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Pelargonic Acid and Rainfall Effects on Glyphosate Activity in Trumpetcreeper (*Campsis radicans*)[1]

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Abstract: The effects of pelargonic acid and rainfall on glyphosate activity, absorption, and translocation in trumpetcreeper were investigated. Four- to six-leaf–stage plants raised from rootstocks were treated with glyphosate at 0, 0.42, 0.84, 1.68, and 3.36 kg ae/ha. Glyphosate at 1.68 kg/ha and higher controlled trumpetcreeper >98% and completely inhibited regrowth from rootstocks of treated plants. A simulated rainfall of 2.5 cm water applied at 6 h after glyphosate application (HAA) reduced efficacy by one-fifth compared with no rainfall. Absorption of ^{14}C-glyphosate in trumpetcreeper increased from 2.3 to 20.2%, whereas translocation increased from 0.4 to 10.5% from 6 to 192 HAA. At 192 HAA, 9.7% of the recovered ^{14}C-label remained in the treated leaf, 0.6% moved above the treated leaf, and 9.0% moved to fibrous roots and rootstock. The addition of pelargonic acid to glyphosate did not improve glyphosate absorption or translocation or synergize activity in trumpetcreeper compared with glyphosate alone. These results suggest that a 24-h rain-free period and 4 d without disturbance from tillage could maximize glyphosate absorption and translocation in trumpetcreeper.

Nomenclature: Glyphosate; pelargonic acid; trumpetcreeper, *Campsis radicans* (L.) Seem. ex Bureau #[3] CMIRA.

Additional index words: Absorption, interaction, rainfastness, regrowth, translocation, uptake.

Abbreviations: HAA, hours after application; WAT, weeks after treatment.

INTRODUCTION

Trumpetcreeper is a native perennial vine extensively found in the Mississippi Delta and is among the 10 most troublesome weeds in cotton (*Gossypium hirsutum* L.), soybean [Glycine max (L.) Merr.], and forestry (Webster 2001). Trumpetcreeper infestations are confined mainly to fine-textured soils (Elmore 1984; Elmore et al. 1989) and range from spotty to severe in cultivated fields. Trumpetcreeper is difficult to control because it can propagate from a deeply positioned and extensive root system (Elmore 1984; Elmore et al. 1989). Additionally, the plant produces numerous pods with hundreds of seeds in noncultivated areas such as ditches, roadsides, and fencerows. Trumpetcreeper can reproduce by seed and has the potential to spread to new areas by means of dispersed seed (Chachalis and Reddy 2000). Edwards and Oliver (2001) observed that even low densities of trumpetcreeper can interfere with soybean and one trumpetcreeper plant per 0.5 m^2 can cause 18% yield loss.

Many herbicides (e.g., acifluorfen, paraquat, glufosinate) that show promising trumpetcreeper control kill only the top growth and have little or no effect on the rootstock. Desiccation of foliage is only temporary, often partial, and new sprouts arise from underground rootstocks. Dicamba or glyphosate applied in spring or fall, either to a fallow field or after crop harvest, can reduce trumpetcreeper infestations (DeFelice and Oliver 1980; Edwards and Oliver 2001; Elmore et al. 1989; Reddy and Chachalis 2000). In greenhouse studies, glyphosate at 0.84 kg/ha controlled 62% of trumpetcreeper at 3 wk after treatment (WAT) (Chachalis et al. 2001). However, under field conditions trumpetcreeper control is variable, depending on degree of infestation and vigor of the underground root system. In an Arkansas study, glyphosate at 0.84 kg/ha controlled trumpetcreeper 95% 2 WAT in glyphosate-resistant soybean and 82% 1 yr after treatment (Edwards and Oliver 2001). In a Mississippi study, trumpetcreeper control was <88% 4 WAT with two applications of glyphosate at the 0.84-kg/ha rate in glyphosate-resistant soybean (Reddy and Chachalis 2000). Trumpetcreeper control was transitory because partially

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[3] Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available only on computer disk from WSSA, 810 East 10th Street, Lawrence, KS 66044-8897.

killed plants recovered and new flushes of shoots emerged from the underground network of rootstocks.

Use of herbicide combinations is a common weed control practice in many crop and noncrop situations. Herbicide mixtures can produce different interactions, but a synergistic or additive interaction will increase weed control efficacy. Pelargonic acid, a naturally occurring nine-carbon fatty acid, causes extremely rapid nonselective desiccation of green tissue (Savage and Zorner 1996). Pline et al. (2000) reported that addition of pelargonic acid to glyphosate caused injury to glyphosate-resistant soybean but did not improve its efficacy on several annual and perennial weeds.

