



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

The intent of the Ornamental 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 ornamental 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 with 45% originating in the Northeast Region (Table 1). Sixty-two percent were growers with the next largest segment being lawn care professionals at 11% (Table 2). The operation type most represented was greenhouse followed by nursery container growers (Table 3). Those participants involved in field-grown nursery production or in the landscape represented a significant portion of the operation types. Most survey participants did select more than one operation type (data not shown).

Over 40% of the respondents used chemical control while a third used biological controls (Table 4). Thirty-eight percent had IPM as a management style and 28% of survey participants use organic tools. Many participants did not choose a philosophy for when to apply, but those that did were more prone to make applications when needed rather than based on a calendar.

More respondents grew bedding plants and perennials than any other crop type (Table 5). Approximately a third of the growers produce ornamental grasses, shrubs, and/or trees. Fewer survey respondents grew foliage plants, seasonal potted plants, cut flowers, palms, and Christmas trees.

Table 1. IR-4 Region for survey participants.

Region	Count	Percent
NorthCentral	42	12%
Northeast	155	45%
Southern	85	25%
Western	64	18%
Total	346	100%

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

Segment	Count	Percent
Extension	22	6%
Government	12	3%
Grower	213	62%
Industry	21	6%
Interiorscaper	1	0%
LCP	39	11%
Researcher	38	11%

Table 3. Operation types (multiple selections).

Production Site	Count	Percent
Greenhouse	168	49%
Nursery Container	107	31%
Nursery Field	75	22%
Landscape	70	20%
Interiorscape	21	6%
Christmas Tree Farm	23	7%
Sod Farm	7	2%

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

Management Styles	Count	Percent
Biological Control	106	31%
Chemical Control	153	44%
IPM	132	38%
Organic	53	15%
Weekly/Monthly Sprays	5	1%
Spray at Thresholds	83	24%

Table 5. Spectrum of crops grown (multiple selections).

Crop Type	Count	Percent
Bedding Plants	141	41%
Cut Flowers	41	12%
Christmas Trees	36	10%
Foliage Plants	91	26%
Perennials	138	40%
Ornamental Grasses	122	35%
Palms	36	10%
Seasonal Potted Plants	68	20%
Shrubs	123	36%
Trees	117	34%
Turf	42	12%

Research Direction/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. Unlike previous surveys, respondents in this survey selected crop safety as the most needed option followed closely by needing both crop safety and efficacy (Figure 1). The next question asked for a ranking of 16 categories based on how much the information is needed for daily operations. This ranking was on a scale of 1 (not needed) to 5 (very important). Any categories that were unranked received a '0' if at least one category was ranked in that person's survey. In general, developing new products had a higher average than expanding current products, and generating efficacy data had a higher average than crop safety data (phytotoxicity), which conflicts with the responses to the previous question (Table 6). Plant pathology, entomology and weed science when analyzed separately followed these same trends, but there were clear preferences among the categories for plant growth regulators.

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.

Figure 1. Counts on type of data to be generated.

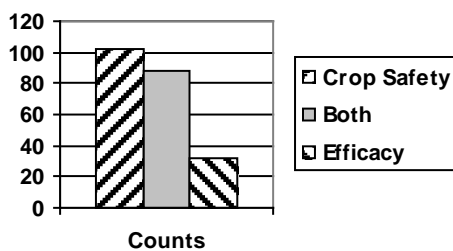


Table 6. Research direction for each discipline.

Research Direction	Disease	Insect	Weed	PGR	Ave
New Products	3.44 a	3.65 a	3.39 a	2.36 a	3.21 a
Expand Products	3.25 ab	3.13 b	3.09 ab	2.52 a	3.00 ab
More Efficacy	3.38 ab	3.26 ab	3.11 ab	2.72 a	3.17 ab
More Phytotoxicity	3.01 b	3.09 b	2.96 b	2.58 a	2.91 b

* Within columns, numbers followed by different letters are statistically different based on Fisher-Hayter at $p < 0.05$.

Table 7. Ranking of pests with limited management choices.

