Hoary alyssum control in Christmas trees

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Funding

Project GREEEN, Michigan Christmas Tree Association

Significance

Hoary alyssum is an invasive biennial mustard that may form dense stands in Christmas tree plantations. This weed produces numerous small, white flowers and many seeds. Hoary alyssum competes with trees for nutrients and is very difficult to control.

Materials and methods

A study was conducted in spring 2003 near Hart, Michigan to evaluate hoary alyssum control with various herbicides. Treatments were applied as a directed spray to Fraser fir Christmas trees with established populations of hoary alyssum on April 24, 2003. Weed control and crop injury was visually rated on a 0 to 100% scale with 0 equal to no weed control or no crop injury and 100 equal to complete weed or crop death. Sprayer output was 20 GPA and treatments are listed in Table 1. An untreated control was included for comparison to herbicide treatments.

Results

Fraser fir injury from herbicide treatments was less than 5% with all treatments. Hoary alyssum control on June 18 was at least 77% with all treatments except Stinger plus Cobra (Table 1). Control with this treatment decreased to 37% at later ratings. On July 17, control was 53 to 63% with Permit, Cobra, and SureGuard plus Roundup Original. Control was 73 to 74% with Roundup Original alone and Princep plus Goal 2XL. Hoary alyssum control was greatest with Garlon at 98% on July 17 and 87% on September 5. Other treatments controlled hoary alyssum 23 to 63% on September 5.

Conclusions and future research

Season-long control of hoary alyssum was only observed with use of Garlon. Other treatments provided initial suppression of the weed, but hoary alyssum recovered and was able to produce flowers and seed. However, SureGuard and Princep plus Goal 2XL treatments did reduce the amount of new hoary alyssum plants emerging during the summer as compared to other treatments. While the majority of these treatments did not control the weed adequately, fall applications of the same herbicides might produce better results. Hoary alyssum plants would be smaller in the fall than in spring and may be more sensitive to treatment then. This research will be repeated in spring 2004 and a similar study will be established in fall 2003.

Table 1. Hoary alyssum control with spring applied herbicide treatments. [a]

Treatment names			Rating date		
Chemical	**Trade**	**Rate[b]**	**6-18-03**	**7-17-03**	**9-5-03**
		lb ai/A		%	
Simazine + oxyfluorfen	Princep + Goal 2XL	1.5 + 0.5	83	73	44
Glyphosate	Roundup Original	1.0	92	74	53
Flumioxazin + glyphosate	SureGuard + Roundup Orig.	0.25 + 1.0	87	63	58
Triclopyr	Garlon	1.0	100	98	87
Lactofen[b]	Cobra	0.25	80	63	63
Clopyralid + lactofen[b]	Stinger + Cobra	0.08 + 0.25	49	37	37
Halosulfuron	Permit	0.047	77	53	23
LSD (0.05)[c]			10	14	12

[a] All ratings on 0 to 100% scale with 0% equal to no control and 100% equal to complete weed death.
[b] Non-ionic surfactant (0.25% v/v) included with treatment.
[c] Means separated with Fisher's Protected LSD test at P = 0.05. Differences in rating values must be equal to or greater than the number in the LSD column to be considered significantly different.

Nursery IR4 projects

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Industry partner

Zelenka Nursery

Funding

IR4 Program

The federal IR4 program provides some funding for assisting in the labeling of pesticides for minor-use crops. The rationale for this program is that companies may not want to spend money needed for obtaining labels on crops like greenhouse and nursery plants that have a relatively small sales market and high risk for lawsuits. We have participated in the IR4 program to help BASF (SanMite) and Syngenta (Flagship) obtain federal labels for nursery crops. Valent Corporation is pursuing a federal label at this time for dinotefuron.

