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Response of Some New Clonal Cherry Rootstocks to Soil Active Herbicides

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Abstract

Five non-grafted clonal cherry rootstocks (Gisela 6, GI 148-1; Gisela 7, 148-8; Gisela 8, 148-9; Gisela 10, 173-9; Gisela 11, 195-1) were treated with label rates and double label rates to assess their response to soil active herbicides. Clonal cherry rootstock Giessen 148-9 showed reduced growth and greater visual herbicide symptoms than the other GI rootstocks used. Terbacil produced the greatest reduction in growth and the greatest visual symptoms across all clones. These cherry rootstocks do not appear overly sensitive to soil active herbicides even when applied at greater than labeled rates.

Introduction

Recently a number of promising clonal cherry rootstocks have been introduced into commercial trade (6, 8). These rootstocks offer precocity, size control and good yields. However, since growers have little experience with these new rootstocks unforeseen problems may arise as they are widely planted. Vegetation, especially grasses, growing near fruit trees can compete with the trees for water and nutrients and will reduce growth and productivity (4). Weeds can also compete for bee visits (1) and may be reservoirs for insect and disease pests (3). As a result, many growers use tank mixes of pre-emergent and post-emergent herbicides to manage weeds around their trees (7). Because many pre-emergent herbicides are active in the root zone the possibility exists that some of the new clonal rootstocks might be more susceptible to these herbicides than the seedling rootstocks previously used. An additional concern was the effect of herbicides on cherries grown in shallow gravelly soils. This research project was initiated to determine if newer clonal rootstocks would be adversely affected by pre-emergent herbicides that are labeled for cherry.

Materials and Methods

This research was conducted at the Peninsular Agricultural Research Station near Sturgeon Bay, WI. Five promising rootstocks from the Giessen series were used (Gisela 6, GI 148-1; Gisela 7, 148-8; Gisela 8, 148-9; Gisela 10, 173-9; Gisela 11, 195-1). These are all interspecific hybrids with *Prunus cerasus* as one of the parents (8). Rooted cuttings were obtained from commercial nurseries and were planted in a greenhouse into commercial potting soil. Mahaleb trees were planted as a reference standard, but these trees were damaged by severe cold in 1994 and were deleted from the data set. Once the GI plants were growing well they were transferred to the field in early June 1993. The soil was a shallow Longrie silt loam. The rootstocks were not grafted with a scion, but were left to produce their own foliage. Trees were planted in a randomized block design with 1 m between trees and 3 m between rows. Each replication of each treatment contained all 5 rootstocks, but the arrangement of individual rootstocks was randomized within the treatment blocks, replicated 4 times.

The herbicides were applied in either the spring or fall as was appropriate to the label. Materials were applied at an typical

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label rate and at double that rate to simulate an accidental over application. The first treatments were applied in the spring of 1994. The area around the trees was kept vegetation free until that time by application of glyphosate as needed. Vegetation free and weedy control plots were provided in each block. If an herbicide treatment did not provide season long control, vegetation was controlled with glyphosate so that the soil active herbicide and not weed competition was the primary effect. Herbicides used were: Napropamide [*N*,*N*-Diethyl-2-(1-naphthalenyloxy)-propionamide], Oxyflurofen [2-chloro-1-(3-ethoxy-4-nitropheynoxy)-4-(trifluoromethyl) benzene], Diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea], Simazine [2-Chloro-4,6-bis (ethylamino)-s-triazine], Oryzalin [3,5-dinitro-N^4,N^4-dipropylsulfanilamide], Terbacil [3-tert-butyl-5-chloro-6-methyluracil], Isoxaben [*N*-{3-(1-ethyl-1-methylpropyl)-5-isoxazoyl}-2,6-dimethoxybenzamide].

Each fall the height and trunk caliper were measured on each tree. The final height and caliper measurements after four years of field growth are shown here (Tables 1, 2). Visual ratings of leaf chlorosis or necrosis were made late each summer and given a rating of 0 to 5, with 0 being no injury and 5 being severe injury. Visual ratings of symptoms were not made for the fall applied herbicides (pronamide and dichlobenil). Visual ratings were summed over the three years of the study (Table 3). Data were subjected to analysis of variance with mean separation by LSD following a significant F-test.

