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Needs Assessment Survey of the Virginia Greenhouse Industry

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Abstract

This report summarizes responses to a survey of the greenhouse and perennial production industry in Virginia. More than two hundred and seventy greenhouse growers or perennial plant producers, ranging from very small operations with no employees to very large ones employing dozens of workers, answered questions regarding the scope of their business, current cultural practices and training interests, and their perception of th primary issues facing their industry.

Analysis of the survey responses reveals that there are far more small operations than large. Small greenhouses, defined as those having less than 10,000 square feet of heated space, made up 58% of the respondents. Nineteen percent of the responding businesses were defined as medium sized greenhouses based operating between 10, 000 and 29,999 square feet of heated space. Large greenhouses, those with over 30,000 square feet of heated space, made up only 15% of the total**.** A final 9% of the respondents were categorized as "other," based on the nature of their business rather than size. However, large growers operate a disproportion share of the production space, employ a disproportionate number of those working in greenhouses, and genera the majority of the revenue earned in this field. Those responding to this survey represent many years of experience in the greenhouse industry. As might be expected, many of the larger operations had been in busin longer, but even small operations reported a median of eight years in business under present ownership.

Most respondents produce a variety of crops, and are interested in learning more about crops that they currently produce, as well as crops that they are not currently producing, with interest in learning more about perennials being the most preferred topic. While nearly two thirds of the respondents produce some form of bedding plants, many other floral and vegetable crops are in production. There was a trend toward some flowe potted plants like poinsettias or chrysanthemums being produced in greater numbers by large greenhouses. Sc training needs varied with the size of the operation. Large and medium sized growers expressed more interest did small and other growers in learning about several plant production topics, including automation of greenho functions, nutritional management, plant growth regulators and managing wastewater and runoff. Large and medium sized growers were generally more interested in employee management topics. Information regardin training needs is being used to develop research and educational programs planned to meet the identified need those in the industry.

Following administration of the survey, three focus groups were conducted in various parts of Virginia Small groups of growers were given an opportunity to discuss the issues greenhouse growers face in running profitable operations. Recurring themes confirmed the survey results and included attracting and retaining a competent labor force, and marketing to deal with competition. A focus group in which participants were VC agents discussed how VCE could address the issues facing the industry.

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Introduction -- Goals

As a result of budget cuts in the early 1990s, there have been no Virginia Tech faculty members dedicated to the greenhouse industry. Therefore, the University had lost contact with this segment of the ornamental horticulture industry. Since 1997, Virginia Tech has added four new faculty members supporting ornamental horticulture. Two floriculturists were added in October 1999 to support the greenhouse industry. The new floriculturists wanted to determine where the greenhouse industry was located, and to identify the primary crops and current research and educational programming needs of this industry. Using this information, new programs could be established that would more clearly address current needs of greenhouse operators and therefore, enhance the growth and profitability of this industry.

At the request of the new floriculturists, the Virginia Agricultural Council funded a Needs Assessment Survey of the Greenhouse Segment of the Ornamental Horticulture Industry in Virginia in the summer of 2000. The needs assessment instrument was developed and conducted by faculty of the Horticulture Department of Virginia Tech and Virginia Cooperative Extension (VCE) with input from industry representatives. Originally, the issues were to be identified through focus groups of growers, but after additional consultation with the VCE experts in this area, we decided to use the focus groups to help us interpret the survey responses.

The primary goal of the project was to collect information on issues facing the greenhouse industry and determine the research and education needs of greenhouse operators. This information will be used to develop research and extension programs that will ultimately improve the profitability of the greenhouse industry.

Materials and Methods

Development of the Survey Instrument

The three-part survey instrument was developed by the Extension Specialist for Greenhouse Crops and the Assistant Professor of Floriculture with input from industry representatives. Assistance with formatting of the questions was provided by Extension Specialists in Program Evaluation. The instrument was designed to gather basic information regarding the scope of the greenhouse industry in Virginia, to determine training and research interests of greenhouse operators, to look at various cultural practices of growers, and to identify the major issues facing the industry. The final survey consisted of 33 questions, many of which had multiple parts. Participants were asked for 266 different pieces of information, and offered an opportunity to make additional comments.

