NEW PRODUCTS - A REVIEW

W.H.L. HAZARD

Department of Primary Industries
Biloela Research Station
P.O. Box 201
Biloela Qld. 4715

Summary. Three papers contributed to the New Products session of the Conference are reviewed in terms of their potential contribution to weed control in Australia and information provided by agricultural chemical companies on six new herbicides currently being developed in Australia is also reviewed. The possible role each herbicide might play is examined. The philosophy of providing new products by developing new compounds as against redeveloping and finding new uses for old compounds is explored using the contributed papers as examples.

INTRODUCTION

The objective of this session is to acquaint delegates with the current situation regarding new products in the discipline of weed control. For this review, a new herbicide product is defined as one whose development in Australia has been publicly announced since the First Conf. Coun. Aust. Weed Sci. Soc. in April, 1978. The review has been restricted to herbicide developments in Australia partly because of the difficulty in obtaining relevant information from overseas sources, and partly because it is the herbicide developments taking place in Australia which should be the prime concern of this Conference.

The small number of contributed papers to this session is disappointing and fails to reflect the diversity of new herbicides undergoing development in Australia. With the co-operation of the Agricultural and Veterinary Chemicals Association of Australia, all member companies were asked to provide information on new herbicides for inclusion in the review. Their response and the contributed papers form the basis for this review.

CONTRIBUTED PAPERS

Other than the small number, a significant feature of the contributed papers is that only one is from a commercial organisation, the other two being from Government research organisations.

Cyanoacrylate herbicides. In their abstract Huppatz and Phillips report briefly on a new group of experimental herbicides. Their mode of action is to inhibit the photosynthetic process (specifically the Hill reaction) as do the phenylurea, triazine and uracil herbicides. In keeping with these herbicides, the new group exhibits similar phytotoxic symptoms in susceptible species. They differ from many other photosynthetic inhibitor herbicides in being highly toxic to aquatic plants, but apart from this activity (which is not unique) no other particular advantages over existing herbicides are claimed for the group.

A new formulation of 2,4-D acid and its effect on groundsel bush. In his paper Diatloff reports on the development of a new formulation of an old herbicide. The formulation, coded AF201, is a low-volatile liquid formulation of 2,4-D acid. The need for the herbicide arose from the prohibition on the use of esters

of chlorinated phenoxy herbicides in declared hazardous areas in Queensland in which the growing of crops sensitive to 2,4-D was an important industry. An alternative to the commonly used esters was therefore required, particularly for the control of groundsel bush (*Baccharis halimifolia*). This is seen as a highly commendable approach which both Industry and Government should be encouraged to emulate with other established herbicide groups. The philosophy of developing new uses for old herbicides is discussed later in this review.

DPX 4189 - A new selective herbicide for winter cereals. In their paper Campion and Tichon report Australian experience with the Du Pont experimental sulphonyl urea herbicide coded DPX 4189. It is expected to be available commercially in Australia in 1982 under the trade name Glean.

The authors refer to the special attributes of this herbicide as:

1. Having a broad spectrum of activity including broadleaved weeds and grasses;
2. Exhibiting crop tolerance in wheat, oats, barley, triticale and rye;
3. Being flexible in that it may be applied pre-plant incorporated, post-plant surface applied or early post-emergence;
4. Being reliable under varying soil types and climatic conditions, and,
5. Possessing little or no hazard to man or animals.

The herbicide is absorbed by foliage and roots and acts by inhibiting cell division. Selectivity is achieved by tolerant plants converting the active constituent to inactive products while sensitive species show little or no metabolism of the herbicide. The herbicide is active at very low rates, with the effective dosage range for sensitive grasses and broadleaved weeds being 8 to 32 g ha^{-1}. Pre-emergence applications have provided more effective control than post-emergence treatments.

The authors tabulate the results of Australian experience with DPX 4189 and discuss some of the implications of these results suggesting potential areas of use in winter cereal production.

