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Research Reports:

English Ivy (*Hedera helix*) Response to Postemergence Herbicides[1]

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Abstract

One application of Roundup at 2.2 or 4.5 kg ai/ha (2.0 or 4.0 lb/A) with or without surfactant, Weedar 64 (2.4-D amine) at 1.1 kg ae/ha (1.0 lb/A), Banvel at 0.6 kg ae/ha (0.5 lb/A), or Garlon 3A at 0.6 kg ae/ha (0.5 lb/A) reduced new shoot growth of English ivy 10 weeks after treatment by 46 to 80%. Roundup at 4.5 kg/ha plus non-ionic surfactant was the only single application treatment that reduced older shoot growth of English ivy (41% reduction) 19 weeks after treatment. English ivy outgrew injury from all other single application treatments. Two applications of Weedar 64 completely controlled English ivy. Two applications of Roundup at 4.5 kg/ha (4.0 lb/A), with or without surfactant, eliminated new shoot growth 11 weeks after treatment, and reduced total shoot weight by approximately 60% 15 weeks after treatment. English ivy shoot weight decreased when the rate of Roundup was increased from 2.2. to 4.5 kg/ha (74 versus 92% reduction) 7 weeks after treatment, but adding a non-ionic surfactant did not further reduce shoot weight. Two applications of Banvel or Garlon (52 and 67% reduction, respectively, 7 weeks after treatment) were less effective than two applications of Roundup at 4.5 kg/ha (4.0 lb/A) in reducing English ivy shoot growth.

Index words: herbicides, non-ionic surfactant, weed control

Species used in this study: English ivy (*Hedera helix* L.)

Herbicides used in this study: Banvel (dicamba), 3.6-dichloro-2-methoxybenzoic acid; Roundup (glyphosate), N-phosphonomethyl)glycine; Garlon 3A (triclopyr amine), [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid; Weedar 64 (2,4-D amine), (2,4-dichlorophenoxy) acetic acid.

Significance to the Nursery Industry

Under certain circumstances, English ivy can become an undesirable plant in landscapes. This research indicates that English ivy cannot be controlled with a single application of Roundup at rates commonly used for weed control in landscapes (2.2 to 4.5 kg/ha (2.0 to 4.0 lb/A)), nor by single applications of 2,4-D, dicamba, or triclopyr at rates commonly applied alone or in combination for broadleaf weed control in turfgrass (1.1, 0.6 and 0.6 kg/ha (1.0, 0.5 and 0.5 lb/A), respectively). Two applications of 2,4-D will

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control English ivy, but such use would be limited to sites that do not contain plants sensitive to this herbicide. Two applications of Roundup did not completely control English ivy.

Introduction

English ivy is an evergreen groundcover of particular value because of its adaptability to sunny or shady landscapes. There are occasions when English ivy can become an undesirable plant, such as when a landscape is being renovated or when this plant begins to climb trees or buildings. English ivy also can invade other portions of a landscape due to its long season of active growth, rapid growth rate and ability to root along the stem.

English ivy is tolerant of the preemergence herbicides commonly used in nursery production and landscape maintenance (3). Insufficient research has been conducted on the tolerance of English ivy to postemergence herbicides. Neal and Skroch reported that March applications of Roundup caused the greatest injury to English ivy, followed by June, September, November, and August applications, respectively (7). Both Roundup application rate and timing affected injury to English ivy.

Herbicides commonly applied alone or in combination for broadleaf control in turfgrass include 2,4-D, dicamba, and triclopyr (1). These herbicides may control English ivy, a broadleaf plant. The objectives of this research were to compare Banvel (dicamba), Garlon (triclopyr), Roundup (glyphosate), and Weedar 64 (2,4-D) for control of English ivy, and to compare one versus two applications.

Materials and Methods

Cuttings of English ivy were taken in the fall of 1989 and were grown in 6 cm (2.25 in) cell packs for more than one year. Two English ivy plants were placed per 11 L (#3) black plastic pot containing pine bark:sand (4:1, by vol.) in April, 1991. Pots were fertilized with a slow release, 17N-2.6P-9.9K (Osmocote 17-6-12) product containing micronutrients.