2001 Pyridaben Miticide (Sanmite)

Container-grown plants were treated with 0x, 1x, 2x and 4x rates of pyridaben. Pyridaben is a miticide being developed by BASF. None of the plant species showed a phytotoxic reaction to the chemical. Pyridaben was registered for nursery use as Sanmite in 2000. The label has since been expanded to include many additional plant species.

poker plant, torch lily	*Kniphofia* 'Flamenco Orange'
Russian sage	*Perovskia* sp.
peony	*Paeonia* sp.
yew	*Taxus densiformis*
plantain lily	*Hosta* sp. 'Golden Tiara'
stonecrop	*Sedum spurium* 'Autumn Joy'
weigela	*Weigela florida* 'Carnival'
mallow	*Malva sylvestris* 'Dema'
tube clematis	*Clematis heracleifolia*
burning bush	*Euonymus alatus* 'Compactus'
butterfly bush	*Buddleia davidii* 'Pink Delight'
gaura	*Gaura lindheimeri* 'Crimson Butterfly'
gaura	*Gaura lindheimeri* 'Blushing Butterfly'
bluebeard	*Caryopteris x clandonenesis* 'Dark Knight'
strawberry foxglove	*Digitalis x mertonensis*
purple coneflower	*Echinacea purpurea* 'Magnus'
alumroot	*Heuchera micrantha* 'Palace Purple'
alumroot	*Heuchera micrantha* 'Splendens'
lady's mantle	*Alchemilla mollis*
bee balm	*Monarda didyma* 'Gardenview Scarlet'
tickseed	*Coreopsis verticillata* 'Zagreb'
false spirea	*Astilbe x arendsii* 'Deuschland'
shasta daisy	*Chrysanthemum x superbum* 'Snow Cap'
Missouri primrose	*Oenothera missouriensis*
blueleaf willow	*Salix purpurea* 'Nana'
wormwood	*Artemisia stelleriana* 'Silver Brocade'
feather reed grass	*Calamagrostis acutiflora* 'Karl Foerster'

2002 Thiamethoxam insecticide (Flagship)

Container-grown plants were treated with 0x, 1x, 2x and 4x rates of thiamethoxam. Thiamethoxam is a new nicotinyl insecticide being developed by Syngenta. It has excellent activity on sucking insects and white grubs. None of the plant species showed a phytotoxic reaction to the chemical. Thiamethoxam was registered for nursery use as Flagship 25 WDG at the end of September 2003.

white pine	*Pinus strobus*
arborvitae	*Thuja plicata* 'Virescens'
dappled willow	*Salix integra* Thunb. 'Hakuro Nishiki'
rosemallow	*Hibiscus* x 'Blue River II'
weigela	*Weigela florida* 'White Knight'
rose of sharon	*Hibiscus syriacus* 'Lucy'
feather reed grass	*Calamagrostis acutiflora* 'Karl Foerster'
red twig dogwood	*Cornus alba* 'Elegantissima'
hydrangea	*Hydrangea arborescens* 'Annabelle'
yew	*Taxus* x *media* 'Densiformis'
lilac	*Syringa laciniata*
white spruce	*Picea glauca*
viburnum	*Viburnum dentatum* 'Christom'
spirea	*Spiraea* x *bumalda* 'Goldflame'
Japanese barberry	*Berberis thunbergii* 'Atropurpurea Nana'
canna	*Canna indica* 'Phasion'
butterfly bush	*Buddleia davidii* 'Black Knight'
silvergrass	*Miscanthus sinensis* 'Strictus'
fountain dwarf grass	*Pennisetum alopecuroides* 'Hameln'
reed canary grass	*Phalaris arundinacea* 'Feesey's Form'
purple coneflower	*Echinacea purpurea* 'Magnus'
black-eyed susan	*Rudbeckia fulgida* 'Goldsturm'
sage	*Salvia* x *superba* 'East Friesland'
juniper	*Juniperis horizontalis* 'Blue Chip'

2003 Dinotefuron insecticide

Container-grown plants were treated with 0x, 1x, 2x and 4x rates of dinotefuran. Dinotefuron is a new nicotinyl insecticide being developed by Valent Corp. It has excellent activity on sucking insects and white grubs. None of the plant species showed a phytotoxic reaction to the chemical. (Related photo, color insert, page 1A.)

