REVIEW OF STATE LEGISLATIVE CONTROLS ON HERBICIDE USE WITH RESPECT TO DOSE RATES

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Abstract  Herbicide dose responses are continuous functions and are strongly dependent on environmental conditions. With vigorous growth, a selective herbicide applied to foliage at sub-label dose rates may devastate populations of target weeds, allowing large benefits in crop yield while also reducing the weed seed bank. Under stress conditions, however, where weed and crop growth is slowed or stunted, the same herbicide applied at doses up to the label rate may show increments in efficacy and generally result in lower yield response benefits compared with the vigorous growth scenario. Thus, a single, high (or range at the high end) dose rate may be guaranteed to “do the job” on a weed in specified crops under any condition.

Results are presented from the authors’ 1999 survey of state laws on herbicide dose rates. These, compared with Pannell’s (1989) survey, show it remains the case that farmers in some parts of Australia are free to apply herbicide at any dose up to the labeled rate, but not more. In other parts of the country, farmers may legally apply herbicide only at the labeled rate or not at all, except by special permit. In light of the recent establishment of the National Registration Authority for Ag and Vet Chemicals, and changes in state legislation, this paper reviews the current situation. It highlights the case for unification of legislation on herbicide use and suggests that manufacturers could provide users of herbicides information allowing better decisions in matching doses to specific conditions.

INTRODUCTION

A need is recognised for the more efficient use of herbicides. The objective of this paper is to show how this need is frustrated both by a lack of information on herbicide labels to guide users and by legislation in some states and territories prohibiting downward adjustment of herbicide doses according to field conditions at the time of application. With increasing public concerns about pesticides, there is an international thrust to finer-tune herbicide dose rate to match the prevailing environmental conditions for the specific problem being targeted. This strategy fits with the trend towards integrated weed management which replaces some of the dependence on herbicides with complementary tactics such as the use of more competitive crops, crop rotations, biological control, fertilisers, pasture phases and timely grazing (Medd and Pratley 1998, Pimentel 1997).

There is considerable evidence of variations in effective herbicide dose according to growing conditions. Pannell (1990) provided an economic analysis of herbicide dose decisions conditioned on weed density and other biological factors as well as prices of herbicide and crop. Minkey and Moore (1998), citing the recent literature, listed several factors important in determining the performance of foliar applied herbicides; they also described a three-season experiment in which, for some crop and herbicide combinations, 90% weed kill was achieved with doses differing by more than an order of magnitude depending on growth conditions.

Kudsk (1988) first introduced the concept of ‘factor-adjusted doses’ with the observation that dose-response curves for percent weed kill make parallel shifts according to environmental factors. In Denmark, a computerised advisory system has been developed which is based on the hypothesis of parallel dose response curves and the derived factor-adjusted doses (see Christensen 1998). In Australia, there is often no specification of variable rates, or a lack of information on when best to use the lower rate or higher rate when a range of rates is given on a herbicide label. Top farmers may sort this out for their own farms and seasonally changing conditions. The vast majority are left without guidance from manufacturers.

In Australia, requirements for registration of an agricultural chemical stipulate the submission of comprehensive data showing results of laboratory and field-scale trials which prove that the end-use product, when used according to directions, is effective for the purposes claimed (NRA 1997a). There is no requirement for manufacturers to provide information derived from those same trials that could guide users in adjusting doses to particular growing conditions. Due to the status of labels as legal contracts, recommended dosages are set at levels sufficient to kill target weeds almost all of the time (Cox and Medd 1998).
A survey reported by Pannell (1989) pointed up the fact that states had different combinations of regulations regarding maximum and minimum herbicide rates and provision for flexibility of private or government advisors in recommending sub-label doses. At that time each state had its own product registration regulations that had to be followed by manufacturers (NRA 1999). Since then, the National Registration Authority (NRA) was established to unify registration requirements nationally. Control of product sales and subsequent use in the field remained at state level under a variety of laws peculiar to each state (Alcorn, 1993).

A National Competition Policy (NCP) legislation review of agricultural and veterinary (ag. and vet.) chemicals legislation has been completed recently (PwC/FAL 1999). It covers the Commonwealth, State and Territory legislation that establishes the National Registration Scheme for ag. and vet. chemicals, the Agvet Code (1994) and the NRA, as well as ‘control of use’ legislation in Victoria, Queensland, Western Australia and Tasmania. From their point of view of improving economic competition the Review Team recommended, inter alia, reform of state ‘control of use’ legislation and was “strongly of the view that significant net public benefits will only be achieved if existing deficiencies with control of use are corrected. These deficiencies arise because of the lack of a nationally consistent approach to control of use.” The Review Team recommended that ARMCANZ sponsor the development of a ‘control of use’ framework that is both nationally consistent and consistent with the National Registration Scheme. “ARMCANZ is a council comprising primary industries or equivalent ministers from the Commonwealth, State, Territory and New Zealand Governments” (PwC/FAL 1999). We are sympathetic with this recommendation and this paper is a contribution to the cause.

