)

In the case of a mixture with a companion product at that product's registered label rate, applicants should present data in support of:

- physical compatibility; and
- biological compatibility.

In the case of a mixture with a companion product at rates that differ from that product's label rate, applicants should provide support data as shown above, plus full efficacy data in support of the proposed mixture.

(d) Applicability of study data

Recommended application rates, methods of application, compatibility statements and any extra information provided in the directions for use table or other parts of the label should be discussed for each use on the label.

(e) Conclusions

Conclusions made should be drawn from the assessments of the data and any claims to be made should be based on these conclusions. Conclusions should be stated for each experiment and comparisons should be made with data from other experiments.

Comparisons between Australian and overseas data may be useful. Relevant scientific literature may be used in support of conclusions.

Each study must be fully evaluated, analysed, and conclusions drawn before it can be used for comparison with other studies. It must be judged to be a valid study, with adequate pest or disease pressure and be free from extraneous influences, before it can be used in further evaluations to support an application for registration.

All recommendations and claims not supported by data must be explained. This may involve extrapolation of data from one crop to another (e.g. control of powdery mildew from wheat to barley). Alternatively, in the case of warnings and restrictions (e.g. weather conditions), that are not supported by data, extrapolation may be appropriate from already approved products containing the same or similar active constituent(s). In these instances, it should be stated clearly that no specific study data exist and that extrapolation has been used. Where appropriate, approved labels of these products may be included as an appendix and explanation made as to how they support the proposed label statements.

Similarly, justification must be given for all instructions that are not supported by data but which are considered to constitute accepted good agricultural practice.

8-4.4 Resistance management

Implications of resistance development in pest populations must be considered where relevant.

Resistance management recommendations are required for some products. In situations where an industry has a

comprehensive resistance management plan (e.g. the insecticide resistance management plan in the cotton industry) applicants need to discuss the implications of the plan for their product and how the product can be used in a manner that fits into the resistance management plan.

Labels for products must carry the appropriate resistance management group symbol and warnings. Applicants should refer to the recommendations that are included in the NRA's *Ag Labelling Code: Code of Practice for Labelling Agricultural Chemical Products*.

8-4.5 Compatibility with farming systems

Studies should be conducted using equipment and application techniques that are similar or comparable to those that will be used commercially.

For fruit trees and grape vines, which are cultivated in rows, it may be necessary to adjust application rates to accommodate different canopy shapes and sizes. Concepts such as 'unit canopy row' (Furness and Magarey 1998) may be used. Such proposals must be fully supported with appropriate data and/or scientific argument.

Where relevant, applicants should address the compatibility of the new product with integrated pest management systems, organic farming practices and any other specialised farming practices.

8-5 PHYTOTOXICITY AND CROP SAFETY

8-5.1 Summary

A comprehensive summary of the phytotoxicity and crop safety studies should be included with an outline of the methods and a description and interpretation of the results. (Individual summaries should also be provided with each study.)

8-5.2 Target crops

Products intended for application to crops or other desirable plants should be tested both alone, and as part of a program with other frequently used products to determine crop safety and possible

adverse interactions. Experiments should be designed to indicate any possible deleterious effects on crop yield or quality.

Safety of a product is likely to be influenced by factors such as:

- application rate, method of application, use of adjuvant etc;
- soil moisture and soil type (soil applied herbicides);
- temperature and/or humidity at time of and after application;
- varietal susceptibility;
- crop size, age, physiological condition; and
- management practices.

The variables that might influence crop or plant safety should be considered when the program of evaluation is being designed.

Demonstration of crop tolerance often requires studies in the absence of the harmful organism. However, it is often difficult to obtain pest-free sites and, therefore, efficacy studies are sometimes used to demonstrate crop tolerance. In terms of yield data, this approach is not ideal because any detrimental effects from pesticide application can be obscured by responses accruing from pest control. In these situations, comparisons between low and high pest sites can be useful.

In the case of selective herbicides, it is desirable that margins of safety (or selectivity) towards the treated crop are established. Where persistent chemicals are being evaluated, possible long-term adverse effects should be considered in the light of possible accumulation in soil or plants (for example certain insecticides have demonstrated long-term or delayed plant growth regulator effects).

Products for use in the home garden or on house plants should be tested on a representative collection of plant varieties including those likely to be susceptible. Appropriate label warning statements should be proposed.

Seed treatment products must be tested to demonstrate that seed germination is

not affected by treatment. As seed treatments are required to include dyes, data should be generated using the dyed product.

8–5.3 Following crops

The effect of repeat treatments and carry-over of soil residues on subsequent crops should be fully considered. The effect on any beneficial organisms should also be considered. Arguments should be based on environmental fate data.