Herbicides were applied on June 10, 1991 to actively-growing English ivy. Each plant averaged 3 shoots, approximately 76 cm (30 in) in length, with approximately 13 cm (5 in) being new growth. Application rates included Roundup at 2.2 or 4.5 kg/ha (2 or 4 lb/A), with and without a non-ionic surfactant (Triton AG 98, Rohm and Haas Company, Philadelphia, PA) at 1.2 L/ha (1 pt/A). Weedar 64 was applied at 1.1 kg/ha (1 lb/A), Banvel at 0.6 kg/ha (0.5 lb/A), and Garlon at 0.6 kg/ha (0.5 lb/A). Herbicides were applied as a foliar spray to English ivy foliage using a CO_2-pressurized backpack sprayer delivering 230 L/ha (25 gal/A) using 8003 flat fan nozzles (TeeJet, Spraying Systems, Wheaton, IL). Air temperature at treatment was 28°C (83°F). Plants were overhead irrigated one day after treatment, and daily thereafter. Plants were maintained outdoors under 50% shade. Half of the pots were retreated on July 10, 1991, one month after the initial application. Air temperature was 28°C (82°F), and rain, totaling 0.3 cm (0.12 in), occurred 3 hours after treatment.

The study was repeated on July 10, 1991 with additional plants. Half of these plants were retreated on August 8, 1991 under 29°C (85°F). Rain, totaling 0.2 cm (0.08 in) occurred 3 hours after treatment. These pots were maintained under the same conditions as the first study.

For plants treated once, shoot fresh weight beyond 30 cm (12 inches) from the shoot base was recorded eleven weeks after treatment. Plants were allowed to regrow for eight weeks and than new and old shoot growth was separated and weighed. For plants treated twice, shoot fresh weight beyond 30 cm (12 in) from the shoot base was recorded seven weeks after the second application (eleven weeks after the first application). Regrowth was recorded eleven weeks after the second application, with total plant shoot weight recorded four weeks later. Results were subjected to analysis of variance with mean separation using the Least Significance Difference Test at $p = 0.05$. Results were similar for both trials of the study (no significant treatment by trial interaction), so combined results were analyzed and presented.

Results and Discussion

Plants treated once. All herbicide treatments reduced English ivy fresh weight beyond 30 cm from the shoot base eleven weeks after treatment (Table 1). Roundup reduced shoot fresh weight by 81% at the 4.5 kg/ha (4.0 lb/A) rate, but only 58% at the 2.2 kg/ha (2.0 lb/A) rate. Addition of a non-ionic surfactant did not further reduce growth. Shoot fresh weight was similar in English ivy plants treated with Roundup at 2.2 kg/ha (2.0 lb/A), Weedar 64, Banvel, or Garlon at eleven weeks after treatment. After plants were allowed to regrow for eight weeks, only the higher rate of Roundup, with or without surfactant, reduced new shoot growth of English ivy. Roundup at 4.5 kg/ha (4.0 lb/A) plus surfactant also reduced the weight of old growth.

Injury to English ivy (shoot dieback, leaf necrosis) with the four herbicides was primarily in the newest growth. Perhaps herbicide absorption was greater in newer, tender leaves compared to older, mature leaves, resulting in greater damage to the younger tissue. This speculation is supported by other research in which overwintered leaves of ligustrum (6) did not absorb ^{14}C following ^{14}C-glyphosate application, while newly-formed leaves absorbed 32% of the applied ^{14}C by 14 days after treatment (6). In that study, differences in tolerance of juniper and ligustrum appeared to be related to differential absorption, as did seasonal differences in ligustrum tolerance. Juniper absorbed no significant amount of ^{14}C when applied to dormant plants or at budbreak, and only absorbed 2% of the applied radioactivity when applied during shoot elongation.

Roundup caused abnormal (small, irregularly-shaped) leaves to develop after application. Similar results for Roundup injury to nursery crops have been reported (2). Prolific adventitious rooting of English ivy stems was observed following application of Banvel, Garlon and Weedar 64 (2,4-D), which is not unexpected considering the auxin-like activity of these growth regulator herbicides. Roundup did not stimulate adventitious rooting of English ivy stems. New leaves appearing after Banvel application were distorted and cupped.

Neal and Skroch (7) reported complete control of English ivy with Roundup at 3.0 kg/ha (2.7 lb/A) applied in March, while June applications resulted in 85% injury. The lower control observed in the current study could be due to differences in growth stage or due to the plants being established longer.

