



IR-4 Environmental Horticulture Program Grower & Extension Survey Summary 2023 – US Respondents

The intent of the Environmental Horticulture Survey was to poll growers, landscape care operators, researchers, extension personnel and others affiliated with this industry on needs and issues related to disease, insect, and weed management. The responses from the survey feed directly into how IR-4 allocates its research budget for environmental horticulture projects.

Demographics of Survey Participants

The purpose for several questions in this survey was to describe the demographics of participating growers, landscape care personnel and others in the green industry. The survey participants came from across the United States, but responses were not equally distributed among the four geographic regions (Table 1); the Southern region had 34% of the participants followed by Northeast, North Central, and Western with 14%. Eighty-five percent were growers with the next largest segment being researchers at 8% (Table 2). The operation types most represented were producers (greenhouse, nursery container, nursery field grown); Christmas tree growers represented 8% (Table 3). Landscape care represented about 7% of the respondents.

Relatively equal numbers of respondents identified themselves as using chemical control and/or IPM (Table 4). Twenty-eight percent used biological controls while 9% of survey participants used organic tools. Many participants did not choose a philosophy for when to apply, but those that did tended to make applications when needed rather than based on a calendar.

Herbaceous perennials, ornamental grasses, shrubs and trees were grown by 25 – 31% of the respondents followed by bedding plants and foliage at 16% (Table 5). Fewer survey respondents grew seasonal potted plants, cut flowers, palms, and Christmas trees.

Table 1. IR-4 Region for survey participants

Region	Count	Percent
NorthCentral	22	22%
Northeast	29	29%
Southern	34	34%
Western	14	14%
Total	99	100%

Table 2. Employment sector for survey participants (single selection option)

Segment	Count	Percent
Extension	3	3%
Government	0	0%
Grower	85	86%
Industry	2	2%
LCP	1	1%
Researcher	8	8%

Table 3. Operation types (multiple selections)

Production Site	Count	Percent
Greenhouse	31	31%
Nursery Container	31	31%
Nursery Field	18	18%
Landscape	7	7%
Interiorscape	0	0%
Christmas Tree Farm	8	8%
Sod Farm	2	2%

Table 4. Disease, insect and weed management styles (multiple selections)

Management Styles	Count	Percent
Biological Control	28	28%
Chemical Control	42	42%
IPM	39	39%
Organic	9	9%
Weekly/Monthly Sprays	18	18%
Spray at Thresholds	27	27%

Table 5. Spectrum of crops grown (multiple selections)

Crop Type	Count	Percent
Bedding Plants	16	16%
Cut Flowers	6	6%
Christmas Trees	9	9%
Foliage Plants	16	16%
Perennials	26	26%
Ornamental Grasses	25	25%
Palms	7	7%
Seasonal Potted Plants	10	10%
Shrubs	28	28%
Trees	31	31%
Turf	5	5%

Type of Data Needed

Two questions solicited information on the general direction of research and the type of data needed in the program. The first question asked whether crop safety data was needed more than efficacy, efficacy more than crop safety, or both equally. The option for needing both crop safety and efficacy equally was highly selected (Figure 1) with slightly more participants favoring efficacy over crop safety data.

Activities to Protect Beneficial Organisms including Pollinators

This was the fourth year a question was included in the survey to assess current practices used to protect beneficial organisms including pollinators during production and maintenance of plants. There were 96 respondents to this question, and they were able to select multiple answers. The activity most employed was applying crop protection tools when no beneficial organisms are present (Figure 2). The next selection by frequency was scouting for pest and disease hot spots and apply crop protection tools to only those areas, followed by applying an optimal rate to manage pests or diseases without harming beneficial organisms. The next highest was applying systemic tools when they offer greater safety than foliar tools.

Of note, the option to apply only biopesticides was the least selected followed by growing crops without pollinator attractive flowers.

Among the write-ins (Table 6, p3), most entered concepts for applications based in current recommendations to minimized impact on pollinators, such as applying at dusk.