Results and discussion

The trees grew well initially and became established during the first year. Most of the rootstocks tolerated the herbicide treatments and continued to grow normally. Only GI 148-9 showed reduction in growth as a result of herbicide treatment. Among the herbicides terbacil produced

Table 1. Increase in height between 1993 and 1996 on 5 clonal rootstocks subjected to single or double rates of nine soil active herbicides. LSD values are provided for comparisons of means within rows or columns when a significant difference was found. n = 4.

Herbicide	Rate Kg ai/ha	Cherry Rootstock 148-1	148-8	148-9	173-9	195-1	LSD
Napropamide	4.48	112.5	155.0	129.0	90.7	117.0	ns
Napropamide	8.96	141.0	99.5	72.6	81.5	105.4	ns
Oxyfluorfen	2.42	123.0	85.3	147.6	93.0	112.3	45.61
Oxyfluorfen	4.84	142.0	148.0	140.0	92.0	125.0	ns
Pronamide	4.84	125.0	136.3	116.3	83.3	111.3	ns
Pronamide	9.68	129.3	117.7	125.0	76.8	112.5	ns
Diuron	3.63	110.3	112.0	158.5	114.7	144.3	ns
Diuron	7.26	103.0		96.7	96.3	137.0	ns
Simazine	4.84	112.3	100.7	113.3	113.0	136.0	ns
Simazine	9.68	123.7	130.0	109.3	92.7	128.8	ns
Oryzalin	7.26	135.7	118.0	130.0	98.0	131.4	ns
Oryzalin	14.52	120.0	145.5	137.8	75.8	124.8	ns
Dichlobenil	7.26	134.0	122.0	109.2	89.7	132.3	ns
Dichlobenil	14.52	123.3	120.3	103.0	74.7	111.6	ns
Terbacil	3.90	127.7	127.7	129.8	96.5	126.8	ns
Terbacil	7.70	112.7	6.0	49.0	48.5	134.2	73.82
Isoxaben	1.21	135.0	119.3	131.3	94.7	102.3	27.06
Isoxaben	2.42	102.0	151.3	110.2	81.0	119.3	35.93
Weed free		119.7	142.5	108.3	105.5	106.3	ns
Weedy		141.0	151.3	87.0	70.0	108.5	58.93
LSD		ns	ns	52.63	ns	ns	

Table 2. Increase in caliper between 1993 and 1996 on 5 clonal cherry rootstocks growing at Sturgeon Bay, WI. LSD values are provided for comparison of means within rows or columns.

Herbicide	Rate Kg ai/ha	Cherry Rootstock 148-1	148-8	148-9	173-9	195-1	LSD
Napropamide	4.48	31.8	27.4	21.2	16.2	28.2	ns
Napropamide	8.96	29.2	19.9	12.3	16.6	23.4	9.19
Oxyfluorfen	2.42	32.2	15.2	26.7	17.2	36.3	7.54
Oxyfluorfen	4.84	29.4	24.0	24.4	16.9	36.5	13.74
Pronamide	4.84	28.3	18.3	22.0	13.4	28.7	8.91
Pronamide	9.68	23.8	16.7	25.4	11.8	29.2	8.67
Diuron	3.63	31.6	18.7	25.0	21.2	37.5	10.74
Diuron	7.26	21.1		12.8	18.3	41.9	12.77
Simazine	4.84	27.9	14.2	17.3	21.8	34.9	14.05
Simazine	9.68	28.0	17.5	22.2	17.6	37.6	10.66
Oryzalin	7.26	27.2	18.7	17.4	13.6	33.2	7.11
Oryzalin	14.52	32.6	16.6	21.2	13.1	30.9	12.64
Dichlobenil	7.26	31.8	23.1	19.3	20.1	32.1	8.29
Dichlobenil	14.52	30.6	16.8	21.8	16.7	29.4	9.46
Terbacil	3.90	28.2	26.4	22.3	21.2	35.5	ns
Terbacil	7.70	24.8	–0.5	9.8	13.4	39.4	24.63
Isoxaben	1.21	31.0	20.2	24.0	14.2	30.6	6.50
Isoxaben	2.42	26.5	25.5	18.6	12.5	29.5	8.44
Weed free		25.5	23.2	20.3	21.8	27.0	ns
Weedy		30.0	23.3	15.4	12.6	26.8	ns
LSD		ns	ns	9.67	7.28	ns	

the greatest reduction in height, particularly at the double rate (Table 1). Terbacil had a greater effect on tree height than uncontrolled weed competition. Because of its known potential for phytotoxicity, Terbacil is rarely used in cherry orchards. The high rate of napropamide also reduced height of GI 148-9.