Table 1. English ivy shoot fresh weight at 11 or 19 weeks after treatment as affected by one application of selected postemergence herbicides.[z]

Treatment	Rate	Shoot fresh weight beyond 30 cm	Regrowth shoot weight beyond 30 cm	Shoot fresh weight within 30 cm
		11 weeks	19 weeks	19 weeks
	kg/ha (lb/A)	gm		
Untreated		311.0	56.9	140.6
Roundup	2.2 (2.0)	131.7	54.2	139.6
Roundup	4.5 (4.0)	60.5	29.9	114.2
Roundup + Surfactant[y]	2.2 (2.0)	111.9	51.4	145.4
Roundup + Surfactant[y]	4.5 (4.0)	97.9	22.6	83.0
Weedar 64 2,4-D	1.1 (1.0)	104.0	42.3	119.6
Banvel	0.6 (0.5)	145.1	50.2	125.9
Garlon	0.6 (0.5)	168.8	51.2	130.8
	LSD(0.05)	107.9	20.2	40.3

[z]Fresh weight beyond 30 cm from the shoot base was recorded eleven weeks after treatment. Regrowth fresh weight beyond 30 cm from the shoot base and fresh weight within 30 cm were recorded nineteen weeks after treatment.

[y]A non-ionic surfactant, Triton AG 98, was added at 1.2 L/ha (1 pt/A).

Other researchers have shown that certain nursery crops possess a degree of tolerance to glyphosate. Three juniper (*Juniperus* spp.) cultivars were tolerant of foliar Roundup sprays in September (4). Fraser fir [*Abies fraseri* (Pursh) Poir.] and Norway spruce [*Picea abies* (L.) Karst.] were tolerant of September and October foliar applications, but were injured by May or July treatments (5). Roundup at 0.6 kg/ha (0.5 lb/A) did not injure seven nursery crops, and caused only slight injury to Helleri holly (*Ilex crenata* 'Helleri'), Hetzi holly (*L. crenata* 'Hetzi'), and Hino azalea (*Rhododendron obtusum japonicum* cv. Hino) (8). Injury to these three species increased with Roundup application rates of 0.8 kg/ha (0.75 lb/A) and 1.1 kg/ha (1.0 lb/A). Six nursery species varied in tolerance from no injury to moderate damage following Roundup application at 0.3 kg/ha (0.25 lb/A) or 0.6 kg/ha (0.5 lb/A) (9). Ten nursery species varied in their tolerances to Roundup application rate and number of treatments (10). Damage was most severe on plants with succulent growth.

Plants treated twice. At seven weeks after the second application, all treatments reduced shoot fresh weight beyond 30 cm from the shoot base (Table 2). Roundup at 4.5 kg/ha (4.0 lb/A) with or without surfactant, and Weedar 64 (1.1 kg/ha) were more effective in reducing shoot weight than the lower rate of Roundup (2.2 k/ha), Banvel (0.6 kg/ha), or Garlon (0.6 kg/ha). As with plants treated once, a rate response, but not a surfactant effect, was observed with Roundup.

At eleven weeks after the second application, the higher rate of Roundup (4.5 kg/ha (4.0 lb/A)), with or without surfactant, and Weedar 64 (1.1 kg/ha (1.0 lb/A)) completely inhibited regrowth (Table 2). This is in contrast to English ivy treated once (Table 1), which regrew following any herbicide treatment. Regrowth was also observed when the lower rate of Roundup (2.2 kg/ha (2.0 lb/A)), Banvel, or Garlon was applied twice, although the shoot weight was less than in the untreated plants.