Figure 1. Counts for type of data to be generated

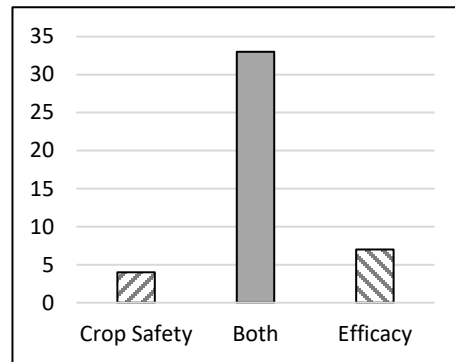


Figure 2. Activities to protect beneficial organisms including pollinators (multiple selections)

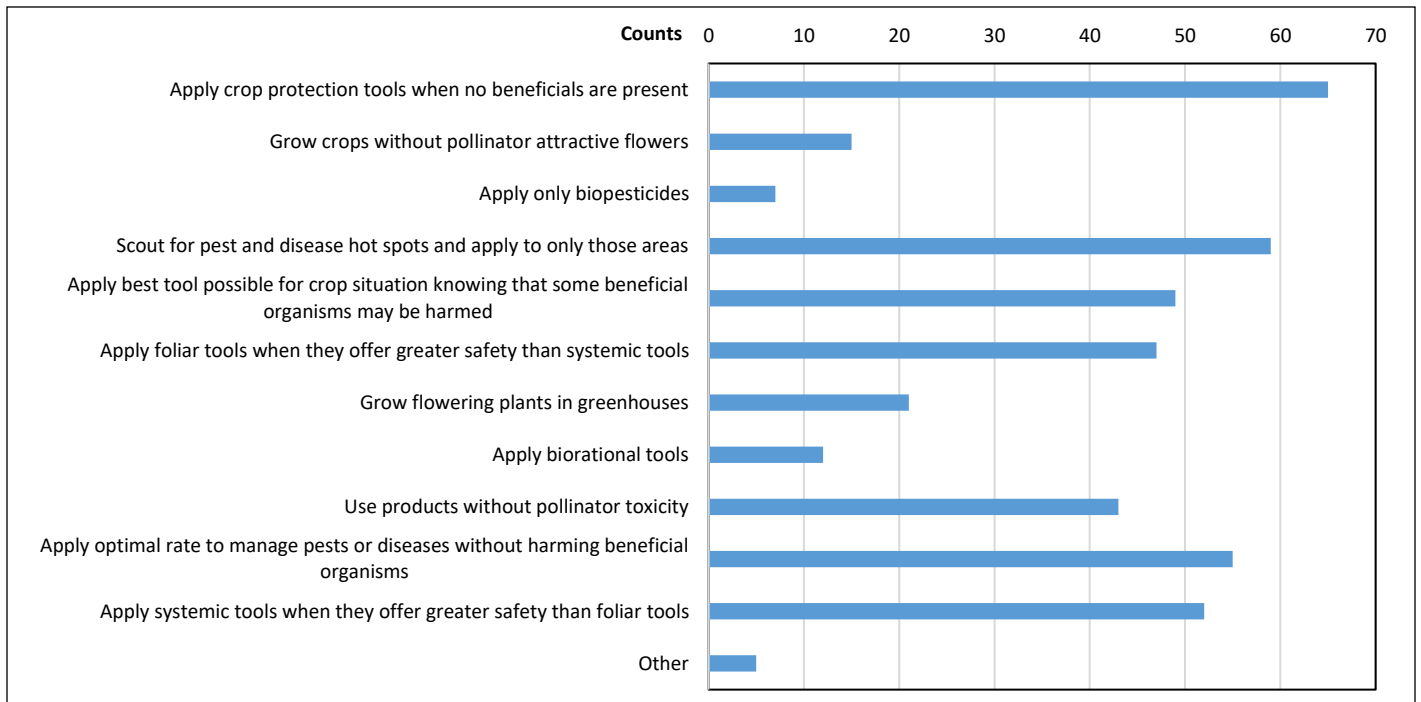


Table 6. Comments included related to protecting beneficial organisms including pollinators

Additional Activities Use to Protect Beneficial Organisms
Use NO insecticides
Use IPM, maintain a population of predators
N/A Pine trees are wind pollinated and this is regarding pines
apply after dusk
Spraying early in the morning/late in the evening when pollinators are less active

Ranking of Issues by Discipline

Each of the issues within the disciplines listed by participants was given a weighted ranking based on the order written. Each was also assigned to a group based on similar diseases, pests, or weeds. This section also examines the survey responses grouped by production site.