The increase in trunk caliper followed the same trend as tree height. Only GI 148-9 showed a significant negative response to herbicide treatments (Table 2). Terbacil and the high rate of napropamide caused the greatest reduction in tree growth.

The visual ratings showed greater differences than growth. Terbacil, diuron and simazine caused the most leaf chlorosis (Table 3). Napropamide, oxyfluorfen, oryzalin and isoxaben did not produce any chlorosis or necrosis compared to the controls. Terbacil is known to cause leaf yellowing in cherry orchards. Terbacil, diuron and simazine are all photosynthesis inhibitors and would be the most likely to cause chlorosis. Chlorotic leaves would most likely to cause growth reductions since less photosynthate would be produced and available for growth. We did not do a visual rating of fall applied herbicide symptoms.

Of the rootstocks used in this study, GI 148-9 was the most sensitive to herbicides. Growers who choose to use GI 148-9 will need to be very cautious in their use of herbicides. The remaining rootstocks appeared to tolerate the soil active herbicides used in this study. When applied at label rates growers should experience no adverse effects from use of these herbicides. These findings agree with Hartley (2), who found no adverse affect on growth of sweet cherry trees from residual herbicides. However, tree growth was affected by the level of week control. Even twice yearly applications of residual herbicides over three years did not affect stonefruit tree growth in New Zealand (5).

Table 3. Cumulative visual rating scores for leaf injury between 1993 and 1996 on 5 clonal rootstocks subjected to single or double rates of nine soil active herbicides. Scores range from 0 (no injury) to 5 (severe injury). Visual ratings were not made for the fall applied treatments LSD values are provided for comparisons of means within rows or columns. n = 4.

Herbicide	Rate Kg ai/ha	Cherry Rootstock 148-1	148-8	148-9	173-9	195-1	LSD
Napropamide	4.48	0.0	0.5	0.3	0.0	0.0	ns
Napropamide	8.96	0.0	1.0	0.0	0.0	0.0	ns
Oxyfluorfen	2.42	0.0	0.7	0.4	0.0	0.0	ns
Oxyfluorfen	4.84	0.0	0.0	0.5	0.3	0.3	ns
Diuron	4.84	2.0	4.7	2.8	0.7	0.8	ns
Diuron	9.68	6.0		7.0	3.8	1.7	ns
Simazine	3.63	0.3	4.3	1.8	0.3	0.0	2.52
Simazine	7.26	1.0	5.0	4.0	2.0	0.8	2.93
Oryzalin	4.84	0.0	1.0	1.5	1.5	0.6	ns
Oryzalin	9.68	0.0	0.5	0.3	0.3	0.3	ns
Terbacil	7.26	3.0	6.0	6.3	4.3	2.8	ns
Terbacil	14.52	6.3	13.0	9.5	7.0	3.2	ns
Isoxaben	7.26	0.0	0.3	0.7	0.3	0.3	ns
Isoxaben	14.52	0.0	0.7	0.6	0.0	0.0	ns
Weed free	3.90	0.0	0.0	0.7	0.0	0.0	ns
Weedy	7.70	0.0	0.0	0.5	0.0	0.0	ns
LSD	1.21	2.85	3.98	2.65	2.89	2.24	
	2.42						

When the label rate and the double rate were compared over all herbicides, there were no clear indications that the higher rate caused more growth reduction or visual symptoms than the label rate (data not shown). However, when growth reduction was noted, the effect was almost always greater at the higher rate. Calibration of application equipment will be crucial to protecting young trees on these clonal rootstocks.

In conclusion, we did not find dramatic effects from treatment with soil active herbicides. With the exception of GI 148-9, when used with caution and with calibrated equipment these rootstocks should still perform up to their potential regardless of the herbicide used.

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