CONTROL OF RUST-INFECTED BLACKBERRY WITH HERBICIDES IN VICTORIA

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Summary. Four trials were conducted on rust-infected blackberry. The rust infection did not appear to alter the efficacy of triclopyr, triclopyr plus picloram, metsulfuron methyl, amitrole, and 2,4,5-T, but fosamine may have been affected in one trial. Glyphosate gave indifferent control in two trials but good control in a third on a different species. Application of foliar-active herbicides in autumn after the rust had caused some defoliation gave control equal to or better than application at the beginning of infection. Time of application affected the soil-active herbicides hexazinone, tebuthiuron and imazapyr, but this was probably unrelated to rust infection.

INTRODUCTION

The eight blackberry species plus hybrids in Victoria (2) vary from very susceptible to highly tolerant in their response, to the strain of the blackberry rust, *Phragmidium violaceum*, which appeared in Victoria in February 1984 (4). The effect of the rust on susceptible species appears to vary between years according to seasonal conditions. A sufficiently high level of infection is not always present early enough to prevent seed production and tip-rooting of canes. Herbicides will continue to be necessary in situations where eradication or high levels of control are required. Questions that need answering are (i) does the rust infection alter the effectiveness of herbicide treatments, and (ii) when should herbicide be applied to gain the maximum combined effect?

It is difficult to compare, in the one trial on the one species, the effect of herbicides on rust-infected and rust-free blackberry. The less-than-perfect options are to compare the efficacy of herbicides on rust-infected blackberry with the responses observed prior to the rust's introduction, or on species which are not susceptible to the rust; or to compare the efficacy of applications before and after infection appears in any one season. In each case the effect of the rust on herbicide efficacy is confounded with the effect of season, species or time of application. If, over several years, the rust alters the growth and vigour of blackberry, results obtained now with herbicides may not apply in future years. Nevertheless guidelines are currently needed for the selection and timing of herbicides on rust-infected blackberry.

METHODS

Application in each trial was as a high volume spray to run-off using a motorized pump and a SS43LA variable cone hand-gun with a D5 nozzle (without swirl plate). Spray pressure was 850-1000 kPa. and spray volume about 2000 L/ha. Treatments were arranged in randomized complete blocks. Control was visually estimated. Where necessary, percentage control values were arcsin transformed for analysis.

Trial 1. *Rubus ulmifolius* hybrid was growing as an almost continuous hedge with few discrete bushes along a roadside at Foster North. At application on 11 April 1985 it was up to 1.5 m high and partially defoliated by blackberry rust. Plot size was approximately 20 m^2, and there were three replications.

Trial 2. *R. ulmifolius* hybrid was growing in an almost continuous infestation along a roadside at Foster North. At application on 20 December 1985, it was mostly at the pre-flowering stage, and up to 1.5 m high. There was a low density infection of yellow rust uredospores on the leaves. Plot size was approximately 20 m^2 with treatments replicated four times.

Trial 3. A factorial design with four replications was used to compare herbicides at three application times on *R procerus* growing in a perennial pasture at Mirboo North. Plots of 15-25 m^2 were either individual clumps or parts of larger thickets. The three application times, at 11 week intervals, were 14 November 1986 (pre-flowering), 30 January 1987 (green fruit stage), and 15 April 1987 (red and ripe fruit). The bushes were 1-1.6 m high (mostly about 1.5 m) at the first application time and up to 2.2 m high at the later applications. At the first applications 5-10% of leaves had 1 to 2 yellow uredospore pustules; at the second, most leaves still had only a low level of uredospore infection, along with a few black teleutospore pustules. There was no leaf death or defoliation. By the third application there was a moderate infection of yellow uredospores and black teleutospores were present. The rust had caused about 10% defoliation, but had not prevented fruiting or tip-rooting.

Trial 4. *R. ulmifolius* hybrid was growing 0.8-1.2 m high in a continuous roadside infestation at Foster North. A factorial design with four replications assessed herbicides at two application times. Plot size averaged 24m^2. The first application time was 15 December 1986, at early flowering. There were a few rust uredospore pustules per leaf, but no defoliation. At the second application time on 10 April 1987, blackberry fruiting had ended. There was a moderately heavy infection of uredospore pustules and some black teleutospores. There had been some leaf-fall.

RESULTS AND DISCUSSION

In Trial 1, application was late in the season when the blackberry was partially defoliated by the rust. Most of the foliar-acting herbicides gave control within the range usually observed for them (3, 6) with non-infected blackberry (Table 1). However glyphosate and fosamine probably gave somewhat poorer control than expected. Tebuthiuron, and hexazinone, which are active through the soil, both gave inadequate control. This was more likely related to timing and dose than to the presence of rust-affected foliage.