Pest Group	Weighted Ranking
Thrips	213
Mites & Spider Mites	172
Scale & Mealybugs	145
Borers & Beetles	117
Aphids	61
White Grubs & Root Weevils	39
Whiteflies	35
Leafminers	27
Fungus Gnats	20
Other	18
Turf Pests	17
Lygus	13
Nematodes	11
Lepidopterans	11
Stink bugs	9
Snails & Slugs	6
Lace Bugs	6
Leaf Hoppers	4
Symphylla	4
Ants	3
Midges	3
Stinkbugs	2
Adelgids	2

Table 8. Ranking of diseases with limited management choices.

Disease Group	Weighted Ranking
Crown & Root Rot	144
Bacterial Diseases	130
Phytophthora & Pythium	105
Leaf Spots & Anthracnose	93
Powdery Mildew	83
Other	69
Botrytis	51
Canker	44
Rusts	41
Downy Mildew	40
Nematodes	37
Turf Diseases	25
Virus	23
Vascular Wilts	23
Foliar Blights	11

Entomology

When all responses were grouped together the top five pests of concern were thrips, mites & spider mites, scale & mealybug, borers & beetles, and aphids (Table 7 - p2). Note that the calculation for weighted ranking here removes any duplication for crop or production site.

When weighted rankings were calculated for categories of crops, the top 5 pests changed for each crop type (Table 10 - p4). Two pest groups were present in at least four out of five crop types: thrips and mites & spider mites.

When the weighted rankings were calculated based on the production sites, there were some differences among the order, but 4 of the top 5 were similar (Table 11 - p4). Three pest types were in the top five for each primary production site: thrips, mites & spider mites, scale & mealybugs, and borers & beetles. It was unexpected for borers & beetles to appear in the greenhouse production site; this seems to come from flea beetles and other coleopterans found in certain greenhouse crops along with some potential for respondents to include woody ornamentals grown for a portion of their crop cycle in hoop houses.

Plant Pathology

When all responses were grouped together, the top five diseases crown & root rots, bacterial diseases, *Phytophthora* & *Pythium*, leaf spots & anthracnose, and powdery mildew (Table 8 - p2). 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.

When the rankings were calculated based on the crop types there were some differences among the groups (Table 12 - p4). While crown & root rots and bacterial diseases were in the top five for each crop type, water mold root rots (*Pythium*, *Phytophthora*) were in 4 of the crop types.

For the rankings grouped by production site, crown & root rots, *Phytophthora* & *Pythium*, and bacterial diseases were the three top issues (Table 13 - p4).

Weed Science

Although there were some variations between rankings whether the responses are grouped together or separated by crop or production site, there was a general trend among the three areas. The top weed type of concern was broadleaf weeds, followed by sedge & nutsedge and then by grass and liverworts & moss & algae (Table 9, Table 14 – p5, Table 15 – p5).

A more detailed look at the weeds respondents included in the survey is warranted (Table 16 - p5). The top weeds mentioned were nutsedge and liverwort. Four broadleaf weeds were included frequently: thistle, bittercress, spurge, and oxalis.

Table 9. Ranking of weeds with limited management choices.

Weed Group	Weighted Ranking
Broadleaf	264
Liverworts & Moss & Algae	88
Grass	66
Sedge & Nutsedge	58
Other	34
Horsetail & Similar Weeds	30
Turf weeds	17
Vine	11
Non-grass Monocots	2

Table 10. Top 5 issues by crop for Entomology.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees, Palms & Christmas Trees
1	Thrips (170)	Thrips (65)	Thrips (8)	Thrips (84)	Borers & Beetles (101)
2	Mites & Spider Mites (74)	Mites & Spider Mites (9)	Mites & Spider Mites (7)	Scale & Mealybugs (66)	Scale & Mealybugs (99)
3	Aphids (39)	Whiteflies (9)	White Grubs & Root Weevils (6)	Mites & Spider Mites (56)	Mites & Spider Mites (89)
4	Whiteflies (27)	Aphids (5)	Fungus Gnats (2)	Aphids (23)	Thrips (41)
5	Leafminers (19)	Leafminers (3)	Snails & Slugs (1)	Borers & Beetles (17)	White Grubs & Root Weevils (35)

Table 11. Top 5 issues by production site for Entomology.