Although safety to following crops may not necessarily be stated on the label, an explanation of why there is no concern or how study results justify the absence of any warning, is required. In other instances it may be argued that based on evaluation of environmental fate, differences in plant metabolism etc, any following crop effects are unlikely or will not occur.

In cases where experiments, such as rotational crops/carry-over experiments, have been undertaken in order to demonstrate safety to following crops, nontarget crops or nontarget animals full details of the methods used must be reported. In many instances, a case may be made for the safety to following crops based on evidence from fate and behaviour studies and results from crop screening studies.

8–5.4 Nontarget crops

Where it might be expected that the use of a product could be hazardous to nontarget crops and plants, data from tests indicating its toxicity to such species should be presented. Applicants must state the conclusions drawn from the data and appropriate warning statements should be included on product labels.

The following product characteristics could signal the need for such action:

- chemicals applied from aircraft or by other methods that might be conducive to drift;
- persistent chemicals;
- volatile chemicals, e.g. 2,4-*D* esters;
- chemicals subject to bioaccumulation;

- chemicals applied in or near waterways.

8–6 OTHER RELATED STUDIES

8–6.1 Summary

A comprehensive summary of the other related studies should contain a separate discussion for each applicable area of study, including an outline of the methods and a description and interpretation of the results. (Individual summaries should also be provided with each study.)

8–6.2 Organoleptic tests

Where there is any reason to believe that use of an agricultural chemical product (or chemical metabolite) could cause tainting or an off-flavour in food, there should be an adequate investigation supported by taste-panel tests (organoleptic tests) to verify that no unacceptable tainting occurs.

Where such tests are required, the data obtained should be included in this part of the application and clearly identified as a separate section.

8–6.3 Effects of residues on subsequent processing

Where residues occur on natural commodities as a result of preharvest or postharvest applications of agricultural chemicals, it may be necessary to determine the effects of these residues on subsequent processing operations.

Examples include the application of an agricultural chemical to barley grain that is intended for malting, or to grapes intended for wine production. In these cases, evidence of the effect of the residue on the malting or vinification process would be required. (This is separate from and additional to information required to establish Maximum Residue Limits as described in Part 5).

8–6.4 Safety to nontarget animals

Data should be provided to demonstrate the safety to any animals that might be exposed to the product when it is used according to label recommendations. The following areas should be considered:

- spray drift on animals grazing in adjacent areas;
- exposure of bees feeding on crops or adjacent areas; and
- effect on beneficial organisms in integrated pest management programs or other farming systems.

8-6.5 Animal welfare

Animal welfare must be addressed for products where use patterns could lead to intentional or unintentional animal exposure which may result in injury or discomfort to an animal. For example,

applicants for registration of a bait product for use in the home garden need to consider possible exposure of pet animals.

8-6.6 Effects on other industries

Effects on other industries or any other possible unintended effects or implications of the use of the product must also be addressed.

8-6.7 Other relevant issues

Any other issues relevant to the use of the new product should be addressed in this section.

Appendix 8–1

Guidelines for specific product categories

Particular requirements apply to certain classes of products, including those which are not designed for use in agriculture. This section provides details of the data requirements for some of these types of products.

1 HOUSEHOLD AND HOME GARDEN PRODUCTS

1.1 Household insecticidal sprays

When efficacy data are required for any application for a household insecticide spray, data on the following species are required as a minimum for each generic group (unless the product is to be marketed for a more specific use alone eg ants only). If pest types other than those discussed below are claimed on the label then appropriate data for those pest types are also required.

Space sprays and flying insect killers

- flies — *Musca domestica* (housefly) and/or *M. vetustissima* (bush fly), a species of *Calliphoridae*, preferably *Calliphora spp* (blowfly);
- mosquitoes — a *Culex spp* or *Aedes spp*; and
- moths — studies using a large and a small moth species.

Claims for control of other flying insect species (e.g. wasps) need to be supported by specific data.

Crawling insect sprays

For applications involving only crawling insects, a reduced data package is acceptable. The minimum acceptable package would include efficacy studies on the following:

- two species of cockroaches (*Blatella germanica*, German cockroach and *Periplaneta spp*, domestic cockroach);
- one flea species, preferably *Ctenocephalides felis* (cat flea);
- ant species representing differing foraging patterns, preferably meat ants *Iridomyrex spp* or *Pheidole spp* (test

regime should be such that droplets are allowed to settle on the ants rather than being not directly sprayed).

Flea control claims must be supported by data relating to adult knockdown and/or larvicidal efficacy as relevant.

Tests for repellency claims must relate to the claims being made. Residual activity must also be considered in light of the length of protection being claimed and consider those conditions that could lead to a reduced period of residual activity.