To obtain efficient control of trumpetcreeper, a lethal amount of glyphosate must be absorbed and translocated to meristematic regions (buds) of the rootstock. There is no published information on absorption and translocation of glyphosate in trumpetcreeper plants. Uptake and translocation studies can provide useful information needed to devise long-term control strategies for trumpetcreeper. The specific objectives of this study were (1) to determine control and regrowth potential of trumpetcreeper treated with glyphosate, (2) to study the effect of rainfall on glyphosate activity, (3) to characterize absorption, translocation, and partitioning of glyphosate in trumpetcreeper, and (4) to examine the effect of pelargonic acid on glyphosate activity, absorption, and translocation in trumpetcreeper.

MATERIALS AND METHODS

Trumpetcreeper plants were grown from rootstocks collected from a farmer's field near Stoneville, MS. One 7-cm-long rootstock was planted in 9-cm-diam plastic pots containing a 1:1 (v/v) mixture of soil (Bosket sandy loam, fine-loamy, mixed thermic Mollic Hapludalfs) and jiffy mix.[4] Plants (one plant per pot) were grown in a greenhouse maintained at 33 and 25 (±3) C day and night temperatures, respectively, with natural light supplemented by sodium vapor lamps to provide a 14-h photoperiod. Four- to six-leaf–stage (18 to 24 cm tall) trumpetcreeper plants were used. The commercial isopropylamine salt formulation of glyphosate[5] was used in all experiments with no additional adjuvant.

Glyphosate Activity. Glyphosate at 0, 0.42, 0.84, 1.68, and 3.36 kg ae/ha was applied using an indoor spray chamber equipped with an air-pressurized system at a volume of 190 L/ha at 140 kPa using a 8002E flat-fan nozzle. Plants were returned to the greenhouse after spraying. Herbicide activity was assessed at 3 WAT. Shoots were clipped at the soil surface and oven dried, and dry weights were recorded. Data were expressed as percent shoot dry biomass reduction as compared with nontreated plants. Clipped plants were allowed to regrow for 5 wk, and the regrowth was harvested as described above to determine regrowth potential of the herbicide-treated plants. Treatments were arranged in a randomized complete block design. Treatments were replicated four times, and the experiment was repeated. Data were subjected to regression analysis using PROC REG, and R^2 value was calculated as 1.0 minus the ratio of the residual sum of squares to the corrected total sum of squares (SAS 1998).

Glyphosate Rainfastness. Glyphosate at 0.84 kg/ha was applied to trumpetcreeper plants as described previously. A simulated rainfall of 2.5 cm water (7.5-cm/h intensity) was applied, using a rainfall simulator, at 6, 24, 48, 96, and 192 h after application (HAA) of glyphosate (Meyer and Harmon 1979). The rainfall simulator was set to deliver droplets at a height of 2 m, and the actual amount of rainfall was measured at the plant level with rain gauges (Reddy 2000). The rainfall simulator was set up indoors, and plants were returned to the greenhouse after the simulated rainfall. Nontreated and glyphosate-treated plants with no rainfall also were included. Shoot dry biomass reduction at 3 WAT and shoot regrowth reduction at 8 WAT were determined as previously described. Treatments were arranged in a randomized complete block design with four replications, and the experiment was repeated. Data were subjected to combined ANOVA, and means were separated using Fisher's LSD test at $P = 0.05$.

Absorption and Translocation of ^{14}C-Glyphosate. Trumpetcreeper plants were transferred from the greenhouse to a growth chamber 2 d before ^{14}C-glyphosate treatment for acclimatization. Growth chamber conditions were 30 and 25 C day and night temperatures, respectively; 60 and 90% day and night relative humidity, respectively; and a 14-h photoperiod (900 μE/m^2/s). Plants were presprayed at a rate of 0.84 kg/ha glyphosate immediately before ^{14}C-glyphosate treatment. The ^{14}C-glyphosate treatment solution was prepared by diluting ^{14}C-glyphosate (^{14}C-methyl labeled, specific activity 2.04 GBq/mmol, 99% purity in an aqueous stock solution of 7.4 MBq/ml as *N*-[phosphonomethyl]glycine) in a com-

[4] Jiffy mix, Jiffy Products of America Inc., 951 Swanson Drive, Batavia, IL 60510.