Fifteen weeks after the second application, no reduction

Table 2. English ivy shoot fresh weight at 7, 11 or 15 weeks after the second treatment as affected by one application of selected postemergence herbicides.[z]

Treatment	Rate	Shoot fresh weight beyond 30 cm	Regrowth shoot weight beyond 30 cm	Total shoot fresh weight
		7 weeks	11 weeks	15 weeks
	kg/ha (lb/A)	gm		
Untreated		277.9	43.7	169.3
Roundup	2.2 (2.0)	72.6	2.9	127.3
Roundup	4.5 (4.0)	23.1	0.0	64.9
Roundup + Surfactant[y]	2.2 (2.0)	69.5	8.7	152.8
Roundup + Surfactant[y]	4.5 (4.0)	31.0	0.0	68.0
Weedar 64 2,4-D	1.1 (1.0)	26.0	0.0	0.0
Banvel	0.6 (0.5)	133.0	12.9	135.7
Garlon	0.6 (0.5)	92.3	16.7	136.1
	LSD(0.05)	51.9	17.6	33.8

[z]Fresh weight beyond 30 cm was recorded seven weeks after second treatment. Regrowth fresh weight beyond 30 cm was record eleven weeks after the second treatment. Total shoot fresh weight was recorded fifteen weeks after the second treatment.

[y]A non-ionic surfactant, Triton AG 98, was added at 1.2 L/ha (1 pt/A).

in total shoot fresh weight was observed with Roundup at 2.2 kg/ha (2.0 lb/A) plus surfactant, Banvel or Garlon (Table 2). Roundup at 4.5 kg/ha (4.0 lb/A), with or without surfactant, reduced total shoot weight by approximately 60%. English ivy can tolerate Roundup to a certain degree, although the rain that occurred three hours after treatment should have reduced activity of this herbicide. Complete control of English ivy was observed with two applications of Weedar 64, 2,4-D.

Ed. note: This paper reports the results of research only and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this paper, be certain of their registration by appropriate state and/or federal authorities).

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Evaluation of Structureless Overwintering Systems for Container-Grown Herbaceous Perennials[1]

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Abstract

Five structureless overwintering systems were evaluated for temperature moderation and protection of 18 container-grown herbaceous perennials from low-temperature injury. Two light-excluding treatments; 30 cm (1 ft) of straw between two layers of 4-mil white polyethylene and 18 cm (7 in) deep, in-ground beds protected with one layer of 4-mil white polyethylene and 30 cm (1 ft) of woodchips, provided the greatest moderation of winter low and early spring high temperatures, but also resulted in severe etiolation. A bonded white polyethylene/microfoam overwintering blanket (thermoblanket) with translucent properties provided comparable plant survival percentages despite dramatic temperature extremes recorded beneath this cover and, in late winter, created an environment conducive to moderate plant growth without formation of etiolated tissue.

Index words: etiolation, temperture monitoring, thermocouple, winter protection

Species used in this study: Yarrow (*Achillea taygetea* x *millefolium* L. 'The Beacon'); Lance coreopsis (*Coreopsis lanceolata* L. 'Goldfink'); Threadleaf coreopsis (*Coreopsis verticillata* L. 'Moonbeam'); Threadleaf coreopsis (*Coreopsis verticillata* L. 'Zagreb'); Delphinium (*Delphinium elatum* L. 'Giant Pacific Hybrid'); Blanket flower (*Gaillardia* x *gradiflora* Van Houtte. 'Goblin'); Geum (*Geum quellyon* Sweet. 'Mrs. Bradshaw'); Coralbells (*Heuchera sanguinea* Engelm. 'Bressingham Hybrids' and 'Splendens'); False dragonhead (*Physostegia virginiana* (L.) Benth. 'Pink Bouquet' and 'Summer Snow'); Balloon flower (*Platycodon grandiflorus* (Jacq.) A. DC. 'Fuji Blue'); Salvia (*Salvia* x *superba* Stapf. 'Stratford Blue'); Sedum (*Sedum spectabile* x *telephium* L. 'Autumn Joy'), Sedum (*Sedum spectabile* Boreau. 'Brilliant'); Painted daisy (*Tanacetum coccineum* Willd. 'Robinsons Mix'); Spike speedwell (*Veronica spicata* L. 'Icicle'); and Creeping veronica (*Veronica repens* Loisel.).

Significance to the Nursery Industry

Most container-grown herbaceous perennials require winter protection if they are to survive low temperatures and wide winter temperature fluctuations typical of a continental climate. Structureless overwintering systems are easy to assemble and maintain and can provide growers and retailers with an inexpensive method of protecting these valuable plants.

Several structureless overwintering systems in this study resulted in high plant survival percentages and high quality ratings after winter storage. Polyethylene/woodchip and sandwich covers were the most effective in moderating temperature extremes and should be favored when over-

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