Dust mite acaricides

A protocol on the recommended methods for performing laboratory-based studies on the efficacy of dust mite acaricide products is available from the NRA.

Spiders

Species to be used in testing should be a range which include at least two of the following common spiders which cause domestic problems:

- red-back (*Lactrodectus hassetti*)
- black house (*Badumna insignis*)
- daddy long legs (*Pholcus phalangioides*)
- white tailed (*Lampona cylindrata*).

Claims for other species of spiders (e.g. funnel webs) must be supported with specific data.

The manner of testing should reasonably simulate the intended use pattern of the product. Field/situational tests are needed in addition to laboratory studies using captive specimens.

1.2 Household bait products

Cockroach baits

Data should be provided on both German and American cockroaches. A standard label for cockroach bait stations is available from the NRA.

Rodenticide products

Please refer to the notes under vertebrate control agents.

1.3 Home garden insecticides, fungicides and herbicides

Household and home garden pesticide products should be relatively harmless to humans or capable of causing only mild illness if accidental poisoning occurs. The NRA considers that ready-to-use products are generally more appropriate for home garden use than concentrates. Products that require personal protective equipment not normally available in the home are not suitable for home garden use. The special safety requirements for household products are described in Part 3 (Toxicology) of this *Ag Requirements Series*.

Claims

Broader claims may be accepted on home garden labels than would be allowed on commercial agricultural products. For example, a claim such as: 'Controls fruit fly, codling moth, Oriental fruit moth and other insect pests on fruit and vegetables in the home garden' OR 'controls crawling and flying insects in household situations' could be allowed if supported by adequate data on the specific pests mentioned.

Efficacy and tolerance data

Data generated under commercial conditions may be accepted in support of the same host/pest combination in the home garden situation. If commercial pesticide products are to be presented in ready-to-use form, evidence of the efficacy of the product in the proposed packaged form must be provided.

Overseas data may be accepted in support of home garden products, but this should be accompanied by at least one confirmatory Australian study.

Product containers

Applicants should consider delivery systems and packaging to reduce the hazard of products to householders, and especially young children. Details of novel delivery systems or novel presentations of products should be provided. Photographs or diagrams are also useful. Data or scientific argument should be supplied if the delivery system or product

presentation could impact on efficacy or plant safety.

1.4 Snail and slug baits

Additives required in formulations

All bran and pollard-based products, typically pellets based on metaldehyde or methiocarb, should contain an approved bittering agent such as denatonium benzoate (Bitrex) or agreed alternative. For existing (registered) products, claims relating to the inclusion of Bitrex should read 'pet taste deterrent' (at 250 ppm) or 'child taste deterrent' (at 100 ppm). New products based on new chemical actives will be considered on a case-by-case basis in relation to this requirement.

Similarly, an applicant for registration may propose the inclusion of other proven 'aversive agents' such as the stenching agent pyridine (or Alamask). Claims relating to the inclusion of such an aversive should read 'pet smell deterrent' (or some similar claim dependant upon mode of action). Sufficient agent must be added to ensure this intended effect lasts for the full duration of the stated shelf life *after the container has been opened*.

If the duration of effect is less than (say) 2 years then the expiry or use by date must be printed on the label.

Products based on dolomite (typically granules based on currently registered active constituents), do not require the addition of any aversive agents as they are not considered to be as inherently attractive to pets. These agents may however be included and appropriate claims made for their addition.

Current legislated requirements, as detailed in the *Agricultural and Veterinary Chemicals Code Regulations*, calling for inclusion of green and blue dyes in metaldehyde and methiocarb (respectively) also apply.

Some (current and future) baits may not require addition of any special dyes if it can be shown that they are not inherently toxic to pets or that they are already 'self coloured'. However, the originator of any new product must propose an appropriate coloration for the bait (or

argue for non-inclusion of same) that will enable the veterinarian to recognise the type of bait involved in any suspected poisonings and to provide an appropriate treatment.

Claims

Claims and inferred claims for 'pet repellency' will not be approved unless supportive data is provided which supports at least 95% repellency.

1.5 Swimming pool products

Products based on new swimming pool chemicals must be supported by efficacy and safety data.

Appendix A of Australian Standard AS3633-1989 *Private Swimming Pools — Water Quality Standard* gives information on major pollutants of swimming pools, including bacteria, viruses, protozoa and algae.

Pool products must show efficacy against these organisms. Alternatively, labels must include advice that the product must be used in conjunction with other products to obtain control of the full range of potentially harmful organisms.

Efficacy data is not required for swimming pool products as listed in AS3633, when used in the manner and for the purposes specified in the Standard.

Applicants should note that they may be required to further demonstrate the efficacy and suitability of their product to State Health Departments if they wish their approval to use such products in commercial pools and spas.