Austrian pine	*Pinus nigra* 'Austriaca'
Colorado spruce	*Picea pungens*
dwarf fountain grass	*Pennisetum alopecuroides*
silvergrass	*Miscanthus sinensis*
yew	*Taxus x media* 'Densiformis'
dianthus	*Dianthus* 'Bath's Pink'
shasta daisy	*Chrysanthemum x superbum* 'Becky'
black-eyed susan	*Rudbeckia fulgida*. 'Goldsturm'
hydrangea	*Hydrangea arborescens* 'Grandiflora'
spirea	*Spiraea* x *bumalda* 'Gold Mound'
white pine	*Pinus strobus*
black spruce	*Picea mariana*
reed canary grass	*Phalaris arundinacea* 'Feesey's Form'
Serbian spruce	*Picea omorika*
sage	*Salvia* x *superba* 'East Friesland'
dappled willow	*Salix integra* 'Hakuro Nishiki'
arborvitae	*Thuja occidentalis* 'Woodward Globe'
mugo pine	*Pinus mugo*
althaea	*Althaea officinalis*
coreopsis	*Coreopsis* 'Moonbeam'
purple coneflower	*Echinacea purpurea*
Japanese barberry	*Berberis thunbergii* 'Crimson Pygmy'
winged euonymus	*Euonymus alatus* 'Compactus'
boxwood	*Buxus sempervirens* 'Winter Gem'
arrowwood viburnum	*Viburnum dentatum* 'Chicago Lustre'
dogwood	*Cornus alba* 'Ivory Halo'

Knawel control in seedling conifers

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Funding

Project GREEEN, Michigan Christmas Tree Association

Significance

Knawel is a low-growing annual weed that may form dense stands in seedling conifers. This is another introduced species that has become naturalized in the United States. Knawel is a very adaptable species and has been reported in most states including Michigan, Florida, California and Washington. In Michigan, most knawel germination will occur in spring and fall. It will appear grass-like as a seedling, but will more closely resemble moss as it matures. Knawel has small linear leaves and small flowers that are usually green and rarely white. This weed will form low clumps or mats, and plants are usually less than 5 inches in height. Traditional weed control methods in seedling conifers often fail to control knawel.

Materials and methods

Two studies were conducted in 2003 near Manistee, Michigan to evaluate knawel control with various herbicides. In the first study, treatments were applied to freshly cultivated ground with no crop before knawel emergence. In the second study, treatments were applied to blue spruce seedlings after knawel emergence. Treatments in both studies were applied on May 22, 2003. Weed control and crop injury was visually rated on a 0 to 100% scale with 0 equal to no weed control or no crop injury and 100 equal to complete weed or crop death. Sprayer output was 20 GPA in both studies. Treatments are listed in Table 1. An untreated control was included in both studies for comparison to herbicide treatments.

Results

In the preemergence study, knawel control was at least 93% on June 24 and July 17 with all herbicide applications (Table 1). In the postemergence study, control on June 24 ranged 72 to 82% with 0.25 lb ai/A SureGuard, SureGuard plus Surflan, Princep, Princep plus Pennant Magnum, and Image. Control was 87% to 89% with 0.38 lb ai/A SureGuard and Image plus Pennant Magnum. Highest control was observed with SureGuard plus Pennant Magnum at 95%. On September 5, control was still greatest with SureGuard plus Pennant Magnum at 89%. Control ranged 73% to 79% with all other treatments except Image, which controlled knawel only 58%. No injury was observed to the crop from herbicide applications.

Conclusions and future research

Knawel was more tolerant to the postemergence applications of the herbicides evaluated than preemergence applications. With postemergence

applications, control was often greater when Pennant Magnum was included than when SureGuard or Image were applied alone. More research is needed to determine if this is an adjuvant effect of the Pennant Magnum formulation or if Pennant Magnum has activity on this broadleaf weed. Additional studies will be conducted in the field and the greenhouse in 2004 to further evaluate knawel control.

Table 1. Preemergence and postemergence of knawel control with selected herbicides.[a]

Treatment name			Preemergence		Postemergence	
Chemical	Trade	Rate[b]	6-24-03	7-17-03	6-24-03	9-5-03
		lb ai/A	%			
Flumioxazin	SureGuard	0.25	100	100	79	73
Flumioxazin	SureGuard	0.38	98	97	88	79
Flumioxazin + s-metolachlor	SureGuard + Pennant Magnum	0.25 + 1.5	99	98	95	89
Flumioxazin + oryzalin	SureGuard + Surflan	0.25	95	93	76	74
Simazine	Princep	1.5	93	93	82	78
Simazine + s-metolachlor	Princep + Pennant Magnum	1.5	98	96	81	78
Imazaquin	Image	0.375	98	95	72	58
Imazaquin + s-metolachlor	Image + Pennant Magnum	0.375 + 1.5	100	98	87	78
LSD (0.05)[b]			3	6	10	12

[a] All ratings on 0 to 100% scale with 0 equal to no control and 100 equal to complete weed death.