DPX 4189 appears to be a useful addition to the current range of herbicides in meeting a need in winter cereals for a broad spectrum pre-emergence herbicide. It may find use either alone or in combination with complementary herbicides to broaden its spectrum of activity. It also appears to have a role in direct drilling or reduced tillage systems when used in conjunction with currently available non-residual foliaractive herbicides.

NEW HERBICIDES BEING DEVELOPED IN AUSTRALIA

Dowco 453. The active ingredient of this experimental herbicide has not been specified (Dow Chemical Co.). It is reported to be effective against a wide range of annual and perennial grasses when applied as a post-emergence treatment, and the addition of a non-ionic surfactant or crop oil is reported to be essential for consistent weed control. It does possess some pre-emergence residual activity. It is not effective against broadleaved weeds and sedges. Crops that are tolerant of Dowco 453 include lucerne, cotton, cucumbers, beans, peanuts, soybeans,

rape, sugar beet, tomatoes and tobacco.

This herbicide is of considerable interest because of its reported ability to selectively control grasses in a range of broadleaved crops. The main method of such control is currently achieved with a wide range of pre-emergence herbicides. Interactions between Dowco 453 and selective post-emergence broad-leaved herbicides, which would be a logical and desirable development, have not been resolved.

Alloxydim-sodium. This is a post-emergence non-residual herbicide discovered by Nippon Soda Co. (Drew 1981). It is being developed in Australia by Schering Pty. Ltd. and is currently registered for the post-emergence control of annual grasses in onions in all Australian states except Western Australia.

Alloxydim-sodium appears to share some of the characteristics of Dowco 453 in spectrum of activity and selectivity. It is registered overseas for use in sugar beet, peas, tomatoes, lettuce, linseed, soybeans, rape and fescue seed crops and is being developed in Australia for use in tomatoes, cucumber and cole crops.

Registration has been granted for a tank mix of alloxydim-sodium and methazole to provide both grass and broadleaved weed control in onions. While cost appears to be restricting its current development to the higher value crops, its characteristics suggest that it has the potential for wide use in a range of broadleaved field crops.

NC 20484 (2-3-dihydro-3, 3-dimethyl-5-benzofuranyl ethanesulphonate). This is an experimental pre-plant incorporated or pre-emergence herbicide discovered by Fisons Ltd. (Horne and Hoogstraten 1980). It has provided initial and residual control of yellow nutgrass (*Cyperus esculentus*) and nutgrass (*Cyperus rotundus*) as well as controlling a wide range of annual grasses and broad-leaved weeds. Foliar absorption does take place but the level of activity post-emergence is generally low.

Australian results suggest a dosage rate of 1.5 to 2.5 kg ha^{-1} and selective use in cotton, tobacco and sugar cane (L. Minter, personal communication, 1981). Mixtures with trifluralin or fluometuron have been proposed to provide a broader spectrum of activity in cotton. It appears that the most significant contribution that this experimental herbicide could make is in the selective control of nutgrass, which is a particularly troublesome weed in the three crops (cotton, tobacco and sugar cane) in which NC 20484 appears to have potential in Australia.

Norflurazon. This is a pre-emergence surface applied herbicide discovered by Sandoz Ltd. (1979). It is primarily an annual grass killer but has also shown activity against some broadleaved weeds and suppression of *Cyperus* spp. The herbicide is absorbed by the roots and acts by interrupting carotenoid synthesis in sensitive plants. Under field conditions it is lost from the soil mainly by volatilization and photochemical degradation.

Norflurazon has been available overseas for at least eight years (Herbicide Handbook, Weed Sci. Soc. Amer., 1974), where it is being developed for selective use in cotton and perennial crops such as cranberries, lucerne, citrus, fruit trees, nut trees, bananas and sugar cane. It does not appear to have any advantages over currently available herbicides possessing similar characteristics, except perhaps for the reported suppression of *Cyperus* spp. and

the lack of any requirement for incorporation.

Sandoz Australia is proposing to register norflurazon for use in orchards in spring 1981 and in cotton in September 1982 (E.R. Herrling, personal communication, 1981).