2 HERBICIDES AND ADJUVANTS

Applicants are referred to the following documents for assistance with herbicide data requirements and studies:

- *Guidelines for Field Evaluation of Herbicides*, 1979. Australian Weeds Committee.
- *Guidelines for Herbicide Efficacy and Tolerance Data in Clearance and Registration Submissions*, 1991. Australian Weeds Committee (copy available from the NRA).

- Agfact P3.1.2 *Using Cereal Growth Stage to Time Herbicide Applications*, NSW Agriculture and Fisheries, 1989.

Applicants are referred to the following publication for information about spray adjuvants:

- *The Pesticides Register Revised Adjuvants List*. Ministry of Agriculture, Fisheries and Food, United Kingdom, 1998.

2.1 Herbicide efficacy

- For each species claimed to be controlled, a number of studies are required. For economically important weeds, three studies/season/location with at least one study in each major region where the weed is a problem may be sufficient, while for a weed of lesser economic importance fewer studies will suffice, provided the results are consistent. The data should not be all from the one season or from a single location.
- Data should be from studies where the weed is at least of consistent moderate density over the study site.
- Possible effects of high and/or low rainfall on efficacy, e.g. leaching from sandy soils, retention in clay or high organic matter soils, should be considered.
- Weed identification should be accurate; the specific taxonomic name (Latin binomial) must be given.
- Weed growth stages should be at the growth stages claimed on the label.
- Semi-commercial evaluation reports can be used as confirmatory data but not as primary data.
- Yield data for crops (using a machine harvester for grains) and yield data or tolerance rating for pastures should be provided.
- Quadrat weed counts, preferably, and/or acceptable weed control rating assessment should be carried out. If ratings only are presented, then an estimate of weed density within untreated control plots must be given.

- The range of rates used in the experiments presented in the application should encompass the proposed commercial rates. The selected dose rate should provide consistent results across the nominated weed species and growth stages.
- When data are conflicting, additional experiments may need to be carried out until the 'weight of evidence' allows a satisfactory conclusion to be made.

2.2 Application methods, mixtures and compatibility

The data presented should encompass the range of application methods proposed on the draft label. This may require additional efficacy data, e.g. comparing conventional boom spraying with alternative methods such as aircraft or ultra-low volume versus high volume rates. Any recommendations need to reflect current application technology.

If the proposed rate of any product in a tank mixture differs from the recommended rate when the component products are used alone, supporting data for any new use rates are required. Similarly, if weeds claimed to be controlled by a tank mixture are in addition to weeds controlled by any of the components individually at equivalent rates, supporting data for a new weed claim is required.

Applicants should note that compatibility statements regarding mixing of a product with other pesticides, which include no additional label claims, imply biological as well as physical and chemical compatibility, unless clearly stated otherwise. Where doubt exists as to the biological compatibility of mixtures, companies should present data supporting label statements. Some biological incompatibility, e.g. slightly reduced control, may be acceptable providing adequate warning statements are included on labels.

If adjuvants, oils, wetters and other additives are recommended, data should be presented to indicate that efficacy is improved and that crop tolerance, where applicable, is not reduced. The

recommended use rate of any additive should be proved by providing data of an equivalent standard to that of the herbicide when used alone.

2.3 Crop tolerance

Crop tolerance experiments should be carried out under weed-free (or near weed-free) conditions, to avoid confounding of crop phytotoxicity with inhibitory weed effects. Crop tolerance results from weed efficacy experiments and semi-commercial evaluations can be reported as supporting data, but should not form the primary crop tolerance data. Tests should cover commonly grown cultivars.

Where it has been demonstrated in a wide range of cultivars that crop tolerance to a particular herbicide is not dependent on soil type, one experiment for each of two seasons in each of the major regions where the herbicide will be used is a minimum requirement. For example in cereals, Western Australia, southeastern cereal zone (South Australia, Victoria, Tasmania and southern New South Wales), northern cereal zone (northern New South Wales and southern Queensland).

Where the activity of a herbicide is related to soil type, two experiments in each of two seasons on each of the major soil types where the herbicide will be used are sufficient. For example in cereals, the acid sandy soils of Western Australia, the alkaline sandy loams of South Australia and western Victoria, the neutral-acid clay-based soils of southeastern Australia and the neutral-acid clay-based soils of the northern cereal zone. Other major regional soil types, e.g. the alkaline clay-based soils in southeastern Australia, would in general be covered by this list, but further experiments on additional soil types may be required if the herbicide demonstrates high sensitivity to differences in soil or climatic characteristics.

If a proposed label claim also includes seedlings or young plants of perennial crops, data need to be generated for these stages as well as for mature plants.