Development of the Mailing List

The goal was to administer the survey to all production greenhouse operators in the state to assess their research and education needs. In the fall of 2000, a mailing list of 980 potential greenhouse businesses was built by combining the mailing lists of the Virginia Flower Growers Association, Virginia Nursery and Landscape Association, smaller regional grower groups, the customer list of a large supplier of horticultural goods, and lists of greenhouse growers provided by local extension agents. There was concern that this combined list might contain some duplication, as well as a large number of nurserymen or landscapers who may not be in the greenhouse business. To address this concern, the first item on the instrument was a box to check if the respondent was not currently engaged in the greenhouse business or in the production of herbaceous perennials**.** For purposes of this survey, being engaged in the greenhouse business means propagating or growing floricultural crops or herbs or vegetables for human consumption in a greenhouse**.**

Administration of the Survey Instrument

The survey instrument was administered according to the method described in Don A. Dillman's *Mail and Telephone Surveys – The Total Design Method.* The initial mailing included the survey with a cover letter explaining the purpose of the survey, stressing that data collected would be used to plan research and educational programs to better serve the greenhouse industry (See Appendix 1). Confidentiality of collected data was also stressed. Participants were asked to return the survey indicating that operating a greenhouse was not their primary business, if this were the case. This letter was sent over the signatures of the presidents of the Virginia Flower Growers Association and the Virginia Nursery and Landscape Association, in addition to those of the Extension Specialist for Greenhouse Crops and the Assistant Professor of Floriculture. One week after the initial mailing, the entire mailing list received a post card encouraging participation in the project. Two subsequent mailings including an explanatory letter and a new copy of the survey were sent to those who had not responded to earlier mailings. Additionally, telephone calls were made by local extension agents to greenhouse growers to encourage survey participation. Project staff also called some growers to determine whether they were in the greenhouse business and to encourage participation.

Response Rate

It was ultimately determined that 503 of the businesses on the original mailing list were neither operating greenhouses nor growing herbaceous perennials. There were forty-two names deleted as undeliverable or duplications. Three returned surveys were so badly damaged in the mail that they were unidentifiable and unusable. After the final mailing, a total of 274 usable responses were analyzed, for a response rate of 63%.

Characterization of the Respondents

Respondents were widely dispersed across the state, with only one county containing more than nine greenhouse operations that responded to the survey (Fig. 1). Twenty-four city or county units in the state had four to nine greenhouse operations, while 48 units had one to three greenhouse operations. More than 28 units had no greenhouse operations responding to the needs assessment survey. The major concentrations of greenhouse operations, based on the number of respondents, were in the Shenandoah Valley and east into Albemarle, Orange and Culpeper counties; the central part of the state including Amelia, Chesterfield, and Hanover counties and Richmond; and the Tidewater area including Suffolk, Chesapeake, Virginia Beach and the Eastern Shore.