[5] Roundup Ultra®, isopropylamine salt of glyphosate with surfactant, Monsanto Agricultural Company, 800 North Lindbergh Avenue, St. Louis, MO 63167.

mercial formulation of glyphosate to give a final concentration of 0.84 kg in 190 L of water (Reddy 2000). Ten microliters of ^{14}C-glyphosate solution containing 5.0 kBq was distributed in 25 droplets on the adaxial surface of all the leaflets of the second youngest fully expanded pinnately compound leaf, which had been covered with aluminum foil while spraying to avoid a double dose of glyphosate. Plants were subirrigated with water as needed.

Treated plants were harvested at 6, 24, 48, 96, and 192 HAA. Treated leaves were excised, immersed in 10 ml deionized water, and shaken for 20 s to remove the ^{14}C-label remaining on the leaf surface. Plants were sectioned into treated leaf, leaves and shoot above the treated leaf, leaf opposite the treated leaf, leaves and shoot below the treated leaf, fibrous roots on the rootstock, and rootstock. Plant sections were wrapped in tissue paper[6] and dried at 45 C for 48 h. The oven-dried plant samples were combusted in a biological oxidizer,[7] and the evolved $^{14}CO_2$ was trapped in 10 ml CarboSorb E[8] and 12 ml Permaflour E.[8] Two 1-ml aliquots of each leaf wash were mixed with 10 ml scintillation cocktail.[9] Radioactivity from leaf washes and oxidations was quantified using liquid scintillation spectrometry.[10] Total amount of radioactivity present in leaf washes and all plant sections was considered as total ^{14}C recovered. The ^{14}C-label recovered averaged 92% of the applied ^{14}C-glyphosate. Sum of radioactivity present in all plant sections was considered as absorbed and was expressed as a percentage of the ^{14}C recovered. Radioactivity present in all parts except the treated leaf was considered as translocated and was expressed as a percentage of the ^{14}C recovered. Treatments were arranged in a randomized complete block design. Each treatment was replicated four times, and the experiment was repeated. Data were subjected to regression analysis using PROC REG, and R^2 value was calculated as previously described.

Effect of Pelargonic Acid on Glyphosate Activity. Pelargonic acid at 0.5, 1.5, and 3% (v/v) was applied with glyphosate at 0.42 and 0.84 kg/ha to determine interaction effects on trumpetcreeper control. Trumpetcreeper control at 3 WAT was determined as described previously. Treatments were arranged in a randomized complete block design and replicated four times, and the experiment was repeated. Data were subjected to combined ANOVA and mean separation as previously described. Expected response for herbicide combinations was calculated as described by Colby (1967). If the observed response of a herbicide combination was significantly (LSD, P = 0.05) lower or higher than the expected value, the combination was declared antagonistic or synergistic, respectively. Combinations were considered to be additive (no interaction) when the observed and expected responses were similar.

Effect of Pelargonic Acid on ^{14}C-Glyphosate Absorption and Translocation. ^{14}C-glyphosate was applied to trumpetcreeper plants pretreated with glyphosate at 0.84 kg/ha alone or in combination with 3% (v/v) pelargonic acid as described above in the absorption and translocation study. ^{14}C-glyphosate treatment solution was prepared by diluting ^{14}C-glyphosate in the respective herbicide spray solutions. The ^{14}C-glyphosate–treated plants were harvested at 48 HAA. The radioactivity from leaf washes and oxidations was quantified as previously described. Treatments were arranged in a randomized complete block design with four replications, and the experiment was repeated. Data were subjected to combined ANOVA and mean separation as previously described.

RESULTS AND DISCUSSION

Glyphosate Activity. Trumpetcreeper control increased from 62% at 0.42 kg/ha glyphosate to 100% at 3.36 kg/ha (Figure 1). Control reached a plateau by 1.68 kg/ha glyphosate. The regrowth from rootstocks of plants that were exposed to 0.42 kg/ha glyphosate was reduced 76% compared with regrowth from the nontreated plants (Figure 1). At 0.84 kg/ha, glyphosate inhibited regrowth 94%, and at 1.68 kg/ha or above, glyphosate completely inhibited regrowth from rootstocks of treated plants. Trumpetcreeper control in this study is slightly more than that reported by Chachalis et al. (2001). This increase may be partly due to differences in plant age. For example, plants were in the four- to six-leaf stage in this study compared with the four- to seven-leaf stage studied by Chachalis et al. (2001). The level of trumpetcreeper control with glyphosate in this study was relatively higher than that reported for redvine [*Brunnichia ovata* (Walt.) Shinners], which is another deep-rooted perennial weed of the Mississippi Delta (Reddy 2000).