Claims of weed suppression as opposed to control will be acceptable if proved.

Crop tolerance data need to be generated for the most important cultivars of each crop on which the herbicide will be used.

2.4 Plant-back recommendations

These are required for herbicides that may be applied shortly before sowing or which have significant long-term residual activity.

Data presented should include Australian field study results as well as consideration of, and integration with, information on the pathways, dynamics and major environmental factors that impact on the breakdown of the herbicide in soil. The possible influence of soil types, rainfall and microbial activity needs to be evaluated.

It would be useful if applicants could provide some quantitative data on the concentration of herbicide in the soil likely to cause problems for different crop groups — this would allow growers to relate soil analysis results to likely problems if necessary. Also, or as an alternative, a suggested bioassay procedure for the particular herbicide would be an advantage. Soil or climatic conditions that could cause shorter or longer intervals of adverse effects should be discussed.

Applicants are referred to the *Guidelines for Herbicide Efficacy and Tolerance Data in Clearance and Registration Submissions*, 1991 (Australian Weeds Committee) for more detailed information.

2.5 Adjuvants and other additives

Separate guidelines for data requirements for spray adjuvants, wetters etc are currently being developed and will be available from the NRA. In the interim, applicants should refer to the general efficacy requirements.

The following should be considered:

- available published data on the adjuvant or similar chemicals;

- physical, chemical and biological compatibility of the adjuvant with the proposed pesticide(s);
- effects of the adjuvant on pesticide residue levels;
- justification — the need for the chemical;
- demonstration of claimed efficacy;
- any adverse effects on crop tolerance; and
- claims for biodegradability. These will need to be justified with appropriate data.

2.6 Herbicide tolerant crops

The use of herbicide-tolerant or herbicide-resistant crops has the potential to change crop management and the patterns of herbicide use in cropping systems. Sustainable cropping systems need to be developed so that, overall, chemical burden is not increased because of the emergence of resistant weeds resulting from inappropriate use of herbicides. Weed management strategies may need to be proposed to address these issues.

Questions arise as to whether or not the crop has been developed using recombinant DNA technology to genetically modify the crop, and relate primarily to the changes in herbicide use patterns arising from introduction of herbicide-tolerant crops.

The NRA does not directly regulate the introduction of herbicide-tolerant crops (i.e. they do not require registration with the NRA). However, extensions of use or label changes to accommodate the new use patterns of herbicides for use on herbicide tolerant crops will be evaluated by the NRA. In such situations, the wider implications of the use of the herbicide-tolerant crop will need to be considered.

3 INSECTICIDES AND INSECT GROWTH REGULATORS

The NRA does not have specific data requirements for insecticide products. However, the general requirements set out in these guidelines and some of the specific notes on herbicides may be

useful to applicants. If more specific advice is required, applicants may contact the Agricultural and Veterinary Chemicals Evaluation Section or apply under Category 50 for assessment of a study protocol (for information on Category 50 applications, see the new edition of the *Ag Manual*, due to be published later in 1999, or contact the NRA).

The data presented should include the range of application methods proposed on the draft label. This may require additional efficacy data, e.g. comparing conventional boom spraying with alternative methods such as aircraft or ultra-low volume versus high volume rates. Any recommendations need to reflect current application technology.

Applicants should note that insecticide addition to paints is not allowed.

3.1 Insecticide resistance management

Some crops, for example cotton, have insect resistance management strategies determined by grower bodies. In such cases, compatibility of the product with resistance management strategies needs to be addressed. Applicants should check with commodity organisations for details of such management plans.

3.2 Termiticides

Applicants are referred to the Australian Standard AS3660 (*Protection of Buildings from Subterranean Termites*) series for the special requirements for termiticide products. Draft AS3660.3 (Termite Management, Part 3 — Assessment Criteria for Termite Management Systems) specifies the criteria to be followed when assessing the effectiveness of termite management systems (including termiticides). The use of termiticides should be consistent with the procedures and techniques outlined in the AS3660 Series however this should not be seen as a hindrance to innovation as any application for the registration of a termiticide and its intended method of use will be evaluated by the NRA on its merits regardless of its compliance with AS3660 series.

The NRA is in the process of developing additional and more specific guidelines on termiticide efficacy requirements. Please contact the NRA prior to establishing any trials if you wish to discuss their appropriateness.

Preconstruction termiticides

Preconstruction termiticides are applied by handspray to form a complete subfloor termite barrier before a concrete slab is laid. All current preconstruction termiticides are registered as restricted chemical products with certain conditions applying to their sale and use. The conditions include an obligation to inform purchasers/users of occupational health and safety provisions and treatment details.