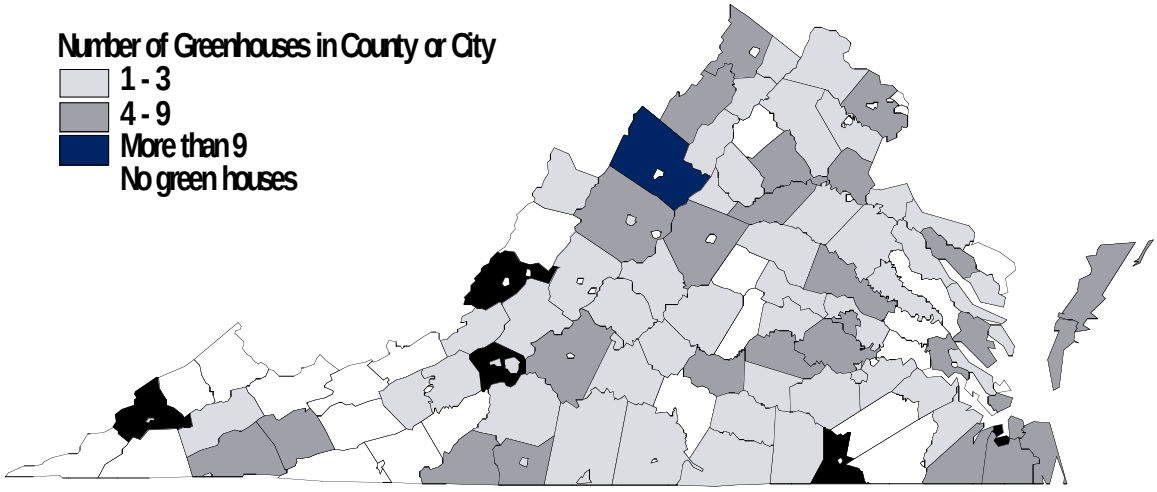


Fig. 1. Distribution of the respondents to the greenhouse needs assessment survey.

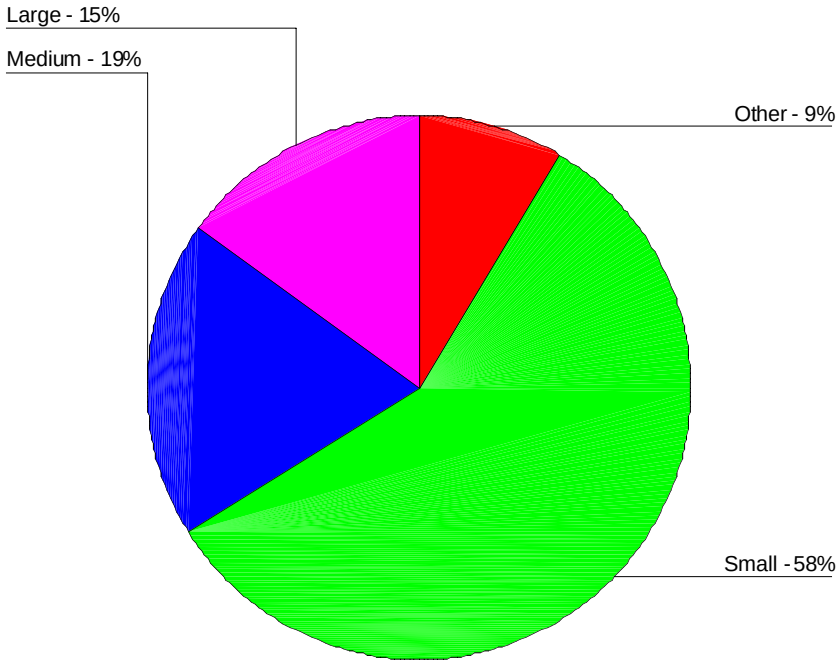
Development of Respondent Categories

An initial review of the responses from greenhouse operators indicated that slightly over half, 51%, had no full time, year-round employees other than family members. The investigators felt that this area required further examination, and developed a brief follow up questionnaire that explored the nature of these operations more fully. As a result of two mailings, 75% of the 139 follow-up surveys were returned. Growers were asked whether operating the greenhouse was the primary occupation of any adult in the family, as well as how many family members and others worked full or part time, year-round or seasonally, in the greenhouse. Growers also were asked whether they were part of a larger operation and which months the greenhouse was in operation. Examination of these responses indicated that the vast majority of these businesses were, in fact, commercial in orientation. Most were either part of a larger farm or nursery or were the primary occupation of at least one adult in the household.