Entomology

When all responses were grouped together the top five pests of concern were foliar feeding beetles, thrips, mites & spider mites, aphids, and mealybugs (Table 7, p3). Note that the calculation for weighted ranking here removes any duplication for crop or production site.

When the weighted rankings were calculated based on the production sites, there were some differences among locations (Table 10, p5). Four pest types were in the top five for each greenhouses and nurseries: thrips, mealybugs, mites & spider mites, and foliar feeding beetles. For Christmas tree farms and landscapes, there was some overlap with the other locations, but scale and white grubs & root weevils were important. Aphids ranked within the top 5 for all but one location.

When weighted rankings were calculated for categories of crops, the top 5 pests were somewhat different for each crop type (Table 13, p6). Thrips and mites & spider mites were in the top 5 for all but one crop category. Mealybugs were mentioned in four crop categories, while foliar feeding beetles and aphids were mentioned in three.

The specific pests mentioned most frequently included flea beetles, mealybugs, mites & spider mites, and thrips (Table 16, p8)

Table 7. Ranking of pests with limited management choices.

Pest Group	Weighted Ranking
Foliar Feeding Beetles	54
Thrips	50
Mites & Spider Mites	43
Aphids	31
Mealybugs	29
Scale	17
Whiteflies	17
White Grubs & Root Weevils	12
Other	9
Lepidopterans	8
Symphyla	8
Adelgids	6
Leaf Hoppers	6
Lygus & Plant Bugs	6
Public Health Pests	3
Leafminers	3
Turf Pests	3
Gall Insects	2
Flies, Sawflies & Fungus Gnats	2
Snails & Slugs	1

Plant Pathology

When all responses were grouped together, the top five diseases included Phytophthora & Pythium, bacterial diseases, leaf spots & anthracnose, crown & root rots, and powdery mildew (Table 8, p4). The crown & root rot group contains diseases affecting roots, crowns, and lower trunks that are clearly not caused by Pythium or Phytophthora. Note that the calculation for weighted ranking here removes any duplication for crop or production site.

For the rankings grouped by site, the greenhouse and nursery production sites had similar issues whereas landscape responses were different. Bacterial diseases, *Phytophthora* & *Pythium*, and powdery mildew were important for growers. (Table 11, p5). Both non-oomycete crown & root rots and leaf spots & anthracnose appeared in the top 5 within greenhouses and either container or field grown nurseries.

When the rankings were calculated based on the crop categories there were some differences among the groups (Table 14, p6). *Phytophthora* & *Pythium* appeared in all crop categories. Bacterial diseases were in the top 5 for all but Christmas trees. Leaf spots & Anthracnose appeared in 4 crop categories as did non-oomycete crown and root rots.

The specific diseases mentioned most frequently include Phytophthora, nematodes, and downy mildew (Table 17, p9)

Weed Science

When all responses were grouped together, the top five weeds included Liverworts & Moss & Algae, Broadleaf Summer Annuals, Broadleaf Perennials, Broadleaf Annuals/Perennials, and Broadleaf Winter Annuals/Perennials (Table 9, p4). Note that the calculation for weighted ranking here removes any duplication for crop or production site.

When the rankings were separated by production site, broadleaf summer annuals, broadleaf winter annual/biennials, broadleaf annuals/biennials, and liverworts & moss & algae ranked in the top five weed types (Table 12, p7).

When separated by crop category, liverworts & moss & algae were most important followed by the various types of broadleaf weeds (Table 15, p5).

The specific weeds mentioned most included nostoc (23), liverwort (20), oxalis (18), bittercress (17), dogfennel (12), and spurge (12) (Table 18 p10).

Table 8. Ranking of diseases with limited management choices.

Disease Group	Weighted Ranking
Phytophthora & Pythium	56
Bacterial Diseases	54
Leaf Spots & Anthracnose	33
Crown & Root Rot	30
Powdery Mildew	17
Nematodes	17
Downy Mildew	17
Vascular Wilts	9
Canker	9
Other	8
Virus	7
Rusts	7
Foliar Blights	7
Botrytis	7
Vegetable Diseases	3
Phytophthora & Pythium	56

Table 9. Ranking of weeds with limited management choices.