[b] Means separated with Fisher's Protected LSD test at P = 0.05. Differences in rating values must be equal to or greater than the number in the LSD column to be considered significantly different.

Liverwort and hosta response to selected herbicides

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Funding

Crompton, Inc., Project GREEEN

Significance

Liverworts are non-vascular, primitive plants that reproduce through spores. These plants can form dense colonies in greenhouse pots resulting in crop damage and reduced marketability. Control of these plants is very difficult. Traditional herbicides may not be applied in greenhouses and handweeding is a temporary solution at best. Current liverwort controls must focus on prevention, sanitation, and careful regulation of watering.

Materials and methods

A study was conducted in 2003 to evaluate liverwort control and Hosta 'Great Expectations' tolerance to selected herbicides. Treatments included two rates of A1656 (an experimental herbicide), Terracyte, BroadStar, and Ronstar G, and a single rate of SureGuard (Table 1). Spray formulations were applied with a backpack sprayer calibrated to deliver 20 gallons per acre of output. Granular formulations were applied using a hand-shaker calibrated for proper rate delivery. Hosta were being held over by the cooperator due to poor vigor and a high infestation of liverwort. Approximate liverwort coverage of pots at time of application was 50%. All pots were watered after application to rinse herbicide from crop foliage and provide adequate moisture for activation. Liverwort control and Hosta injury were rated on a 0 to 100% scale, with 0% equal to no control or no crop injury and 100% equal to complete control or crop death. Ratings were collected on June 19, July 15, August 6, and September 24. Liverwort coverage of the untreated pots on these dates was approximately 70, 85, 90, and 95%, respectively. In addition, Hosta diameter was measured to the nearest inch on September 24. Treatment means are listed in tables 1 and 2 followed by the standard error for each.

Results

Liverwort control on June 19, was 67 to 79% with A1656 (6.8 lb/A), Terracyte (15 lb/1000 ft^2), and both rates of BroadStar (Table 1). The higher Ronstar G rate controlled 55 to 62% of liverwort on June 19, July 15, and August 6, while control exceeded 86% on June 19, July 15, and August 6, with A1656 (13.6 lb/A) and SureGuard (0.25 lb ai/A). On July 15, control was 61 to 69% with most other treatments. Control on September 24, was 75% with A1656 (13.6 lb/A) and 87% with SureGuard (0.25 lb ai/A). Control did not exceed 44% at any rating with the lower Terracyte rate (5 lb/1000 ft^2) or the low rate of Ronstar G (150 lb/A).

Hosta injury was high on each rating date with the flumioxazin formulations, BroadStar and SureGuard (Table 2). Injury ranged from 25 to 66% over all rating intervals with these treatments. Hosta injury on June 19 was 12% with the A1656 (13.6 lb/A), 5% with Ronstar G (150 lb/A), and 7 to 9% with other non-flumioxazin treatments. On July 15, injury was 8 to 9% with A1656 (13.6 lb/A) and Ronstar G (150 lb/A), and 5 to 6% with other non-flumioxazin treatments. Hosta injury on August 6 and September 24 was 0 to 1% with both rates of A1656 and Terracyte. Injury with Ronstar G was 4 to 8% on August 6 and 0% on September 24. Hosta diameter

Table 1. Liverwort control with selected herbicides.[a]

Herbicide name			Rating date			
Common	Trade	Rate	6/19/03	7/15/03	8/6/03	9/24/03
			%			
Quinoclamine	A1656	6.8 lb/A	74 ± 6	61 ± 6	38 ± 7	18 ± 7
	A1656	13.6 lb/A	92 ± 2	90 ± 4	87 ± 4	75 ± 5
Sodium carbonate peroxyhydrate	Terracyte	5 lb/1000 ft^2	41 ± 6	30 ± 8	16 ± 8	7 ± 6
	Terracyte	15 lb/1000 ft^2	79 ± 4	69 ± 6	53 ± 8	20 ± 7
Flumioxazin	BroadStar	150 lb/A	67 ± 6	68 ± 8	58 ± 9	25 ± 8
	BroadStar	200 lb/A	70 ± 5	65 ± 6	58 ± 7	18 ± 5
Flumioxazin	SureGuard	0.25 lb ai/A	93 ± 1	98 ± 1	97 ± 2	87 ± 9
Oxadiazon	Ronstar G	150 lb/A	44 ± 6	42 ± 6	40 ± 9	21 ± 11
	Ronstar G	200 lb/A	55± 5	62 ± 8	56 ± 10	32 ± 10

