

## HERBICIDE TOLERANCE OF THREE GROUND COVER SPECIES WITH POTENTIAL FOR USE IN ORCHARDS

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### SUMMARY

A strategy to reduce or eliminate herbicide use in orchards during the growing season could be to grow ground covers which are sprayed to keep them pure only during crop dormancy. The results of three pot experiments are presented to show how potential ground cover species are being assessed for herbicide tolerance. Creeping buttercup (*Ranunculus repens*), creeping speedwell (*Veronica filiformis*) and creeping willow herb (*Epilobium nummulariifolium*) were each tolerant of several herbicides. The suitability of these species to act as weed-smothering orchard ground covers is discussed.

**Keywords:** creeping buttercup, creeping speedwell, creeping willow herb, orchard crops, ground cover

### INTRODUCTION

Vegetation under orchard trees is generally controlled by mowing between tree rows and removing all vegetation with herbicides in strips directly beneath the trees (Harrington *et al.* 1992). The bare soil beneath trees is conducive to germination of weed seeds, so several applications of knockdown and residual herbicides are often required during the growing season to keep this soil bare. There has been considerable public concern in recent years about the use of pesticides in the production of food, especially since doubts were raised by MacIntyre *et al.* (1989) about the level of testing for pesticide residues in food.

One way of reducing the possibility of herbicide residues being found in fruit might be to replace the bare soil under trees with a low-growing ground cover species which could prevent weeds from establishing. Herbicides with little or no persistence could be used during tree dormancy to remove any weeds that did invade the ground cover, but no herbicides would be used during the growing season. The ground cover could be planted over the complete orchard floor and reduce the need to mow, freeing up labour for more productive activities.

Any competition that did occur between ground cover plants and trees might be overcome by applying extra fertiliser and irrigation. However Durand (1991) has shown that competition between ground covers and orchard trees actually can be beneficial at certain times in the growing season, increasing the quality of fruit produced and reducing the need for summer pruning.

As part of a research programme to investigate the possible role of ground covers in orchards, three potential species were tested for tolerance to herbicides. Creeping buttercup, creeping speedwell and creeping willow herb are often considered to be weeds themselves. However they all form perennial, low-growing, stoloniferous mats of vegetation and are known to tolerate several herbicides. These characteristics make them potentially useful as orchard ground covers.

Although the objective is to use only non-persistent herbicides once ground covers are established, residual herbicides were also screened as these could be used in the first year to help establish ground covers.

### METHODS

Polythene planter bags (1.5 litres for creeping buttercup, 600 ml for the other two species) were filled with Kiwitea loam soil (pH of 5.0 and 7.7% organic matter) and

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plants of the three ground cover species were established in these by transplanting from the field during November 1992. Creeping buttercup was obtained from a dairy pasture, creeping speedwell from a Palmerston North lawn and creeping willow herb from weed-infested pots in a glasshouse. The bags were then placed on automatically sub-irrigated felt mats in a glasshouse kept at temperatures between 18 and 26°C. Plants were left to become well established, and were periodically trimmed to prevent stolons growing out of the bags.

A range of herbicides (Fig. 1) were applied to plants of each species using a laboratory pendulum sprayer similar to that described by Wiese (1977). As the herbicides were being assessed for use on ground cover species growing under fruit trees, it was mainly only chemicals registered for orchard use that were studied. Herbicides were applied to creeping willow herb in 340 litres/ha of water on 19 January 1993, to creeping speedwell in 310 litres/ha on 22 January 1993 and to creeping buttercup in 325 litres/ha on 28 January 1993. For each species, treatments were replicated five times and allocated using a completely randomised design.

All plants were visually assessed for herbicide tolerance 7 weeks after treatment. An analysis of variance was performed on the arcsine transformed scores, and means were separated using the Student-Newman-Keuls multiple range test.

### RESULTS AND DISCUSSION

Most of the residual herbicides applied to creeping buttercup plants caused little lasting damage (Fig. 1), although terbacil (Sinbar) and norflurazon (Solicam DF) did initially cause significant phytotoxic effects. Thus pendimethalin (Stomp 330E), oxadiazon (Foresite), dichlobenil (Prefix-D), simazine (Gesatop 500 FW), oryzalin (Surflan Flo), norflurazon and terbacil may all be useful products to prevent weeds from invading a sward of creeping buttercup until it was dense enough to prevent weeds from establishing. As this trial was only conducted on established plants, further work is necessary to determine which of these chemicals would also be safe for establishing seedlings of creeping buttercup.