Glyphosate Rainfastness. Trumpetcreeper control was 70% with glyphosate at 0.84 kg/ha and no simulated rainfall, but it was reduced to 53 and 57% with simulated

[6] Kimwipes EX-L, Kimberly-Clark Corporation, 1400 Holcomb Road, Roswell, GA 30076.

[7] Packard oxidizer 306, Packard Instruments Company, 2200 Warrenville Road, Downers Grove, IL 60515.

[8] CarboSorb E and Permafluor E^{+}, Packard Instruments Company, 800 Research Parkway, Meridian, CT 06450.

[9] EcoLume, ICN, 3300 Hyland Avenue, Costa Mesa, CA 92626.

[10] Minaxiβ Tri-carb 4000 series liquid scintillation counter, Packard Instrument Company, 2200 Warrenville Road, Downers Grove, IL 60515.

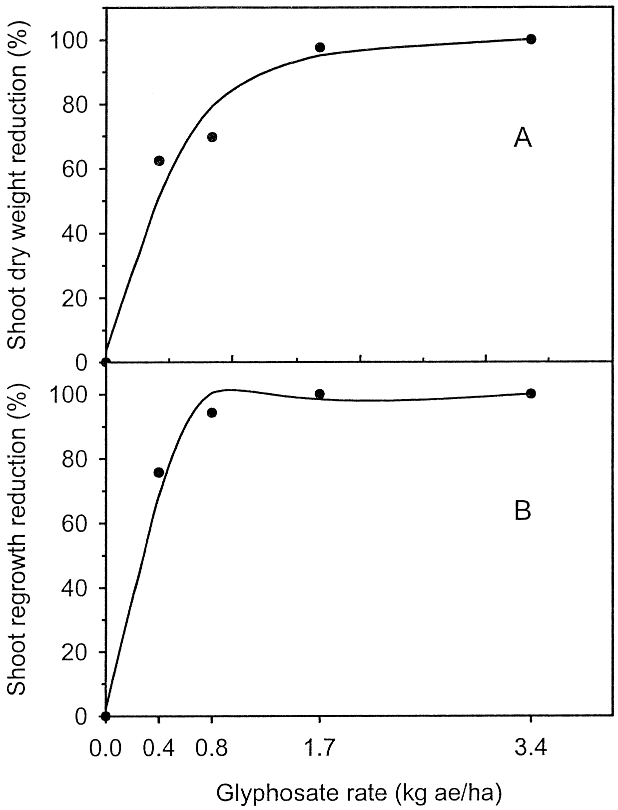

Figure 1. Trumpetcreeper control 3 wk after treatment (WAT) with glyphosate, expressed as percent shoot dry weight reduction compared with the nontreated control (A). After shoots were clipped at 3 WAT, plants were allowed to regrow for 5 wk, and regrowth reduction of glyphosate-treated plants was expressed as percent shoot dry weight reduction compared with the nontreated control (B). Values are regressed by the rate of glyphosate application. The model for trumpetcreeper control is $y = 3.61 + 141.02x - 69.58x^2 + 10.76x^3$ ($R^2 = 0.91$). The model for regrowth reduction is $y = 2.31 + 206.71x - 125.1x^2 + 21.5x^3$ ($R^2 = 0.95$).

Table 1. Trumpetcreeper control with glyphosate after simulated rainfall.[a–c]

	Control	
Rainfall interval	Treated shoot at 3 WAT	Shoot regrowth at 8 WAT[d]
HAA	%	
6	53	75
24	57	89
48	65	82
96	67	90
192	68	89
No rain	70	94
Nontreated control	0	0
LSD (0.05)	10	14

[a] Glyphosate was applied at 0.84 kg/ha, followed by a simulated rainfall of 2.5 cm in 20 min after application of glyphosate.

[b] Control is expressed as percent shoot dry weight reduction compared with the nontreated control.

[c] Abbreviations: HAA, hours after glyphosate application; WAT, weeks after glyphosate treatment.