METHODS

A survey of state and territory authorities was carried out in June 1999 to up-date Pannell’s (1989) survey on regulations regarding use of sub-label doses of herbicides. The same three pairs of questions asked by Pannell were asked in the new survey:

1. “Is there a maximum legal rate at which each chemical may be applied? If so what are the penalties faced by producers who exceed this rate?”

2. “Is it legal for producers to apply rates of chemicals less than the recommended or label rate? If not what are the penalties faced by producers who do cut rates?”

3. “Are agricultural consultants and advisors (private and government) legally prohibited from advising producers to use chemical rates other than those specified on chemical labels? If so what penalties are faced by advisors?”

A survey letter was faxed to representatives of each of eight state and territory authorities; contact numbers were from NRA (1997b), up-dated by Peter Prammer (personal communication 1999). It included an explanatory covering note on the need for a 1999 update, a table citing the state-by-state results of Pannell’s survey, for comparison, and a one-page answer sheet. To each of the above pairs of questions was added a query: “Decided by?” in the case of penalties. Space limitations preclude the inclusion of these details, but they can be made available upon request.

RESULTS

All eight state and territory authorities kindly responded to the survey and telephone follow-ups. Results of this new survey are presented, in Table 1, in conjunction with those reported ten years earlier by Pannell (1989). In Table 1 the current diversity in ‘control of use’ legislation across Australia is apparent in the directions regarding over and under label rates, in the flexibilities of advisors and in the wide range of maximum penalties for offenders. SA is the exception on maximum rate; NSW, Tasmania and ACT do not allow use below a minimum rate without a permit and NSW does not allow advisers to provide recommendations on variable dose rates. Changes have occurred over the past decade, most of them being towards allowing greater flexibility in the market place.
DISCUSSION

There is no argument intended here for exceeding maximum label rates as we respect the necessary bounds to meet maximum residue levels (Baker 1991; Pannell 1991). The biological, economic and free market driven arguments for flexibility in using herbicides at rates lower than the maximum label rate, however, are conditional and constrained by health and safety considerations, and hence the need for appropriate government intervention.

In the cases of some products, such as Schedule 7 poisons and other high risk chemicals (i.e., atrazine, and ester formulations of MCPA, 2,4-D, 2,4-DB and triclopyr) a minimum dose may be stipulated on the label and the user is faced with an all or none decision (R. Grenall, personal communication 1999). In other cases, a recommended range of doses is given on the label which will provide commercially acceptable levels of weed kill in most conditions. Under ideal growth conditions when weeds are most vulnerable, a sub-label dose may suffice, however, the potential user may be constrained from using it by a lack of information and/or legal prohibition. We propose such information could be provided by manufacturers (to support their products in the market) based on the same efficacy trials that are conducted for the purpose of registration by recording and including the environmental and plant growth factors in their analyses.

In considering an application for registration of a herbicide, the NRA is bound by Section 14(3)f of the Agvet Code (1994) to satisfy itself that a product’s claimed efficacy is both true and appropriate (PwC/FAL 1999, p.41). Since determination of ‘appropriateness’ involves regulation of product standards, the NCP considered it a restriction on economic competition in a free market. The NCP, therefore, recommended “the Agvet Code be amended to specify that efficacy review extends only to ensuring that the chemical product meets the claimed level of efficacy on the label” (PwC/FAL 1999). In other words, the NCP judges it is better for the market to decide what levels of efficacy are appropriate, leaving the NRA to ensure that manufacturers’ claims regarding efficacy are true. Consequently the desire to amend the Agvet Code to require the addition of use information will not be straightforward and is likely to be met with resistance from manufactures as well as regulators. Further, it is important to note that efficacy review is always in addition to NRA’s provisions for assessing health, OH&S, environment and trade effects. Market failure in fully valuing health externalities (Brush and Clemes 1995) make such measures necessary, and the addition of efficient use regulations would seem to be in accordance with such needs.