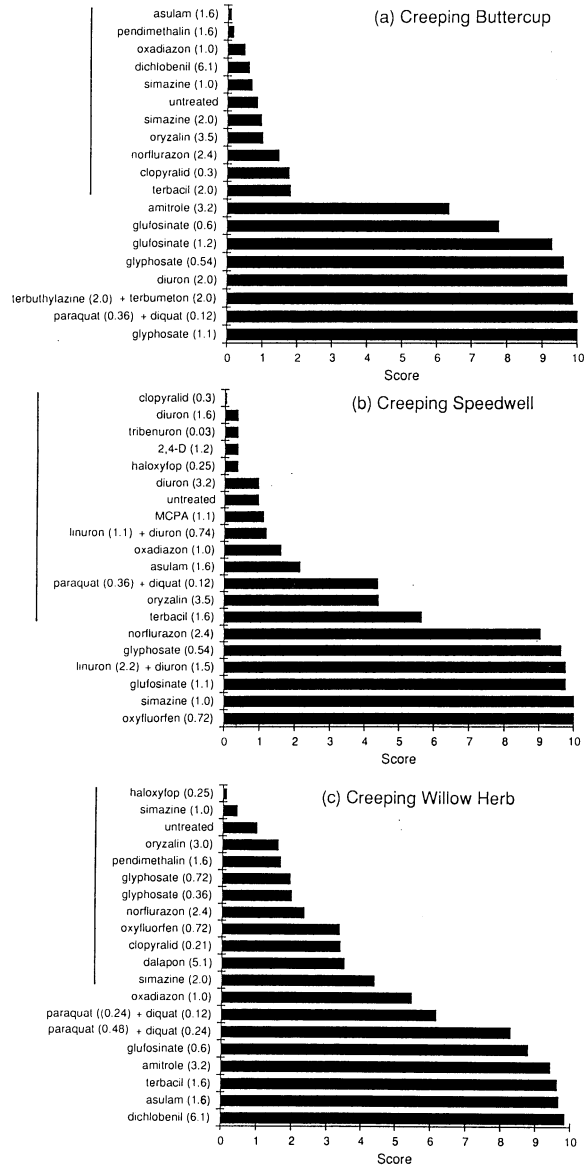
Berry (1992) found that a number of orchardists consider creeping buttercup to be a troublesome weed, so the terbuthylazine/terbumeton mixture (Caragard 500 FW) or diuron (Karmex) appear to be appropriate residual herbicides for growers wishing to kill this species.

Matthews (1975) claimed creeping buttercup is highly tolerant of amitrole, and Berry (1992) found a number of growers considered it also tolerant of low levels of glyphosate. In this work, amitrole (Amitrole ATA 40) caused a significant set-back to plants and, though the plants were not killed, the adverse response might be severe enough to open up a creeping buttercup ground cover and allow ingress of weeds. However, as the plants had been kept trimmed, there was little stolon material present in the bags. If a normal mat of stolons had been present as would be found in the field, plants may have shown more tolerance to these herbicides.

Although a wide range of residual herbicides were tolerated, the lack of tolerance to most of the foliar herbicides may make it difficult to clear broad-leaved weed species which invade a creeping buttercup sward. Further work is necessary with field populations of creeping buttercup to determine whether amitrole or glyphosate might possibly be used in this role.

Creeping speedwell is an invasive mat-forming turf weed which tolerates most herbicides registered for turf (Harrington 1992). Speedwells are also tolerant of many substituted urea herbicides (Matthews 1975). Results from this experiment confirm this (Fig. 1), with diuron and oxadiazon appearing to be suitable residual herbicides to keep weeds from invading open swards of creeping speedwell until a dense canopy has formed.

Invading weeds could be removed in winter using haloxyfop (Gallant), asulam (Asulox), clopyralid (Versatill), MCPA (IWD MCPA), 2,4-D (DowElanco 2,4-D Amine) and tribenuron (Granstar). The last four of these herbicides are not registered for use in orchards, but residues should disappear before the start of the growing season if they were applied in late autumn each year.



**Figure 1:** Effect of herbicides on three potential ground cover species in pots, 7 weeks after application (0 = healthy, 10 = dead). Application rates (kg ai/ha) appear in brackets. Treatments joined by vertical lines on the left are not significantly different (P=0.05) from the untreated control treatment.

One potential problem with using creeping speedwell is that few seeds are formed, so establishment would probably require planting of vegetative plugs. Another problem is that creeping speedwell is a bad turf weed but is limited in distribution at present. Planting in orchards may lead to more rapid spread into new areas of turf throughout the country.

The third species, creeping willow herb, is native to New Zealand and related to tall willow herb (*Epilobium ciliatum*) which causes problems in orchards due to its tolerance of many herbicides (Berry 1992). Creeping willow herb is probably much less competitive than tall willow herb as it forms a low-growing stoloniferous mat, though its prolific seed production makes it a weed problem in nurseries.

The experiment showed creeping willow herb to be tolerant of many residual (simazine, oryzalin, pendimethalin, oxyfluorfen (Goal) and norflurazon) and knock-down (glyphosate, haloxyfop, 2,2-DPA (Icapon) and clopyralid) herbicides (Fig. 1). This good tolerance of herbicides, coupled with its small size, dense growth habit and prolific seed production make this species the most promising of the three species discussed here as a possible orchard ground cover.

A number of other potential ground cover species have either already been tested for herbicide tolerance (Harrington and Grant 1993) or are being tested at present. The most promising species will then be planted into a pipfruit orchard to determine how well they establish and control weeds under conditions of shade, drought, soil compaction and other normal environmental stresses. Their effect on the quantity and quality of fruit produced will also be assessed.

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