[d] After clipping shoots at 3 WAT, plants were allowed to regrow for 5 wk.

rainfall at 6 and 24 HAA, respectively (Table 1). These reductions amounted to loss of nearly one-fifth of the glyphosate activity in the event of rainfall within 24 HAA compared with the no-rainfall control. Rainfall applied after 48 HAA had no effect on glyphosate activity in trumpetcreeper. Control of regrowth was reduced to 75% when rainfall was applied 6 HAA as compared with 94% control of regrowth when no rainfall followed the glyphosate application. Rainfall applied after 24 HAA had no effect on regrowth control in trumpetcreeper compared with the no-rainfall control. Overall, the loss of glyphosate activity in trumpetcreeper due to rainfall at 24 HAA was similar to the one-fourth loss of activity that has been reported in redvine (Reddy 2000) and less than the one-third loss of activity reported in purple nutsedge (*Cyperus rotundus* L.) (Bariuan et al. 1999). In johnsongrass [*Sorghum halepense* (L.) Pers.], a simulated rainfall of 1.3 cm in 15 min at 1 HAA reduced glyphosate activity by one-third compared with the no-rainfall control (Miller et al. 1998).

Absorption and Translocation of ^{14}C-Glyphosate. Most of the ^{14}C-glyphosate was not absorbed by trumpetcreeper, as is evident from the amount of ^{14}C-glyphosate recovered in the leaf washes (data not shown). Absorption of ^{14}C-glyphosate increased with time from 2.3% at 6 HAA to 20.4% at 96 HAA, with no increase thereafter (Figure 2). A similar trend in absorption of ^{14}C-glyphosate has been reported in redvine (Reddy 2000), which is another common woody perennial vine in the Mississippi Delta. Other researchers have shown a wide range of glyphosate absorption (7 to 74% during exposures between 24 and 120 h) depending on plant species (Devine et al. 1983; McWhorter et al. 1980; Norsworthy et al. 2001; Satchivi et al. 2000; Wills 1978). Higher glyphosate absorption does not necessarily result in higher control. For example, hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. *ex* A. W. Hill] had more tolerance to glyphosate than prickly sida (*Sida spinosa* L.) despite 52% absorption in hemp sesbania compared with 18% absorption in prickly sida (Norsworthy et al. 2001).

The pattern of ^{14}C-glyphosate translocation was somewhat similar to the absorption with time; translocation increased from 0.4% at 6 HAA to 10.6% at 96 HAA, with no increase thereafter (Figure 2). Movement of glyphosate varies with plant species and duration of plant exposure to herbicide. Translocation of ^{14}C-glyphosate in several annual and perennial species ranged from 3.5 to 38% during a time period of 48 h to 14 d after application (McWhorter et al. 1980; Reddy 2000; Sandberg et al. 1980; Satchivi et al. 2000; Wills 1978). No attempt