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Thrips (344)	Thrips (169)	Thrips (147)	Thrips (104)
2	Mites & Spider Mites (215)	Mites & Spider Mites (160)	Mites & Spider Mites (93)	Scale & Mealybugs (90)
3	Scale & Mealybugs (126)	Scale & Mealybugs (113)	Borers & Beetles (73)	Mites & Spider Mites (58)
4	Aphids (75)	Borers & Beetles (73)	Scale & Mealybugs (56)	Borers & Beetles (44)
5	Borers & Beetles (57)	White Grubs & Root Weevils (48)	White Grubs & Root Weevils (48)	White Grubs & Root Weevils (41)

Table 12. Top 5 issues by crop for Plant Pathology.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees, Palms & Christmas Trees
1	Crown & Root Rot (69)	Powdery Mildew (16)	Phytophthora & Pythium (12)	Phytophthora & Pythium (50)	Leaf Spots & Anthracnose (83)
2	Phytophthora & Pythium (56)	Crown & Root Rot (9)	Vascular Wilts (6)	Crown & Root Rot (42)	Bacterial Diseases (75)
3	Bacterial Diseases (51)	Botrytis (7)	Crown & Root Rot (5)	Powdery Mildew (40)	Crown & Root Rot (69)
4	Powdery Mildew (38)	Bacterial Diseases (7)	Nematodes (4)	Bacterial Diseases (37)	Canker (38)
5	Botrytis (28)	Nematodes (6)	Bacterial Diseases (3)	Nematodes (25)	Phytophthora & Pythium (33)

Table 13. Top 5 issues by production site for Plant Pathology.

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Crown & Root Rot (167)	Bacterial Diseases (130)	Bacterial Diseases (75)	Crown & Root Rot (79)
2	Phytophthora & Pythium (146)	Crown & Root Rot (125)	Crown & Root Rot (62)	Phytophthora & Pythium (62)
3	Bacterial Diseases (145)	Phytophthora & Pythium (101)	Phytophthora & Pythium (59)	Bacterial Diseases (53)
4	Powdery Mildew (97)	Leaf Spots & Anthracnose (74)	Leaf Spots & Anthracnose (54)	Powdery Mildew (52)
5	Leaf Spots & Anthracnose (65)	Powdery Mildew (63)	Powdery Mildew (37)	Vascular Wilts (31)

Table 14. Top 5 issues by crop for Weed Science.

	Bedding Plants & Seasonal Potted Plants	Cut Flowers	Ornamental Grasses	Foliage & Perennial Plants	Shrubs, Trees, Palms & Christmas Trees
1	Broadleaf (38)	Broadleaf (15)	Liverworts & Moss & Algae (32)	Broadleaf (89)	Broadleaf (163)
2	Liverworts & Moss & Algae (23)	Horsetail & Similar Weeds (8)	Broadleaf (28)	Liverworts & Moss & Algae (54)	Liverworts & Moss & Algae (67)
3	Horsetail & Similar Weeds (7)	Grass (5)	Grass (14)	Sedge & Nutsedge (23)	Sedge & Nutsedge (28)
4	Grass (4)	Liverworts & Moss & Algae (3)	Sedge & Nutsedge (8)	Grass (18)	Grass (26)
5		Sedge & Nutsedge (3)	Turf weeds (3)	Horsetail & Similar Weeds (11)	Horsetail & Similar Weeds (24)

Table 15. Top 5 issues by production site for Weed Science.

	Greenhouse	Nursery Container	Nursery Field	Landscape
1	Broadleaf (236)	Broadleaf (248)	Broadleaf (157)	Broadleaf (91)
2	Liverworts & Moss & Algae (151)	Liverworts & Moss & Algae (154)	Liverworts & Moss & Algae (100)	Liverworts & Moss & Algae (80)
3	Grass (46)	Sedge & Nutsedge (52)	Grass (43)	Grass (41)
4	Sedge & Nutsedge (36)	Grass (49)	Sedge & Nutsedge (36)	Sedge & Nutsedge (32)
5	Horsetail & Similar Weeds (34)	Horsetail & Similar Weeds (33)	Horsetail & Similar Weeds (30)	Horsetail & Similar Weeds (14)

Table 16. Specific issues for each weed group.