Weed Group	Weighted Ranking
Liverworts & Moss & Algae	46
Broadleaf - Summer Annual	34
Broadleaf - Perennial	32
Broadleaf - Annual/Perennial	18
Broadleaf - Winter Annual/Biennial	17
Sedge & Nutsedge	16
Grass	16
Other	13
Broadleaf	9
Turf weeds	8
Broadleaf - Winter Annual	8
Horsetail & Similar Weeds	7
Comment	3
Broadleaf - Biennial	2

Table 10. Top 5 issues by production site for Entomology.

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Thrips (80)	Foliar Feeding Beetles (80)	Mites & Spider Mites (22)	Mealybugs (12)
2	Mealybugs (58)	Mites & Spider Mites (66)	Foliar Feeding Beetles (21)	Aphids (7)
3	Mites & Spider Mites (57)	Thrips (58)	Thrips (19)	Thrips (4)
4	Foliar Feeding Beetles (39)	Mealybugs (51)	Mealybugs (15)	Scale (4)
5	Aphids (32)	Aphids (30)	Scale (13)	White Grubs & Root Weevils (3)

Table 11. Top 5 issues by production site for Plant Pathology.

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Bacterial Diseases (50)	Phytophthora & Pythium (64)	Phytophthora & Pythium (31)	Powdery Mildew (6)
2	Phytophthora & Pythium (42)	Bacterial Diseases (60)	Bacterial Diseases (31)	Leaf Spots & Anthracnose (6)
3	Powdery Mildew (32)	Crown & Root Rot (31)	Leaf Spots & Anthracnose (30)	Foliar Blights (3)
4	Leaf Spots & Anthracnose (26)	Powdery Mildew (29)	Powdery Mildew (8)	Downy Mildew (3)
5	Crown & Root Rot (23)	Nematodes (21)	Vascular Wilts (6)	Phytophthora & Pythium (2)

Table 12. Top 5 issues by production site for Weed Science

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Broadleaf - Summer Annual (67)	Liverworts & Moss & Algae (76)	Liverworts & Moss & Algae (34)	Sedge & Nutsedge (24)
2	Liverworts & Moss & Algae (64)	Broadleaf - Summer Annual (66)	Broadleaf - Annual/Perennial (34)	Broadleaf - Annual/Perennial (9)
3	Broadleaf - Winter Annual/Biennial (53)	Broadleaf - Winter Annual/Biennial (53)	Broadleaf - Winter Annual/Biennial (33)	Broadleaf - Summer Annual (8)
4	Broadleaf - Annual/Perennial (34)	Broadleaf - Perennial (49)	Broadleaf - Summer Annual (26)	Grass (6)
5	Sedge & Nutsedge (33)	Broadleaf - Annual/Perennial (40)	Sedge & Nutsedge (21)	Broadleaf - Winter Annual/Biennial (6)

Table 13. Top 5 issues by crop category for Entomology.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees & Palms	Christmas Trees
1	Thrips (11)	Thrips (24)	Mites & Spider Mites (7)	Thrips (36)	Foliar Feeding Beetles (50)	Scale (7)
2	Mites & Spider Mites (3)	Mealybugs (19)	Foliar Feeding Beetles (3)	Foliar Feeding Beetles (33)	Mites & Spider Mites (29)	Adelgids (6)
3	Lepidopterans (3)	Mites & Spider Mites (14)	Thrips (1)	Mealybugs (22)	Mealybugs (16)	White Grubs & Root Weevils (5)
4	Mealybugs (1)	Whiteflies (12)		Mites & Spider Mites (17)	Scale (16)	Aphids (5)
5		Aphids (11)		Aphids (14)	Thrips (15)	Lepidopterans (3) Public Health Pests (3)