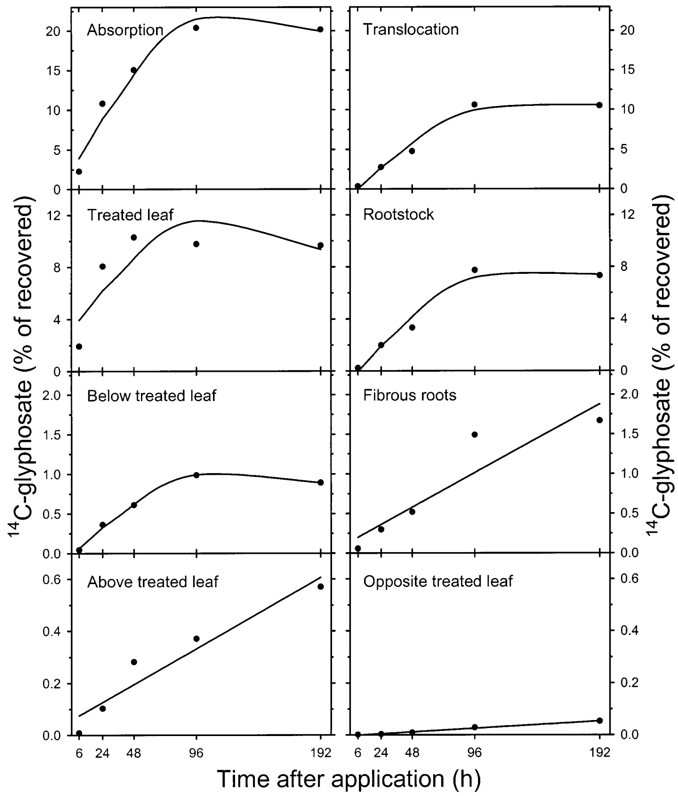

Figure 2. Absorption, translocation, and distribution of recovered ^{14}C-glyphosate in trumpetcreeper over time. Total radioactivity present in the treated leaf; foliage above, opposite, and below the treated leaf; fibrous roots; and rootstock is considered as absorption. Absorption minus radioactivity present in the treated leaf is considered as translocation. Values are regressed by the time after ^{14}C-glyphosate application. The fitted regression lines are absorption $= 2.08 + 0.31x - 0.001x^2$ ($R^2 = 0.70$); translocation $= -1.01 + 0.17x - 0.0006x^2$ ($R^2 = 0.71$); treated leaf $= 3.09 + 0.14x - 0.0006x^2$ ($R^2 = 0.44$); rootstock $= -0.8 + 0.12x - 0.0004x^2$ ($R^2 = 0.61$); below treated leaf $= -0.03 + 0.016x - 0.0001x^2$ ($R^2 = 0.47$); fibrous roots $= 0.145 + 0.009x$ ($R^2 = 0.53$); above treated leaf $= 0.06 + 0.003x$ ($R^2 = 0.30$); and opposite treated leaf $= -0.003 + 0.0003x$ ($R^2 = 0.22$). Scale for y-axis varies with each layer of graphs.

was made to determine whether the ^{14}C-label that moved out of the treated leaf was ^{14}C-glyphosate. However, it has been reported that glyphosate is metabolized to aminomethylphosphonic acid to a limited extent in plants. Accumulation of aminomethylphosphonic acid in various plant tissues of several weed species ranged from 2 to 11% of the total ^{14}C present in the tissue 7 d after treatment (Sandberg et al. 1980).

The patterns of ^{14}C accumulation over time were best described by linear models in fibrous roots ($R^2 = 0.53$), leaves and shoot above the treated leaf ($R^2 = 0.30$), and leaf opposite the treated leaf ($R^2 = 0.22$) and by nonlinear models in treated leaf ($R^2 = 0.44$), rootstock ($R^2 = 0.61$), and leaves and shoot below the treated leaf ($R^2 = 0.47$) (Figure 2). Overall, both linear and nonlinear models indicated that ^{14}C movement to various plant parts was linear between 6 and 96 HAA. The linearity in ^{14}C movement continued beyond 96 HAA in the leaves and shoot above the treated leaf and fibrous roots, the centers of metabolic activity. At 192 HAA, 9.7% of the recovered ^{14}C remained in the treated leaf, 0.6% moved acropetally, and 9.9% moved basipetally. At 192 HAA, radioactivity was distributed throughout the plant with ^{14}C accumulation decreasing in the following order: treated leaf > rootstock > fibrous roots > leaves and shoot below the treated leaf > leaves and shoot above the treated leaf > leaf opposite the treated leaf.

Effect of Pelargonic Acid on Glyphosate Activity. The addition of pelargonic acid regardless of rate (0.5, 1.5, and 3%) to glyphosate at 0.42 and 0.84 kg/ha had an additive effect on trumpetcreeper control compared with glyphosate alone (Table 2). Similarly, addition of pelargonic acid did not enhance mugwort (*Artemisia vulgaris*

Table 2. Pelargonic acid effect on glyphosate applied at 0.42 and 0.84 kg/ha on trumpetcreeper control.[a]

Treatment	Glyphosate rate	Control: Observed	Control: Expected[b]
	kg/ha	%	%
Glyphosate	0.42	35	
Glyphosate	0.84	54	
Pelargonic acid (0.5%)		17	
Glyphosate + pelargonic acid (0.5%)	0.42	38	46
Glyphosate + pelargonic acid (0.5%)	0.84	65	62
Pelargonic acid (1.5%)		23	
Glyphosate + pelargonic acid (1.5%)	0.42	43	50
Glyphosate + pelargonic acid (1.5%)	0.84	74	65
Pelargonic acid (3.0%)		52	
Glyphosate + pelargonic acid (3.0%)	0.42	53	69
Glyphosate + pelargonic acid (3.0%)	0.84	88	78
LSD (0.05)		16	

[a] Control is expressed as percent shoot dry weight reduction compared with the nontreated control at 3 wk after glyphosate treatment.
[b] Expected values were calculated as described by Colby's (1967) method.