Applications for products similar to a registered product (which will be at a minimum a category 24 application) will need to demonstrate that their formulation is substantially similar or identical to the reference product, for example by comparing the two formulations using gas chromatography and carrying out comparative soil infiltration tests to demonstrate similar dispersion and dissipation and degradation characteristics. Soil infiltration tests must be carried out on a variety of soil types (i.e. sand, loam, clay) and each test must be properly replicated, analysed and reported.

Postconstruction termiticides

Postconstruction termiticides are applied by handspray or reticulation system to form a termite barrier around and under existing buildings.

It is probable that applications for products claiming similarity to a registered reference product will be treated as category 24 applications and data as described under preconstruction termiticides above will need to be provided.

Reticulation systems

Reticulation systems for termiticides are permanent delivery systems, usually consisting of a system of piping, which can be charged with termiticide so that

the termite barrier can be reinstalled as required.

Applicants must demonstrate that the system is able to provide an adequate application of termiticide.

The Australian Building Codes Board (ABCB) considers for certification reticulation systems which have been appraised for all of the following factors for certification:

- compatibility with other building components;
- compatibility of the system's components with particular termiticides.

Approvals from both the NRA and ABCB are required before reticulation systems can be used. Applicants should seek advice from the ABCB as to how to go about having their system appraised.

In situations where it is proposed that the reticulation system will deliver the termiticide in a manner that is outside the specifications of the AS3660 series, this use must be evaluated by the NRA and appear as a separate use pattern on the approved label of the product. In this case the applicant must demonstrate that the termiticide, when used through this particular system, is capable of maintaining an effective termite barrier for the interval between recommended recharges of the system.

4 FUNGICIDES

The NRA does not have specific guidelines available for data requirements for fungicide products. However, the general requirements set out in these guidelines and some of the specific notes on herbicides may be useful to applicants. If more specific advice is required, applicants may contact the Agricultural and Veterinary Chemicals Evaluation Section or apply under Category 50 for assessment of a study protocol (for information on Category 50 applications, see the new edition of the *Ag Manual*, due to be published later in 1999, or contact the NRA).

The data presented should include the range of application methods proposed

on the draft label. This may require additional efficacy data, e.g. comparing conventional boom spraying with alternative methods such as aircraft or ultra-low volume versus high volume rates. Any recommendations need to reflect current application technology.

Fungicides may be added to paints in order to preserve the paint in the can without the need for registration with the NRA. However, if fungicidal effects are to be claimed for a paint following application, the product will require registration.

4.1 Seed dressing fungicides

Seed dressing fungicide products for application to seed to be stored must contain a dye so that treated seed can be readily identified during and after storage. For this reason, an application to the NRA for extension of use as a seed dressing treatment of a general use fungicide without a dye will not be accepted, unless the use is for treating seed which is for immediate sowing.

Treatment of seeds with pesticides has the potential to affect germination. It is therefore necessary that any adverse effect on germination, emergence, establishment and yield of the main cultivars is determined. Replicated studies should also be carried out with freshly treated seed and seed that has been kept in store for at least one year.

4.2 Timber preservatives

Applicants are referred to the following documents:

- *Protocols for Assessment of Wood Preservatives*, 1997. Australasian Wood Preservation Committee.
- Australian Standard AS 1604-1997. *Timber — Preservative-Treated — Sawn and Round*.

5 BIOCIDES AND DISINFECTANTS

Disinfectants for domestic use and industrial biocides used in the manufacture of paper pulp do not require registration with the NRA. However, biocides, microbiocides or disinfectants

that are used in air conditioning cooling towers, animal housing, dairies or agricultural and horticultural premises such as glasshouses and sheds are considered to be agricultural chemicals and require registration with the NRA.

Some biocidal chemicals proposed for registration as agricultural chemicals are 'commodity chemicals' that have been in common use for other purposes without known harmful effects. Applications for registration of such commodity chemicals that are proposed for use as agricultural biocides may be considered under a modular application category.

Overseas data is likely to prove adequate in support of biocidal products, provided the test organisms and experimental conditions can be shown to adequately represent those present in the relevant Australian situations.

The NRA does not have a specific guideline for data requirements for disinfectants and biocides. However, applicants may follow overseas guidelines, for example the United Kingdom Pesticides Safety Directorate's *Guidelines on the Efficacy Data Requirements for Approval of Non-Agricultural Pesticide Products: Part Three/B2, Surface Biocides* (available on request from the Agricultural and Veterinary Chemicals Evaluation section of the NRA).

6 ANTIFOULING PAINTS

In general applicants are required to demonstrate acceptable control and prevention of fouling organisms when the products are applied in accordance with label instructions. Data from overseas may be submitted but the relevance of this information must be established, including consideration of such factors as salinity, water temperature and type of fouling organisms present. Generally, confirmatory Australian data will also be required.