Table 14. Top 5 issues by crop category for Plant Pathology.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees & Palms	Christmas Trees
1	Botrytis (4)	Powdery Mildew (12)	Bacterial Diseases (3)	Phytophthora & Pythium (25)	Phytophthora & Pythium (35)	Phytophthora & Pythium (10)
2	Bacterial Diseases (3)	Downy Mildew (12)	Phytophthora & Pythium (3)	Bacterial Diseases (21)	Bacterial Diseases (34)	Leaf Spots & Anthracnose (7)
3	Leaf Spots & Anthracnose (3)	Bacterial Diseases (11)	Nematodes (2)	Crown & Root Rot (10)	Leaf Spots & Anthracnose (23)	Crown & Root Rot (4)
4	Phytophthora & Pythium (3)	Phytophthora & Pythium (9)	Rusts (1)	Nematodes (8)	Crown & Root Rot (15)	Canker (3)
5	Powdery Mildew (3)	Crown & Root Rot (4)		Powdery Mildew (6) Leaf Spots & Anthracnose (6)	Nematodes (14)	

Table 15. Top 5 issues by crop category for Weed Science.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees & Palms	Christmas Trees
1	Broadleaf - Summer Annual (5)	Liverworts & Moss & Algae (9)	Liverworts & Moss & Algae (17)	Liverworts & Moss & Algae (23)	Liverworts & Moss & Algae (39)	Broadleaf - Perennial (7)
2	Broadleaf (3)	Broadleaf - Summer Annual (8)	Broadleaf - Perennial (15)	Broadleaf - Annual/Perennial (15)	Broadleaf - Summer Annual (26)	Broadleaf - Winter Annual/Biennial (5)
3	Sedge & Nutsedge (3)	Broadleaf - Winter Annual/Biennial (6)		Broadleaf - Summer Annual (15)	Broadleaf - Perennial (24)	Broadleaf - Winter Annual (3)
4		Broadleaf - Annual/Perennial (5)		Broadleaf - Winter Annual/Biennial (15)	Broadleaf - Winter Annual/Biennial (17)	Sedge & Nutsedge (3)
5		Sedge & Nutsedge (3) Comment (3)		Broadleaf - Perennial (15)	Broadleaf - Annual/Perennial (16) Sedge & Nutsedge (16)	Broadleaf - Annual/Perennial (2)

Table 16. Specific issues for each pest group.

Pest Group	Pest	Weighted Ranking
Adelgids	Balsam woolly adelgid	6
Aphids	Aphids	8
	Aphids, ajuga	3
	Aphids, bedding plants	1
	Aphids, calabracchoa	3
	Aphids, edibles	2
	Aphids, milkweed	3
	Pine bark aphids	2
	Root aphids	6
	Woolly aphids	3
Flies, Sawflies & Fungus Gnats	Fungus gnats	2
Foliar Feeding Beetles	Cucumber beetle, dahlia	3
	Flea beetle	12
	Flea beetle, hydrangea	2
	Flea beetle, hydrangea/azalea	3
	Flea beetle, perennials	1
	Japanese beetle, rose	6
	Japanese beetle, rose/linden	2
	Red-headed flea beetle	25
Gall Insects	Shoot gall midge, norway spruce	2
Leaf Hoppers	Leaf hopper	3
	Potato Leafhopper	3
Leafminers	Leafminer, daylily	3
Lepidopterans	Cabbage Looper	2
	Cut Worms	1
	European Corn Borer	2
	Pine Tip Moth	3
Lygus & Plant Bugs	Garden fleahopper	2
	Lygus	4
Mealybugs	Citrus mealybug	1
	Mealybug	23
	Mealybug, coleus	1
	Mealybug, cuphea	1
	Mealybug, tropical plants	3
Mites & Spider Mites	Aloe mites	3
	Blister mites, Pyrus	2
	Broad mite	4
	Broad mite, hydrangea	2
	Mites	12
	Pear blister mite	3
	Spider mite	12
	Spider mite, bamboo	3
	Spider mite, chrysanthemum	2
Other	Chewing insects	3
	Leaf roller	1
	Leafcutter Ants	3
	Termites	2
Public Health Pests	Yellow jackets	3
Scale	Armored scale	3

Pest Group	Pest	Weighted Ranking
	Elongate hemlock scale	3
	Hard scale, ficus	1
	Scale	9
	Scale, holly	1
Snails & Slugs	Snail & slug	1
Symphylla	Garden symphylla	3
	Symphylla	5
Thrips	Chili thrips	11
	Chili thrips, shrubs	2
	Echinothrips	1
	Flower thrips	1
	Thrips	33
	Western flower thrips	2
Turf Pests	Zoysia mite	3
White Grubs & Root Weevils	Japanese beetle	7
	White grubs	3
	Whitepine weevil	2
Whiteflies	Whiteflies	9
	Whiteflies, lantana	3
	Whiteflies, poinsettia	5