Application in Trial 2 was early in the season, when the rust infection was low. Triclopyr (butoxyethanol ester), triclopyr ester plus picloram (triisopropanolamine), glyphosate, fosamine and metsulfuron methyl gave comparable results to the control they gave in the first summer after application in Trial 1, while amitrole and 2,4,5-T (iso-octyl ester) gave poorer control (Table 1). This suggests that, in Trial 1, the efficacy of these herbicides was not reduced by application to partially defoliated blackberry. Glyphosate and fosamine gave indifferent control in both trials and it is possible that the rust reduced their efficacy. However, since glyphosate gave equivalent results in both trials, the severity of rust infection at application does not appear to have been be a factor. Fosamine is only effective when applied in late summer or autumn (5), so control in Trial 1 should have been better than in Trial 2. The root-absorbed herbicides hexazinone and tebuthiuron gave better control than in Trial 1, probably because the December application coincided better with upward sap flow.

In Trial 3, there was little increase in the level of rust infection between the first and second application times, and the control from the two application times was comparable (Table 2). By the third application time, the rust was obvious, if not particularly severe. Control from these April applications was about equal to that from earlier applications, except for glyphosate which was significantly better (P=0.05). However, there may be some bias in favour of the last application time because of the shorter interval between application and assessment. Glyphosate gave better results in this trial, than in Trials 1 and 2. It is tempting to suggest that this could be a species effect, since the greater difficulty in controlling *R. ulmifolius* hybrid has been observed with other herbicides (1). Hexazinone gave inadequate control in Trial 3, but control was not influenced by application time.

Table 1. Control of rust-infected *R. ulmifolius* hybrid 8 and 20 months after herbicide application in April 1985 in Trial 1, and 12 months after application in December 1985 in Trial 2.

Herbicide	Rate (g/100L)	Trial 1 Control (%) 8 M.A.T.[a]	Trial 1 Control (%) 20 M.A.T.	Trial 2 Control (%) 12 M.A.T.
Amitrole	500	90(71.56)[b]	72	28(31.31)[b]
2,4,5-T L.V. ester	68	67(55.86)	32	35(36.00)
Triclopyr ester	100	92(76.84)	72	83(68.79)
Triclopyr ester plus picloram	100 +33	97(81.39)	85	99(86.77)
Glyphosate	360	70(61.03)	48	68(55.44)
Fosamine[c]	430	57(48.85)	42	59(50.48)
Metsulfuron methyl[c]	3			23(27.86)
Metsulfuron methyl[c]	6			96(82.27)
Metsulfuron methyl[c]	9			98(81.87)
Metsulfuron methyl[c]	12	98(85.69)	93	99.5(87.13)
Hexazinone	250	13(13.08)	38	84(69.22)
Tebuthiuron[d]	4.0kg/ha	25(25.25)	63	90(71.86)
Untreated	-	0(0.00)	5	15(22.41)
s.e.d. (16 d.f.)		(11.91)	18.2	(6.44)

[a] M.A.T. = months after treatment

[b] Data transformed to arcsin √% for analysis

[c] Agral 60 surfactant included in spray at 0.2% v/v

[d] As pellets containing 200 g/kg

Table 2. Control of rust-infected *R. procerus* in Trial 3. Herbicides applied in November 1986, January 1987 or April 1987 and assessed in May 1988.

Herbicide	Rate (g/100L)	Application date 14.11.86	30.1.87	15.4.87
		Control(%) 3.5.88		
Triclopyr ester	100	79(63.77)[a]	84(67.07)	78(61.72)
Triclopyr ester plus picloram	100 +33	98(84.46)	91(74.08)	94(77.28)
Glyphosate	360	78(67.40)	79(63.04)	97(79.29)
Metsulfuron methyl[b]	6	96(82.16)	98(83.30)	100(90.00)
Hexazinone	250	49(44.06)	50(45.00)	45(41.59)
Untreated	-	13(20.61)	15(22.79)	13(20.61)
s.e.d. (50 d.f.) =			(7.39)	

[a] Data transformed to arcsin √% for analysis.

[b] Agral 60 surfactant included in spray at 0.2% v/v

In Trial 4, the April applications of all herbicides gave equal or better control than the December applications (Table 3). This was so, even though by April, the rust had caused some defoliation, which might have been expected to reduce the uptake of the (predominately) foliar-acting herbicides triclopyr and metsulfuron methyl. With imazapyr, which is taken up through both foliage and roots, the December application also might have been expected to give the better results. The differing assessment intervals for the two application times may bias the results somewhat in favour of the April applications.

Table 3. Control of rust-infected *R. ulmifolius* hybrid in Trial 4. Herbicides applied in December 1986 and April 1987 and assessed in January 1988.

Herbicide	Rate (g/100L)	Application date 15.12.86	10.4.87
		Control (%) on 28.1.88	
Triclopyr ester	100	73	78
Metsulfuron methyl[a]	6	72	97
Metsulfuron methyl[a]	9	93	99.8
Imazapyr	83	11	18
Imazapyr	167	28	79
Untreated	-	0	3
s.e.d. (30 d.f.)		6.9	

[a] Agral 60 surfactant included in spray at 0.2% v/v

The results from these trials suggest that (i) the rust has not, to date, decreased the susceptibility of blackberry to foliar-applied herbicides, and (ii) applying these herbicides after the rust has caused some defoliation gives equal or better control than applications earlier in the season. While soil-active herbicides have the potential to give high levels of control, their persistence and broad-spectrum activity makes them less attractive as general treatments against blackberry as long as foliar-active herbicides continue to be effective.

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