[a] All ratings on 0 to 100% scale with 0% equal to no liverwort control and 100% equal to complete liverwort death. Treatment means are followed by the standard error for that treatment, i.e., Quinoclamine applied at 6.8 lbs, (rated on 6/19/03) gave 74 percent control plus or minus 6 percentage points for an effective range of 68-80% control.

Table 2. Hosta response to herbicide treatment.

		Injury[a]				Diameter
Herbicide	Rate	6/19/03	7/15/03	8/6/03	9/24/03	9/24/03
		%				inch
A1656	6.8 lb/A	8 ± 1	6 ± 1	0 ± 0	0 ± 0	12 ± 1
A1656	13.6 lb/A	12 ± 1	9 ± 2	1 ± 1	0 ± 0	14 ± 1
Terracyte	5 lb/1000 ft^2	9 ± 2	5 ± 1	0 ± 0	0 ± 0	12 ± 2
Terracyte	15 lb/1000 ft^2	8 ± 1	5 ± 1	0 ± 0	0 ± 0	12 ± 2
BroadStar	150 lb/A	45 ± 10	34 ± 22	25 ± 25	25 ± 25	8 ± 3
BroadStar	200 lb/A	54 ± 10	66 ± 17	48 ± 21	43 ± 25	6 ± 3
SureGuard	0.25 lb ai/A	60 ± 4	64 ± 21	55 ± 27	63 ± 24	5 ± 3
Ronstar G	150 lb/A	5 ± 1	5 ± 1	4 ± 2	0 ± 0	15 ± 1
Ronstar G	200 lb/A	7 ± 2	8 ± 3	8 ± 1	0 ± 0	10 ± 2
Untreated		0	0	0	0	12 ± 1

[a] All ratings on 0 to 100% scale with 0% equal to no injury and 100% equal to complete Hosta death. Treatment means are followed by the standard error for that treatment.

was 12 to 15 inches on September 24 with the untreated control, Ronstar G (150 lb/A), and both rates of A1656 and Terracyte. Diameter was 10 inches with Ronstar G (200 lb/A) and ranged from 5 to 8 inches with the flumioxazin formulations.

Conclusions and future research

In summary, the highest liverwort control with minimal crop injury was observed with A1656 (13.6 lb/A). Suppression of liverwort was achieved with several other treatments, but SureGuard and BroadStar treatment resulted in high injury to Hosta. A1656 (6.8 lb/A), Terracyte (15 lb/1000 ft^2), and Ronstar G (200 lb/A) also suppressed liverwort, but control had generally faded by three months after treatment. Hosta injury may have been higher in this study than observed elsewhere due to low crop vigor. The typical injury that was observed with A1656 and Terracyte was minor speckling of the foliage and Hosta rapidly recovered. This foliar injury should not be a concern for fall applications to labeled crops approaching dormancy.

Evaluation of herbicidal controls for yellow fieldcress (*Rorippa sylvestris*)

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Funding

Project GREEEN, Michigan Nursery and Landscape Association

Significance

Rorippa sylvestris is an exotic, invasive perennial weed that is very difficult to control. This weed has invaded many nurseries in Michigan, infesting both field and container-grown stock. Yellow fieldcress has been found in contaminated perennials such as hosta and has also been found in strawberries in other states. It has been found in most states where ornamentals are grown and it is regulated as a noxious weed in California, North Carolina and Oregon.

Yellow fieldcress is very difficult to control. Root segments smaller than one inch may form new plants. Thus, cultivation may spread root segments out of the infested area and result in a greater weed problem than present initially. The herbicides currently used in ornamental production do not control yellow fieldcress. In addition, handweeding is very ineffective for controlling this weed. Yellow fieldcress grows low along the ground and leaves break off if pulled. This results in removal of most of the weed foliage by handweeding, but roots are left intact. Therefore, research studies were conducted to evaluate postemergence herbicides for yellow fieldcress control.