Data on leaching or release rates of the active chemical from the paint is essential, as is information to indicate the period of protection that may be expected.

Acceptable safety to marine organisms must be shown (see also the requirements in Part 7 — Environment).

7 VERTEBRATE CONTROL AGENTS

Applicants are referred to the following documents for information about State requirements for vertebrate pest control agents:

- *Vertebrate Pesticide Manual — A Guide to the Use of Vertebrate Pesticides in Queensland*. Land Protection Branch Department of Natural Resources, June 1995.
- *Vertebrate Pest Control Manual*. Fourth edition, 1996. Agricultural Protection Program Industry Support. NSW Agriculture.

Information on other States' requirements for vertebrate pest control can be obtained by contacting the local department of agriculture or primary industry.

Some vertebrate control agents are restricted chemical products under State legislation. Applicants should check State requirements before supplying such products for use as the various State requirements may differ substantially. Restricted chemical products can be used only under the conditions specified and by people specified (for example by licence) under the relevant State legislation.

The NRA does not have guidelines for data requirements for vertebrate control agents at this time.

However, the following information should be included in the submission.

- Careful description of study sites.
- Size of bait or bait station in relation to size of target animal.
- Efficacy data for each rodent species claimed for commercial products.
- Appropriate density estimates of pest animal populations before, during and following any treatments and the methods by which these densities are assessed — capture/recapture, spotlight counts, faecal pellet/dung counts etc. Expansion of density to include population structure is also useful since, for example, younger animals may be more neophobic/bait shy, which may

- affect the results if a population has large numbers of younger animals.
- Suitable replication and controls. Pseudoreplication has been used in efficacy studies (e.g. multiple bait stations in one location) and this approach is not accepted. For example, when testing rodenticide products, replicates should be separated by sufficient distance to avoid one rodent visiting more than one station. Separate buildings need to be matched to provide replicates and untreated controls.
 - If overseas data is to be used in support of an application, applicants must ensure that pest species and/or strains tested are appropriate. For example, rabbits and rodents, which have a high reproductive ability, have been shown to adapt rapidly to local conditions.
 - Disappearance of bait is not sufficient evidence on its own as to the effectiveness of a bait. Dead animals should be checked for evidence of poisoning.
 - Primary poisoning of nontarget animals (cats, dogs, native fauna) and the possibility of secondary poisoning of cats, dogs and raptor birds needs special consideration.
 - Palatability to and unintended consumption of baits by nontarget species (e.g. native rodents and other fauna). Appropriate warning statements will be required on the label.
 - Use of dye in formulation to enable rapid identification of nontarget poisoning.
 - Hazard reduction by use of special delivery systems, bait placement or application methods.

- Animal welfare considerations.
- Overall pest management strategy, baiting strategy and integration with industry pest management strategies (for example, the sugar industry has a rodent management strategy).
- Disposal of carcasses.
- Removal and destruction of unused bait. (Note: State/Territory requirements differ).

8 BIOLOGICAL AGRICULTURAL PRODUCTS

The following product groups are regarded as biological products:

- biological chemicals (including pheromones, hormones and biorationals);
- extracts of plants or other organisms;
- microbial products including genetically modified organisms;
- certain genetically modified plants (for example those that express genes for pest resistance); and
- biological control agents (excluding macroscopic parasites and predators, but including disease agents, viruses, fungi etc.).

For further details see the NRA's *Guidelines for Registration of Biological Agricultural Products* (in preparation; available from the NRA).

Applicants should note that import of biological control agents and field release/conduct of studies is subject to previous approval by the Australian Quarantine and Inspection Service (AQIS). This may include assessment by other agencies, e.g. Environment Australia. For more details contact AQIS.

Glossary

Active constituent The substance or substances in a formulated product, which is/are primarily responsible for the biological or other effects that make the product an agricultural chemical product.

Agricultural chemical product

A substance or mixture of substances that fits the legal definition in the *Agricultural and Veterinary Chemicals Code Act 1994*.

Crop safety The safety of an agricultural product for target plants when applied at the rate indicated on the label.

Efficacy The ability of an agricultural chemical product to perform according to label claims.

End-use product/formulated product

See *product*.

Formulated product See *product*

Phytotoxicity The property of causing a deleterious effect on plant tissues; of being toxic to plants.

Product A formulation containing one or more active constituent(s), and possibly non-active constituents(s), which is intended for application, with or without dilution prior to use, and which is labelled with directions for use.

Reference product A currently registered product and its label.

Registration The process whereby the NRA approves the sale and use of a formulated product in Australia, after the evaluation and assessment of appropriate scientific data demonstrating that the

product is effective and not unduly hazardous to human health, the environment, or target plants and animals, and that it will not adversely affect trade.