Since numerous agronomic studies have shown efficacy to be a function of environmental conditions, as well as herbicide dose, the present authors propose consideration of further amending the Agvet Code to require manufactures to provide expanded label information. This information would allow users to recognise growth conditions for which high doses are required for efficacy and conditions for which lower doses will work. For example, this could be in the

<table>
<thead>
<tr>
<th>Table 1. A comparison of results of 1989 and 1999 surveys of laws on herbicide rate flexibility in each state.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a maximum legal rate?</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>No/Yes</td>
</tr>
<tr>
<td>Is there a minimum legal rate?</td>
</tr>
<tr>
<td>Private advisors flexible?</td>
</tr>
<tr>
<td>Govt. advisors flexible?</td>
</tr>
</tbody>
</table>

Notes: No response from NT or ACT in 1989 survey. Agvet Code (1994) and NRA have national jurisdiction but ‘control of use’ provisions are subject to enabling legislation at state and territory level. Where a change has been reported, both old/new are given with the new in bold type. Where there has been no change, a single entry is shown for the situation.

Source: 1989 survey by Pannell (1989); 1999 survey compiled by authors from sources in Acknowledgments.
form of a table or tables, each specific to a weed density, giving expected efficacy (%) as a function of weed growth condition and maximum recommended herbicide dose (MD) such as:

<table>
<thead>
<tr>
<th>Dose</th>
<th>0.5MD</th>
<th>0.75MD</th>
<th>1.0MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigorous growth</td>
<td>90</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Normal growth</td>
<td>70</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td>Stressed condition</td>
<td>30</td>
<td>50</td>
<td>90</td>
</tr>
</tbody>
</table>

Such information should be viewed as “for guidance”, rather than being legally binding, to relieve manufacturers of unnecessary legal obligations, while keeping them truthful in word-labelling of products for various uses. It is thus envisaged that manufacturers should be obliged to provide the information tailored to specific product uses. Generally data of this kind is gathered routinely during testing, so there would only be a marginal cost in analysing and presenting the information in forms most meaningful to users.

A key to success of integrated pest management is a farmer’s close monitoring of conditions in the field and the deliberate creation of diversified conditions over time in each field to avoid maintaining niches in which pests (weeds, insects and diseases) can thrive. There is controversy over the belief that low herbicide doses lead to development of herbicide resistance. An alternative view ascribes the cause to a lack of diversity in growing conditions with herbicide constantly present. This is supported in Denmark, where use of herbicides has been cut back by government environmental policy, with no appearance of resistance due to wide use of diverse crop and herbicide rotations (Per Kudsk, personal communication 1999). The NCP “discovered considerable debate over the science of resistance management” and was “unable to ascertain whether the current system of efficacy review creates a benefit or disbenefit in respect to resistance management” (PwC/FAL 1999).

Sorting out the questions of herbicide resistance would seem to be among those of highest priority, particularly where considerations of lower doses on the basis of economics and health are clouded by these unknowns.

ACKNOWLEDGMENTS

Dave Pannell’s 1989 survey of state regulations on sub-label herbicide doses was the starting point for this study. The authors thank David Hutchison and Peter Prammer of the National Registration Authority for Ag and Vet Chemicals, Kingston, ACT, for help in understanding the NRA’s roles and rules, and providing contact addresses of state and territory authorities. For help in up-dating our information on state and territory regulations on herbicide dose rates, the authors especially thank Mr Roger Toffolon (Program Leader, Ag and Vet Chemical Control, NSW Agriculture, Orange), Mr Ian Reichstein (Agvet Chemical Coordinator, Office of the Environment, Chemicals and Noise Section, Dept of Urban Services, ACT), Dr Jane Mallen-Cooper (Head, Pesticides Unit, Hazardous Substances Branch, NSW Environmental Protection Authority, Chatswood), Mr Robert Grenall / Bob Chaffey (Product and Chemical Standards Branch, Dept of Agriculture, Victoria), Mr Mike Norman / John Mollison (Chemical Management Unit, Dept of Primary Industries, Water and Environment, Tasmania), Mr John Kasserbaum (Farm Chemicals Program, Dept of Primary Industries and Resources, South Australia), Mr Russel Scholl (Compliance Coordinator, Legislative Support Unit, Animal and Plant Health Service, Dept of Primary Industries, Queensland), Dr John Alcock (Pesticides Registrar, Dept of Primary Industries and Fisheries, Northern Territory), and Mr Chris Sharpe / Peter Rutherford (Ag and Vet Chemicals Section, Dept of Agriculture, Western Australia). Suggested studies for changing legislation on label information are the authors’ ideas and do not necessarily reflect the policy of their respective institutions or the Weeds CRC.

REFERENCES


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