Acifluorfen. This is a selective pre- and post-emergence herbicide being developed for weed control in soybeans (Rohm and Haas Co. 1977). The company claims that post-emergence applications provide more effective and consistent control of sensitive weeds than pre-emergence applications.

Acifluorfen has a post-emergence broad-leaved spectrum of activity which is similar to bentazone, but differs from it in exhibiting pre-emergence activity and activity against certain grass species. The herbicide is currently registered for use in soybeans in Queensland and an application for registration in New South Wales has been lodged (J. Guerassimoff, personal communication, 1981).

Oxyfluorfen. This is a selective pre- and post-emergence herbicide being developed for weed control in a number of field, horticultural and plantation crops. (Rohm and Haas Co. 1979). It is reported to be effective against a range of broad-leaved weeds as a pre-emergence treatment. In this role it is recommended that it be combined in a tank mix with complementary herbicides such as trifluralin (incorporated) or alachlor (surface applied). Oxyfluorfen may be applied as a directed post-emergence treatment either alone or in combination with paraquat, 2,2-DPA or MSMA in crops such as maize, cotton and soybeans; the same mixtures have been suggested for use in reduced or zero till systems.

Oxyfluorfen differs from acifluorfen in that the former appears to be herbicidally more active and/or less selective, since it cannot be applied as an overall post-emergence treatment in those crops in which it can be used as a pre-emergence treatment. Rohm and Haas anticipate that oxyfluorfen will be registered for use in Australia in 1982 (P.V. Grassick, personal communication, 1981).

REDEVELOPING THE OLD VERSUS DEVELOPING THE NEW

The three papers contributed to this session represents three different approaches to the process of making new herbicides available for commercial use.

The Du Pont herbicide DPX 4189 represents the generally accepted manner in which a new herbicide is developed. DPX 4189 is the product of a large commercial organisation with the structure and resources to discover, test and market a new herbicide on a world-wide basis. Binstead (1978) estimated the development costs of a typical pesticide at approximately $10 M. This figure must have increased since then, as costs have risen and the tests required to obtain registration have become more stringent.

The above approach contrasts with that of Huppatz and Phillips in their development of the cyanoacrylate herbicides. They work in a publicly funded organisation with comparatively limited resources. While their initial objectives may appear to be similar to those of a commercial organisation, the herbicidally active compounds have been discovered as a by-product of basic research. It is possible for this low budget approach to make a potentially significant contribution in developing a new product as was shown with the cyanoacetanilide herbicides (Huppatz, Phillips and Rattigan 1979). However, both commercial

input and considerable expense would be required to develop to a marketable product a particular herbicide from such an organization.

The approach of Diatloff in developing a new low-voltaile liquid formulation of 2,4-D acid to meet a specific need is in marked contrast to those of Du Pont and of Huppatz and Phillips. The herbicide is only new in the sense that it is a new formulation with new characteristics. As the active constituent has remained unchanged, the development costs required for registration purposes would be comparatively small.

The work of Copping and Garrod (1980) provides a similar example of the benefits of re-assessing old herbicides for new uses. Their work with benazolin (18 years old) and bentazone (at least 14 years old) has shown that mixtures of these two herbicides have a more than additive effect in the control of a number of broadleaved weeds including Noogoora burr (*Xanthium pungens*) and common thornapple (*Datura stramonium*); similar results were obtained with mixtures of benazolin and acifluorfen. These findings could be of considerable significance in providing better control of Noogoora burr and common thornapple in soybeans in Australia. Bentazone and acifluorfen are currently registered for use in Australia, and benazolin is being developed in Australia for broadleaved weed control in soybeans, cereals and rape (L. Minter, personal communication, 1981).

The greatest drawback to the redevelopment of old herbicides is that a potential manufacturer of a redeveloped product may not have patent protection. It is for this reason that Industry would be unlikely to find such developments commercially attractive. This would appear to be a logical area in which publicly funded organisations could carry out development work on old herbicides to meet specific needs and then pass the redeveloped herbicide to Industry to manufacture and market.

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Footnote: F and B Chemicals advised at the conference that development of NC 20484 will be discontinued in Australia.