Table 3. Pelargonic acid effect on ^{14}C-glyphosate absorption, translocation, and distribution in trumpetcreeper at 48 h after application.[a–c]

Treatment	Absorption	Translocation	Treated leaf	Above treated leaf	Opposite treated leaf	Below treated leaf	Fibrous roots	Rootstock
	% ^{14}C-glyphosate recovered							
Glyphosate	15.1	4.7	10.4	0.3	0	0.6	0.5	3.3
Glyphosate + pelargonic acid (3.0%)	11.4	4.1	7.3	0.2	0	0.6	0.6	2.7
LSD (0.05)	NS	NS	2.1	NS	NS	NS	NS	NS

[a] Total radioactivity present in the treated leaf, foliage above, opposite, and below the treated leaf, fibrous roots, and rootstock is considered as absorption. Absorption minus radioactivity present in treated leaf is considered as translocation.

[b] Plants were grown in the greenhouse and moved to the growth chamber for acclimatization two days before ^{14}C-glyphosate application. The growth chamber was maintained at 30 and 25 C day and night temperatures, respectively, 60 and 90% day and night relative humidity, respectively, and a 14-h photoperiod.

[c] Abbreviation: NS, not significant.

L.) control with glyphosate (Bradley and Hagood 2002). Pline et al. (2000) reported that addition of 3% (v/v) pelargonic acid to glyphosate did not improve efficacy on several annual and perennial weeds, although this herbicide combination has caused injury to glyphosate-resistant soybean. Pelargonic acid has been reported to increase absorption of glyphosate while concurrently causing rapid desiccation of treated plants (Savage and Zorner 1996). For control of perennial weeds such as trumpetcreeper, higher accumulation of herbicide in the rootstock is considered to be of greater importance than mere desiccation of the foliage. In this study, addition of pelargonic acid did not synergize glyphosate activity, but it may still have enhanced absorption and translocation of glyphosate and increased accumulation of glyphosate in rootstocks of trumpetcreeper. To test this hypothesis, absorption and translocation of ^{14}C-glyphosate in the presence of pelargonic acid was measured.

Effect of Pelargonic Acid on ^{14}C-Glyphosate Absorption and Translocation. Absorption and translocation of ^{14}C-glyphosate in trumpetcreeper were similar regardless of addition of pelargonic acid (Table 3). Accumulation of ^{14}C-glyphosate in the treated leaf was higher in plants treated with glyphosate alone than in plants treated with an equivalent rate of glyphosate plus pelargonic acid. Accumulation of ^{14}C-glyphosate in all other plant parts was similar regardless of addition of pelargonic acid. Pline et al. (1999a) reported that addition of pelargonic acid reduced absorption of ^{14}C-glyphosate in glyphosate-resistant soybean compared with glyphosate alone but had no effect on its translocation. In the case of glufosinate, treatment with pelargonic acid did not affect glufosinate absorption and translocation in five weed species (Pline et al. 1999b). Normally, one might expect that rapid desiccation of green tissue by pelargonic acid could potentially reduce the absorption and efficacy of a systemic herbicide such as glyphosate.

Results of this greenhouse study suggest that effective control of trumpetcreeper requires glyphosate rates of 1.68 kg/ha or higher and a rain-free period of at least 24 HAA. However, in fields with severe infestations, trumpetcreeper reestablishment after two applications of glyphosate at 0.84 kg/ha has been observed (Reddy and Chachalis 2000). The glyphosate label specifically limits total glyphosate applications to less than 2.52 kg/ha in glyphosate-resistant soybean and to less than 1.68 kg/ha in glyphosate-resistant cotton. Thus, with the label use rate of glyphosate, control of trumpetcreeper in these glyphosate-resistant crops may be less than satisfactory. Higher ^{14}C-glyphosate movement below the treated leaf than above the treated leaf and the significant amount of ^{14}C-glyphosate accumulation in the rootstock seem to explain the complete inhibition of shoot regrowth at higher rates in greenhouse experiments. The reason for the discrepancy in regrowth reduction between this greenhouse study and field experiments (Reddy and Chachalis 2000) is not clear. One explanation might be that translocation of glyphosate is limited in field-grown trumpetcreeper because of longer or larger rootstocks or that field-grown trumpetcreeper has greater rootbud dormancy. The factors affecting rootbud dormancy and shoot emergence from trumpetcreeper rootstock and the extent of glyphosate translocation along the rootstock are currently under investigation.

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