Relevant scientific argument

relevant means:

- related to the active constituent and/or product
- related to the claims and use patterns.

scientific argument includes

arguments based on:

- accepted scientific principles
- data published in peer reviewed journals
- relevant texts
- relevant laboratory studies
- relevant field studies.

Resistance The inherited ability of a pest or pest population to tolerate the label rate of application of an agricultural chemical product.

Study protocol A document describing a trial design used to generate data to support applications for approval and registration or a permit (also called a 'trial protocol').

Use-pattern The combination of all factors involved in the use of a formulated product, including the concentration of active constituent in the preparation being applied, rate of application, method of application, frequency and duration of treatments, additives recommended and other directions which determine total quantity applied, timing of treatment and withholding period.

References

NOTE: Details are provided for the current edition at the time of publication in each case. Applicants should always ensure that they obtain the most up-to-date version of any publication they require. Books with an asterisk can be obtained from AusInfo Shops (formerly Australian Government Publishing Service, AGPS) in capital cities.

- Agricultural Protection Program Industry Support 1996. *Vertebrate Pest Control Manual*. 4th edition, NSW Agriculture, 161 Kite Street, Orange, NSW 2800.
- Australian Standard AS 1604-1997. *Timber — Preservative-Treated — Sawn and Round*. (Available from Standards Australia, The Crescent, Homebush, NSW 2140; ISBN 07337 1052 2)
- Standards Australia. Australian Standard AS3633-1989. *Private Swimming Pools — Water Quality*. (Available from Standards Australia, The Crescent, Homebush, NSW 2140; ISBN 0 7262 5957 8)
- Standards Australia. Australian Standard AS3660.3, Draft DR 98376. Termite Management. Part 3 — Assessment Criteria for termite Management Systems. (Available from Standards Australia, The Crescent, Homebush, NSW 2140)
- Standards Australia. Australian Standard AS3660—1993. *Protection of Buildings from Subterranean Termites— Prevention, Detection and Treatment of Infestation*. (Available from Standards Australia, The Crescent, Homebush, Sydney; ISBN 0 7262 8375 4)
- Australian Weeds Committee 1979. *Guidelines for Field Evaluation of Herbicides*. AGPS, Catalogue number 9761 374. ISBN 0642 042 525.*
- Australian Weeds Committee 1991. *Guidelines for Herbicide Efficacy and Tolerance Data in Clearance and Registration Submissions*. (Available from the NRA)
- Australasian Wood Preservation Committee 1997. *Protocols for Assessment of Wood Preservatives*. (Available from CSIRO Division of Forestry and Forest Products, South Clayton, Victoria)
- Department of Natural Resources 1995. *Vertebrate Pesticide Manual — A Guide to the Use of Vertebrate Pesticides in Queensland*, Land Protection Branch, Department of Natural Resources, Queensland.
- Furness, Geoffrey O., Magarey, Peter A., 1998. Unit Canopy Row: A better way to calibrate your sprayer for fruit trees and grapevines. South Australian Research and Development Institute, Loxton Centre, SA.
- United Kingdom Pesticides Safety Directorate 1997. Guidelines on the efficacy data requirements for approval of non-agricultural pesticide products, Part Three/B2: Surface biocides. In: *Registration Handbook: Pesticides, Biocides, Plant Protection Products*, Volume II. Pesticides Safety Directorate, Ministry of Agriculture Fisheries and Food and Pesticides Registration Section, Health and Safety Executive, pp9-25. (Available from Pesticides Safety Directorate Information Section, Mallard House, 3 Peasholme Green, York YO1 2PX)
- United Kingdom Ministry of Agriculture, Fisheries and Food 1998. *The Pesticides Register: Revised Adjuvants List 1998*. Supplement to the April 1998 Pesticides Register. (Available from Pesticides Safety Directorate Information Section, Mallard House, 3 Peasholme Green, York YO1 2PX)
- National Registration Authority for Agricultural and Veterinary Chemicals 1996. *Ag Manual: The Requirements Manual for Agricultural Chemicals*. NRA, Canberra. ISBN 0 642 25922 4.*
- National Registration Authority for Agricultural and Veterinary Chemicals 1996. *Ag Labelling Code: The Code of Practice for Labelling Agricultural and Chemical products*. NRA, Canberra. ISBN 0 642 26471.6.*

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Biological Agricultural Products*, in
preparation. (Available from the NRA)

NSW Agriculture and Fisheries 1989.
*Using Cereal Growth Stage to Time
Herbicide Applications* Agfact P3.1.2.
(Available from NSW Agriculture,
161 Kite Street, Orange, NSW 2800;
Agdex 110/682)