Weed Group	Weed	Weighted Ranking
Broadleaf	Bengal Day Flower	1
Broadleaf	Bermuda buttercup	3
Broadleaf	Bindweed	3
Broadleaf	Bittercress	28
Broadleaf	Bittercress - pre-emergent limited activity labeled for perennial	
Broadleaf	Bittercress in actively growing conifer seedlings	
Broadleaf	Black swallow wort	6
Broadleaf	Swallowwort	
Broadleaf	Blue mustard	1
Broadleaf	Broad leaf	3
Broadleaf	Burn weed in containers	3
Broadleaf	Button weed	2
Broadleaf	Chickweed	3
Broadleaf	Clover	5
Broadleaf	Clovers	
Broadleaf	Common Groundsel	11
Broadleaf	Groundsel	
Broadleaf	Crown vetch	6
Broadleaf	Erownvetch	
Broadleaf	Vetch	
Broadleaf	Dauter	3
Broadleaf	Dore weed	3
Broadleaf	Eclipta	7
Broadleaf	Ecliptia	
Broadleaf	Field bindweed	6
Broadleaf	Field bindweed in dicots	

Weed Group	Weed	Weighted Ranking
Broadleaf	Galisoga	3
Broadleaf	Ground Ivy	4
Broadleaf	Japanese Knotweed	8
Broadleaf	Japanese Knotweed in the landscape	
Broadleaf	Prostrate knotweed	
Broadleaf	Kiek	3
Broadleaf	Malva	3
Broadleaf	Mikania micrantha	3
Broadleaf	Mile-A-Minute	5
Broadleaf	Milkweed	8
Broadleaf	Milkweed in field grown nursery stock	
Broadleaf	Milkweed; Canadian thistle	
Broadleaf	Northern Willow Herb	11
Broadleaf	Northern willow herb (thanks Oregon)	
Broadleaf	Northern Willowherb in containers	
Broadleaf	Willow herb	
Broadleaf	Nothern willow herb	
Broadleaf	Black Medic (oxalis)	18
Broadleaf	Oxalis	
Broadleaf	Oxalis - postemergent	
Broadleaf	Oxalis in the GH	
Broadleaf	Oxalis in the greenhouse	
Broadleaf	Perennial-broadleaf	3
Broadleaf	Phyllanthus, Fatoua, and Oxalis on Hippeastrum and other Amaryllidaceae	3
Broadleaf	Pigweed	2
Broadleaf	Pigweed (all types)	
Broadleaf	Poison ivy is big issue	3
Broadleaf	Prickle lettuce/sow thistle	1
Broadleaf	Purple night shade	2
Broadleaf	Purslane	3
Broadleaf	Ragweed	1
Broadleaf	Sanseveria sp.	2
Broadleaf	Sedum	3
Broadleaf	Shepardspurse	3
Broadleaf	Smartweed	5
Broadleaf	Sow Thistle	2
Broadleaf	Nodding Spurge	25
Broadleaf	Prostrate Spurge	
Broadleaf	Prostrate, Spotted Spurge	
Broadleaf	Spotted (prostrate) spurge	
Broadleaf	Spurge	
Broadleaf	Spurge on misc trees	
Broadleaf	Canada thistle	28
Broadleaf	Canada thistle	
Broadleaf	Thistle	
Broadleaf	Thistle in nursery stock	
Broadleaf	Thistle, bull and canadian	
Broadleaf	Thistles	
Broadleaf	Thistles near young sensitive plants	2
Broadleaf	Tropical Spiderwort	
Broadleaf	Speedwell	9

