Effects of herbicides on weed control and fruit quality in blackcurrant.

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Herbicide treatments were tested for their ability to control weeds and their effect on fruit quality in well-established blackcurrant during 2012. The trial was conducted at East Adamston farm (Andrew Husband, grower cooperator) near Muirhead (Angus), Scotland.

Materials and Methods

Seven-year-old blackcurrant ('Ben Dorain') was used for the trial. Plots were 9 m long by 1 m wide, centered on a single row of blackcurrant bushes; two adjacent rows were used for the trial. Herbicide combinations, napropamide + pendimethalin or metribuzin + flufenocet, were applied as a directed spray to the soil on 13 March using an air-pressurized backpack sprayer. Because these herbicides do not have postemergence activity on weeds, all plots, including nontreated control plots, had previously been treated with diquat on 1 March to remove emerged weed foliage. Initial weed cover within three 50 by 50 cm quadrats/plot was estimated prior to herbicide application (29 February) and again on 4 April and 22 May (1 and 2 months after treatment (MAT), respectively). Plots were then hand-weeded 13 June and 4 July to minimize the effect of weed interference on berry production.

Plots were harvested using the grower's machine harvester on 2 August and berries from each plot were weighed in the field. Additionally, 50-ml berry samples were collected from each plot and frozen at -80 C until used for fruit quality analyses. Three-berry subsamples were extracted for organic acid and sugar identification and quantification on 16-20 August and for vitamin C quantification on 27-28 September. Total fruit polyphenols were measured on 7 September and total anthocyanin on 18 September using a spectrophotometer. Sugars were identified and quantified on 29-30 August and organic acids were identified and quantified on 12-14 September, both using HPLC. Fruit remaining following extraction were processed for juice ºBrix score and pH on 26-27 September.

The experimental design was a randomized complete block with three replicates. Data were analyzed using SAS, and means were separated using Fisher's Protected LSD (P = 0.05).

Results

There were no significant differences in weed cover in the treatments prior to herbicide application (Table 1, 29 February evaluation). Two weed species were most numerous in the plots: common groundsel (*Senecio vulgaris*, annual) and willow-herb (a compilation of several *Epilobium* species, both annual and perennial, and *Chamerion angustifolium*, a perennial). These species accounted for 75 to 84% of all species recorded in the plots at the February evaluation. Artist and Stomp + Devrinol reduced weed cover by 75 and 35%, respectively, by 3 weeks after treatment (WAT, 4 April evaluation). At that time, both products were controlling 93% of common groundsel seedlings, but there was no influence on willow-herb. By 10 WAT (May evaluation), Stomp + Devrinol was still providing 69% common groundsel control, but control with Artist was similar to the nontreated check. Willow-herb control at 10 WAT with Stomp + Devrinol and Artist was 80 and 87%, respectively; these products were controlling primarily seedling willow-herb plants of the annual *Epilobium* species, not the perennial *Chamerion* species. Herbicide treatment did not significantly affect total weed cover at 10 WAT, although total weed density was reduced from 45 to 68% by these herbicides.

Herbicide treatments did not affect berry yield in this trial (Table 2), although there was a trend toward lower yield in treated plots. This may indicate a degree of herbicide phytotoxicity to blackcurrant, or simply be due to differences in vigor of the tested bushes prior to herbicide application.

Similarly, most fruit quality parameters were not significantly affected by herbicide treatment in this trial. The only statistically significant affect was an increase in total sugar content of fruit from blackcurrant treated with Stomp + Devrinol compared with fruit from nontreated bushes or those treated with Artist (Table 2). All measured sugars (glucose, fructose, and sucrose) displayed a similar pattern (data not shown). Although statistically nonsignificant, other trends in the fruit quality data included a tendency toward higher polyphenol content, lower anthocyanin content, fewer organic acids, and greater vitamin C content in nontreated blackcurrant; fruit also tended to be fewer and larger on nontreated bushes. Despite the tendency toward lower yield in Artist-treated plots, juice yield was numerically highest from those fruit. There was no clear relationship between herbicide treatment and juice ºBrix or pH.

