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EFFECTS OF ROUNDUP® AND PULSE® ON AQUATIC ECOSYSTEMS

(Short Answers in Conservation Science)

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NIWA
Taihoro Nukurangi

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Mr Fred Overmars
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Private Bag
HOKITIKA

Dear Mr Overmars

EFFECTS OF ROUNDUP® AND PULSE® ON AQUATIC ECOSYSTEMS

1. Roundup

The active ingredient of Roundup® is the isopropylamine salt of glyphosate (N-(phosphonylmethyl) glycine), present in the product at a concentration of 360 g/litre, as a water-soluble concentrate (O'Connor 1990; Worthing & Walker 1983). Some of the published toxicity data for glyphosate (in its acid form and as the isopropyl salt) to aquatic organisms is given below, in Table 1. Although I have not seem literature saying as much, I imagine that the isopropylamine salt is rapidly converted to the acid form in water.

Table l. Toxicity of glyphosate to aquatic organisms

Organism	96 hour LC 50 in mg/litre*		Reference
	glyphosate (acid)	glyphosate isopropylamine salt	
chironomid**	10–50	N/A	1
Daphnia magna**	2.95	N/A	1
rainbow trout	86	8.2	2
bluegill minnow	120	10.5	2

* The 96 hour LC50 is the concentration causing 50% mortality of test animals over a period of 96 hours (4 days).
** Refers to a 24 hour exposure period.
1 Meyer & Ellersieck1986
2 Worthing & Walker 1983

The data indicate that the isopropylamine salt (i.e.the form that is in Roundup®) is about 10 times more toxic to sensitive freshwater fish than is the acid form. Compared to other pesticides, such as synthetic pyrethroids and organophosphate insecticides, both the acid and the isopropylamine salt forms of glyphosate would be considered practically non-toxic to aquatic life when entering aquatic ecosystems in runoff from land, overspray from air or ground applications, or leachate from groundwaters. That is because the concentrations in such runoff would already be well below that which is considered harmful and would be subject to further (in-stream) dilution (Edwards et al. 1980; Wilcock 1993; Willis & McDowell 1982).

Any chemical can exert a toxic effect if the concentration or dosage is sufficiently high. In the case of Roundup® this might be when a large amount of undiluted material enters a waterway, such as from illegal washing of spray equipment or from rupture of a drum of Roundup®. Efforts should be made to minimise the chances of these sorts of inputs to streams and other waterways.

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I have not been able to find data for the bioconcentration of glyphosphate by aquatic organisms but would suggest that, based on its chemical structure, it is readily excreted and not accumulated.

The high solubility of glyphosate (and its salts) in water means that Roundup® is not a suitable herbicide for treating aquatic plants (O'Connor 1990). For the same reason, residues of glyphosate in waterways are unlikely to exert a herbicidal effect unless there is prolonged exposure from a major input (e.g. a spill of concentrated product). Normally, one might expect glyphosate to be rapidly dispersed and diluted.

2. Pulse®

I have been unable to acquire any information about the toxicity of this product to aquatic organisms and have had to approach Monsanto for the meagre data that I do have about its other properties. Pulse® penetrant is an organosilicone surfactant that is also known as SILWET® Silicone Surfactant (Union Carbide Chemicals and Plastics Co. Inc.). Because it is not an "active ingredient" but is an additive, toxicity data are not needed for its registration as a pesticide (M. Willocks, Monsanto, pers. comm.). In general terms, Pulse® seems to be of moderate-low toxicity (i.e. in feeding trials to rats and dogs), and not mutagenic (causing cellular changes that might cause cancers or otherwise alter genetic traits). Pulse® is a moderate-mild skin irritant (M. Willocks, Monsanto, pers. comm.).

A study of the effects of various Roundup® formulations on 4 species of aquatic invertebrates and 4 species of fish indicated that the surfactant was the primary toxic agent of the formulations (Murty 1986). Based on this limited information and a consideration of the chemistry of Pulse® I would think that under normal conditions of use little harm would result from inputs to natural waters. Furthermore, I am of the opinion that the silicone polymer would degrade in water (hydrolyse), reasonably quickly.

CONCLUSIONS

Roundup® and Pulse® are both highly soluble formulations that will disperse rapidly upon entry to natural waters. They are of low toxicity and inputs from normal land-based uses are highly unlikely to generate concentrations that might be considered harmful.

Aquatic plants are unlikely to be affected unless exposed to very high concentrations for a prolonged period.

Normal precautions should be taken in handling bulk chemicals and in disposing of , or cleaning, empty containers.

Finally, I understand that Mr Bill Fleury, DoC Wanganui, has also assessed the use of Roundup® and Pulse® for control of spartina in the Foxton River estuary. It might be worth approaching that office for additional information.

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Yours sincerely

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Scientist