Weed Group	Weed	Weighted Ranking
Broadleaf	Veronica (speedwell)	
Broadleaf	Veronica sp	
Broadleaf	Wild Mustard	2
Broadleaf	Wild tomato	1
Broadleaf	Wild Violets	3
Broadleaf	Wooly croton	3
Broadleaf	Yellow parsips	1
Grass	Annual bluegrass	2
Grass	Bamboo	6
Grass	Bamboo in the landscape	2
Grass	Bermuda and Zoysia in shrub beds	3
Grass	Bermuda grass	3
Grass	Bermudagrass	2
Grass	Coastal Bermudagrass	2
Grass	Cogongrass	1
Grass	Common bentgrass	1
Grass	Crabgrass	1
Grass	Dallas grass	9
Grass	Goose grass on misc trees	2
Grass	Grass	3
Grass	Grasses in vegetable crops	3
Grass	Johnson grass	
Grass	Johnsongrass	6
Grass	Late season grasses	2
Grass	Perennial fescues, other perennial grasses	3
Grass	Poa annua	3
Grass	Quack grass	
Grass	Quackgrass	10
Horsetail & Similar Weeds	Equisetum	2
Horsetail & Similar Weeds	Field horsetail in landscape plantings	2
Horsetail & Similar Weeds	Horesetail (Equisetum) in herb perennials, cut flowers	3
Horsetail & Similar Weeds	Horse tail	4
Horsetail & Similar Weeds	Horse tail-equisetium	3
Horsetail & Similar Weeds	Glyphosate tolerant maretail	3
Horsetail & Similar Weeds	Horseweed	3
Horsetail & Similar Weeds	Mare's tail (big problem in recent years - no good control)	3
Horsetail & Similar Weeds	Marestail	7
Liverworts & Moss & Algae	Liverwort	
Liverworts & Moss & Algae	Liverwort (propagation of perennial and woody plugs)	
Liverworts & Moss & Algae	Liverwort on Passiflora	57
Liverworts & Moss & Algae	Liverwort on woody liners	
Liverworts & Moss & Algae	Liverworts	
Liverworts & Moss & Algae	Moss	
Liverworts & Moss & Algae	Moss in greenhouse	15
Liverworts & Moss & Algae	Mugwort	
Liverworts & Moss & Algae	Mugwort in shrubs	4
Liverworts & Moss & Algae	Pearlwort	
Liverworts & Moss & Algae	Pearlwort in container	5
Liverworts & Moss & Algae	Toxic Algae Lyngaya	3
Non-grass Monocots	Wild oats	2
Other	All Weeds in greenhouses	6
Other	General weed control in small containers	3

Weed Group	Weed	Weighted Ranking
Other	Herbicide research and safety within greenhouses	3
Other	Limited herbicide options for natives	3
Other	Rest of greenhouse weeds (need a pre-emergent herb.)	1
Other	Use Roundup (generic) three times a season	3
Other	Weed control without lasting chemicals	3
Other	Weeds	3
Other	Weeds in bonsai	3
Other	Weeds on a green roof	3
Other	Weeds on floors	3
Sedge & Nutsedge	Nutgrass	8
Sedge & Nutsedge	Nut grass	
Sedge & Nutsedge	Nutgrass (post emergent) in field grown nursery stock	
Sedge & Nutsedge	Nut Sedge	23
Sedge & Nutsedge	Nutsedge	
Sedge & Nutsedge	Nutsedge - post emergent nursery	
Sedge & Nutsedge	Nutsedge in the field	
Sedge & Nutsedge	Nutsedge on misc trees	
Sedge & Nutsedge	Purple nut sedge	
Sedge & Nutsedge	Sedge	3
Sedge & Nutsedge	Nut Sedge Yellow	4
Sedge & Nutsedge	Yellow nutsedge in landscapes	21
Turf weeds	Crabgrass in St. Augustine	3
Turf weeds	Dallis and Goose Grass control in warm season turf	2
Turf weeds	Grass type weeds in St. Augustine	3
Turf weeds	Poa annua and Yellow Woodsorrel control in warm season turf	1
Turf weeds	Quackgrass in turf	3
Turf weeds	Trees/Shrubs in Lawn	2
Turf weeds	Weedy grass in Lawn	3
Vine	Convolvulus in the field	11
Vine	Morning glory	
Vine	Morning glory in conifer	