Preliminary Conclusions

Stomp, Devrinol, and Artist provided at least 10 weeks of control of seedling common groundsel and willow-weed species. Herbicides did not significantly affect yield or most fruit quality parameters, although total sugar was increased by treatment with Stomp + Devrinol.

Table 1. Weed cover (%) and weed counts (plants/m^2) before and after herbicide application to 'Ben Dorain' blackcurrant.

Herbicide[z] and date of evaluation	Rate		Weed cover	Willow-herb	Common groundsel	Total weeds[y]
	kg ai/ha	product/ha	%	plants/m^2	plants/m^2	plants/m^2
29 February, prior to application						
Stomp + Devrinol	1.3 + 3.2	2.9 L + 7 L	20	28.2	0.4	34.2
Artist	1.7	3.3 kg	29	22.2	3.6	33.4
Nontreated	---	---	31	30.0	2.9	43.8
$LSD_{0.05}$	---	---	NS	NS	NS	NS
4 April, 3 weeks after treatment						
Stomp + Devrinol	1.3 + 3.2	2.9 L + 7 L	8 b	0.8	0.9 b	273.8
Artist	1.7	3.3 kg	3 c	0.3	0.9 b	177.6
Nontreated	---	---	12 a	0.9	13.6 a	333.3
$LSD_{0.05}$	---	---	4.2	NS	6.2	NS
22 May, 10 weeks after treatment						
Stomp + Devrinol	1.3 + 3.2	2.9 L + 7 L	21	12.2 b	15.8 b	40.2 b
Artist	1.7	3.3 kg	11	7.8 b	57.8 a	69.6 b
Nontreated	---	---	25	61.6 a	50.4 a	125.8 a
$LSD_{0.05}$	---	---	NS	16.1	4.0	29.5

[z]All plots were treated with Retro (diquat) at 2L/ha (400 g diquat/ha) + nonionic surfactant (0.25%, v/v) 1 March 2012; residual herbicides applied to appropriate plots 13 March 2012.

[y]Most of the total weeds counted in the plots at the April evaluation were seedling blackcurrant.

Table 2. Berry yield[z] and fruit quality parameters from 'Ben Dorain' blackcurrant treated with herbicides in late dormancy (2012).

Treatment[y]	Rate	Berry yield	Berry number	Mean berry weight	Juice yield	°Brix	pH	Total polyphenols	Total anthocyanin	Total sugars	Total organic acids	Vitamin C
	producttha	kg/plot	no./sample	g/berry	L/tonne			mg/100ml	mg/500ml	g/L	g/500ml	mg/100ml
Stomp + Devrinol	2.9 L + 7 L	16.23	27.7	0.80	518	16.1	2.47	4037	3868	1674 a	91	0.61
Artist	3.3 kg	13.71	27.0	0.79	536	15.8	2.44	4022	3645	1334 b	85	0.72
Nontreated	---	17.56	25.7	0.88	530	16.1	2.46	4102	3315	1430 b	66	0.83
Pr > F	---	0.06	0.94	0.72	0.83	0.76	0.66	0.98	0.71	0.02	0.49	0.44

Means within a column and followed by the same letter, or not followed by a letter, are not significantly different (P < 0.05).

[z]Plots harvested 2 August 2012.

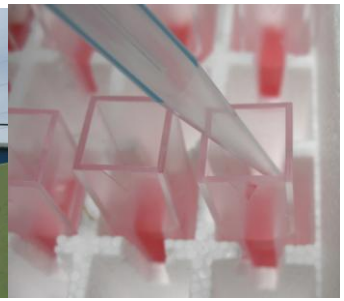
[y]All plots were treated with Retro (diquat) at 2L/ha (400 g diquat/ha) + nonionic surfactant (0.25%, v/v) 1 March 2012; residual herbicides applied to appropriate plots 13 March 2012.

Initial herbicide application.

Weed counts in early spring.

Machine harvest of 'Ben Dorain'.

Collecting fruit from machine harvested plots.



Pipetting anthocyanin extracts.