Materials and methods

Field and greenhouse studies were conducted to evaluate control of yellow fieldcress with selected herbicides. The field study was conducted near West Olive, Michigan in a fallow field with no crop present. Treatments were applied on October 8, 2002, and weed control was evaluated several times after application. Weed control was visually rated on a 0 to 100 percent scale with 0 equal to no weed control and 100 equal to complete weed death. Sprayer output was 20 GPA in both field and greenhouse studies. Treatments for field and greenhouse studies are listed in Table 1. An untreated control was included in all studies for comparison to herbicide treatments. In the greenhouse study, weed control was also visually rated after herbicide application to yellow fieldcress. Pots were harvested at four weeks after treatment to determine the biomass of yellow fieldcress in each treatment. A second harvest to determine regrowth was conducted five weeks after initial harvest. Regrowth data was converted to a percentage of the untreated control. All data was subjected to analysis of variance and Fisher's Protected LSD was used for mean separation.

Results

Initial control of yellow fieldcress exceeded 80% with Clarity, Weedar 64, Finale, Redeem R&P, and Curtail M treatments in the field study. Control with other treatments in October 2002 was not greater than 58%. However, in May 2003 control was 95% or greater with Clarity, Weedar 64, Plateau, Manage, Redeem R&P and Curtail M treatments. Control with Roundup UltraMax was 77%, while SureGuard controlled 63% of the weed. Control with Lontrel, Finale and Muster in May 2003 was only 30 to 33%.

In the greenhouse study, control at four weeks after treatment was at least 82% with Weedar 64, Roundup UltraMax, Finale, Redeem R&P and Curtail M. Regrowth from harvested pots was less than 5% of the untreated control with Weedar 64, Finale, Plateau, Manage, Redeem R&P and Curtail M, indicating death of roots with these treatments. Clarity, Lontrel and Muster provided no control of

yellow fieldcress in the greenhouse.

Conclusions and future research

Excellent control of yellow fieldcress was obtained with Weedar 64, Plateau, Manage, Redeem R&P and Curtail M. While control with Plateau and Manage was slow to develop, these two herbicides have the most potential of those tested for selective control within ornamental crops. In non-crop situations, Weedar 64, Redeem R&P and Curtail M may provide excellent control in a shorter amount of time than Plateau and Manage. These three herbicides are not safe to use on most ornamental crops, but may be used in certain areas not in crop production.

As Plateau and Manage are not currently labeled for ornamental crops, additional research is needed prior to pursuing a special local needs label for either herbicide. An additional field study was established in October 2003, to repeat the previous study and additional greenhouse studies have been conducted. The results from all studies will be compiled and published. In addition, a bulletin on yellow fieldcress will be published through Michigan State University Extension late in 2003.

Table 1. Control of yellow fieldcress in field and greenhouse studies with selected herbicides.[a]

Herbicide name			Field		Greenhouse	
Chemical	**Trade**	**Rate[b]**	**10-24-02**	**5-08-03**	**Control**	**Regrowth[c]**
		lb ai/A		%		
Dicamba	Clarity	1	83	97	71	90
2,4-D	Weedar 64	2	92	100	93	4
Clopyralid	Lontrel	0.188	38	30	20	136
Glyphosate	Roundup UltraMax	1	51	77	92	11
Glufosinate	Finale	1	89	33	95	3
Flumioxazin	SureGuard	0.38	58	63	54	77
Imazapic	Plateau[b]	0.19	44	100	77	0
Halosulfuron	Manage[b]	0.094	33	95	62	0
Ethametsulfuron	Muster[b]	0.032	27	30	24	113
Triclopyr + clopyralid	Redeem R&P	1	81	100	82	0
MCPA + clopyralid	Curtail M	1	91	100	99	0
LSD (0.05)[d]			9	13	11	15

[a] All ratings on 0 to 100% scale with 0% equal to no control and 100% equal to complete weed death.

[b] Non-ionic surfactant (0.25% v/v) included with treatment.

[c] Regrowth was determined by harvesting fieldcress foliage five weeks after an initial harvest. The initial harvest was conducted at four weeks after treatment. Regrowth data is expressed as a percentage of the untreated control.

[d] Means separated with Fisher's Protected LSD test at P = 0.05. Difference in rating values must be equal or greater than the number in the LSD column to be considered significally different.