BENSULFURON FOR MANAGEMENT OF AQUATIC WEEDS IN IRRIGATION SYSTEMS

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Summary. Bensulfuron methyl was tried as a soil-residual herbicide in irrigation channels by treatment of empty channels about a week before the start of irrigation water flows in spring. Assessments in the late summer following showed poor control of *Myriophyllum variifolium*, fair control of *Elodea canadensis*, moderate control of *Vallisneria gigantea*, and excellent control of *Potamogeton tricarinatus*.

INTRODUCTION

In Australia, the management of submerged aquatic weeds in irrigation channels is mainly dependent on the use of acrolein. This herbicide is applied by injection into flowing water and has a necrotic effect on green tissue. Ribbonweed, *Vallisneria gigantea*, and elodea, *Elodea canadensis*, which are the two most important submerged weeds, are effectively and rapidly treated. Floating pondweed, *Potamogeton tricarinatus*, with both submerged juvenile leaves and floating waxy leaves, is less easily controlled; and only limited effects are obtained on the semi-emergent species, common water milfoil, *Myriophyllum variifolium*. On all these plants the effect of acrolein is short-term, and two applications are often required each season. Acrolein has several other disadvantages. It is extremely toxic to aquatic organisms and fish; and its handling, transport, storage and application require special facilities and training.

Bensulfuron methyl is very effective in controlling broad-leaved weeds in rice when applied into the flood water. Its efficacy, safety and adoption in the rice industry prompted further experiments into its efficacy in irrigation distribution channels. Bensulfuron methyl (Mariner®) dry flowable formulation was supplied by Du Pont (Australia) Ltd. for evaluation. We investigated its potential for use in drained channels by application to the sediment. Prospects for longer-term management of weeds were investigated, since the economy and logistics of weed control and water supply would be improved by an effective single annual treatment applied during the drawdown period.

METHODS

Bensulfuron methyl was applied in four experimental sites in early spring 1989. The sites were selected for homogeneity and purity of weeds. Experiments on common milfoil and ribbonweed were located in the Murrumbidgee Irrigation Areas, near Griffith; floating pondweed near Murrami; and the elodea experiment near Deniliquin in the Murray Valley, New South Wales.

The channels were each divided into at least 3 blocks, with treatments randomised within the blocks. The five treatments were 100, 200 and 300 g/ha of bensulfuron methyl. Two untreated controls were used in each block to improve the assessment of weed variability along the channel. Plot lengths varied from 13 to 50 m.

Ideally, the herbicide is applied to impounded water, or directly on to the wet sediment surface following draining (drawdown). Application to impounded water is impracticable in Australian irrigation practice. In this experiment we applied the herbicide near the end of the 3-month drawdown period and at least 4 days before channels were refilled with water in the spring.
The water status of the sites varied between dry and flooded. Where there was no free water at treatment, in elodea and ribbonweed experiments, applications of herbicide were followed by water (2500 L/ha) to simulate rainfall, in an attempt to fix the herbicide in the sediment. Channels were filled with water 4-15 days after treatment, and held full for 6-9 days before draining and refilling with new water. Further details are given in Table 1.

Quadrats (0.25 m^2) were harvested from the untreated plots before treatment, and from all treatments at the conclusion of the irrigation season. Plots were also assessed visually at intervals.

Table 1.Time of application of bensulfuron methyl, and subsequent water management.

Weed	Date treated	Channel filled (DAT)[a]	Channel drained and refilled (DAF)[a]	Final assessment (DAT)[a]
Elodea	4.9.89	15	7	168
Milfoil	20.9.89	6	9	-
Ribbonweed	20.9.89	4	8	127
Pondweed	15.9.89	8	6	132

[a] Days after treatment (DAT); days after filling (DAF).

RESULTS

Pre-treatment analysis showed good cover of weeds in all four experiments and reasonable homogeneity (Table 2). Ribbonweed appeared to be a dense even mat of decaying plant material.

Results obtained at the conclusion of the irrigation season, some 18-24 weeks after treatment are shown in Table 3. (Visual assessment showed negligible control of common milfoil, even at the highest rate of bensulfuron methyl).

Table 2. Pre-treatment assessment of weeds freshweight for 6 plots.

Weed	Mean (g/m^2)	C.V. (%)	Range (g/m^2)
Elodea	433	30	296-772
Milfoil	1815	38	972-2552
Pondweed	1484	19	1096-1780

Table 3. Effect of bensulfuron methyl on fresh weight of weeds at the end of the irrigation season.

Bensulfuron methyl (g/ha)	Elodea (g/m^2)	Ribbonweed (g/m^2)	Pondweed (g/m^2)
0	2163	5290	3413
100	1998	3564	121
200	2017	1513	53
300	1418	894	414
lsd (P = 0.05)	(NS)	1467	571

Figures are means of 3 plots except for untreated controls which are means of 6 plots.

DISCUSSION

Elodea. Stunting was evident early in the season but regrowth occurred later. The highest rate of bensulfuron-methyl reduced biomass by about 54%, and this was considered to give a worthwhile increase in channel flow capacity by water authority officers. Successive treatments over several seasons may still be worth investigating. Application immediately after the autumn drawdown onto exposed sediments or on to shallow static remnant water should also be investigated.

Common milfoil. The weed was dense at treatment, and had begun to grow after a mild winter. New shoot tips became chlorotic after treatment but all treatments fully recovered by the close of the irrigation season in autumn. Earlier treatment, before spring growth, may be tried to improve results in future.

Ribbonweed. Control was quite good, with weed populations showing stunted growth rather than removal. Rates of 200 and 300 g/ha were similar in effect, with reduction in plant biomass by 71 and 83%, respectively. As with elodea, successive treatments over several seasons may reduce the biomass sufficiently to require only periodic treatment.

Floating pondweed. This species was the most sensitive of those tested, with excellent control being maintained season-long, even at 100 g/ha of herbicide. However, unless a higher rate is used there is a danger that in mixed stands, repeated treatments could lead to the development of the more resistant species.

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