Table 17. Specific issues for each disease group

Disease Group	Disease/Pathogen *	Weighted Ranking
Bacterial Diseases	Agrobacterium	3
	Bacteria	19
	Bacterial Gall, loropetalum	2
	Bacterial leaf spot	12
	Fire blight	6
	Pseudomonas	2
	Rhodococcus	2
	Xanthomonas, annuals	3
	Xanthomonas, delphinium	3
	Xanthomonas, shrubs	2
Botrytis	Botrytis	7
Canker	Botryosphaeria	3
	Canker	2
	Canker, pitch	2
	Phomopsis, juniper	2
Crown & Root Rot	Boxwood decline (Paecilomyces buxi)	3
	Crown rot	1
	Fusarium	6
	Root rot	10
	Sclerotinia, black eyed susan	3
	Thielaviopsis	5
	Thielaviopsis, calibrachoa	2
Downy Mildew	Downy mildew	2
	Downy mildew, basil	10
	Downy mildew, rose	5
Foliar Blights	Boxwood blight	1
	Twig Blight (Kabatina, Phomopsis)	3
	Volutella, boxwood	3

Leaf Spots & Anthracnose	Anthracnose	7
	Black spot	6
	Colletotrichum	1
	Cylindrocarpon	5
	Cylindrocladium	1
	Leaf Blotch, Peony	3
	Leaf spot, hydrangea	1
	Needle blight	1
	Needle cast	3
	Needle cast, spruce (Rhizosphaera)	3
	Needle cast, swiss, douglas fir	2
Nematodes	Nematode	6
	Nematode, foliar	11
Other	Fungal disease	8
Phytophthora & Pythium	Phytophthora	39
	Phytophthora, boxwood	3
	Pythium	9
	Pythium, boxwood	3
	Pythium, pansy	2
Powdery Mildew	Powdery Mildew	9
	Powdery Mildew, dogwood	2
	Powdery Mildew, gerbera	3
	Powdery Mildew, poinsettia	3
Rusts	Rust, cedar-hawthorne (Gymnosporangium globosum)	3
	Rust, daylily	3
	Rust, myrtle	1
Vascular Wilts	Vascular Streak Dieback	6
	Wilt (Ascochyta clematidina), clematis	3
Vegetable Diseases	Multiple, Tomato	3
Virus	Impatiens Necrotic Spot Virus	3
	Rose Mosaic	4

Table 18. Specific issues for each weed group.

Weed Group	Weed	Weighted Ranking
Broadleaf	Cut leaf primrose	3
	Foxtail	3
	Broadleaf	3
Broadleaf - Annual/Perennial	Oxalis	18
Broadleaf - Biennial	Wild Carrot	2
Broadleaf - Perennial	Dog Fennel	12
	Canada Thistle	9
	Goldenrod	3
	Dandelion	3
	Cottonwood	2
	Creeping Charlie	2
	Willow	1
Broadleaf - Summer Annual	Spurge	12
	Ragweed	4
	Eclipta	4
	Pigweed	3
	Dayflower	3
	Mulberryweed	2

Weed Group	Weed	Weighted Ranking
	Purslane	2
	Chamberbitter	2
	Lambsquarter	1
	Pineapple weed	1
Broadleaf - Winter Annual	Cudweed	4
	Groundsel	3
	Conyza	1
Broadleaf - Winter Annual/Biennial	Bittercress	17
Comment	Weeds in greenhouse	3
Grass	Grass	5
	Annual grasses	3
	Grasses	3
	Poa annua	3
	Quackgrass	2
Horsetail & Similar Weeds	Equisetum	7
Liverworts & Moss & Algae	Nostoc Algae	23
	Liverwort	20
	Pearlwort	2
	Algae	1
Other	Weeds	6
	water wort	3
	All weeds	3
	Wild Proso Millet	1
Sedge & Nutsedge	Nutsedge	7
	Yellow Nutsedge	5
	Nutgrass	3
	Sedge	1
Turf weeds	Goosegrass	3
	Downy Brome	3
	Crabgrass	2