The original surveys of those who failed to respond to the follow-up survey were reviewed to determine whether their operations appeared to be commercial in nature, based on reported revenues, unheated space, field plantings, or direct knowledge of the business. On this basis, thirty-four operations were categorized as small and one was considered a medium sized operation. Twenty-three were considered “other”; some were part time operations, some could not be definitively categorized, and some grew only field crops. Nine respondents provided so little information that they could not be placed in any category. (Fig. 2, Table 1).

Heated greenhouse space was decided upon as the most significant factor in determining whether a greenhouse was considered small, medium or large. Gross revenues were considered, but rejected, since more than one third of respondents did not provide revenue information. Number of employees was rejected as the determining factor because of the wide variations in staffing patterns; many operations use a large proportion of seasonal and/or part-time workers.

Fig. 2. Categories of respondents based on amount of heated greenhouse space.



Operations categorized as small greenhouses are less than 10,000 square feet, medium greenhouses are between 10,001 and 29,999 square feet, and large greenhouses have 30,000 square feet or more of heated space. "Other" status is based on activity, not size. Of 264 operations for which size was determined, 152 were small, 50 were medium, 39 were large, and 23 were considered "other".

Table 1. Categories of respondents based on heated greenhouse space (n=264).

Greenhouse category	Other	Small	Medium	Large
Heated greenhouse space (sq. ft.)	**	<10,000	10,000 – 29,999	>30,000
Total respondents (%)	9	58	19	15
Total respondents (number of greenhouse operations)	23	152	50	39

** Category based on level of activity, not size

Professional Background of Respondents

The instructions at the top of the first page of the survey stressed the importance of having the survey completed by the person in the company who has the best understanding of the business and the industry as a whole. Owners, most of whom were growers as well, completed the great majority, 86%, of the surveys (Fig. 3). Six job titles, describing roles in a greenhouse, were offered to indicate the position of the person completing the survey. The vast majority of respondents answered this question, with only 1.5% failing to indicate a job title. The job titles indicated by those choosing "Other", included: nursery manager, GM/grower, production manager, owner/ architect, marketing manager, landscape manager, co-owner, vice president, account executive, co-owner and grower, vice president of technology, and sales/shipping manager

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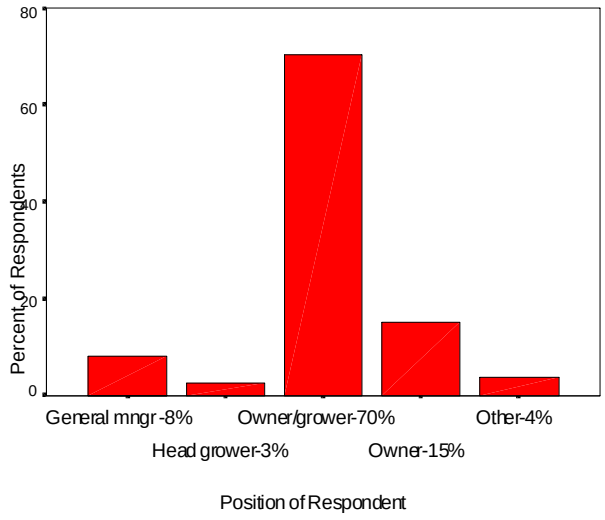
Fig. 3. Percent of surveys completed by individuals with various job titles (n=270).



Years of Experience in the Greenhouse Industry

Those growers responding to the survey represent many years of experience in the greenhouse industry (Fig. 4, Table 2). Years of experience of respondents ranged from 1 to 50 years. Overall, respondents reported a mean of 15.6 years in the field, with a median of 14 years. The most frequently reported (mode) number of years of experience was 20. Years of experience in the greenhouse industry varied significantly with the size of the greenhouse operation. If we assume that most large greenhouses began as small ones, it is not surprising that the median number of years of experience is 50% higher

among the respondents from large greenhouses than from small ones. This question elicited few comments; two individuals indicated experience in other areas of horticulture.

Fig. 4. Mean years of greenhouse experience by size of greenhouse operation (n=238).

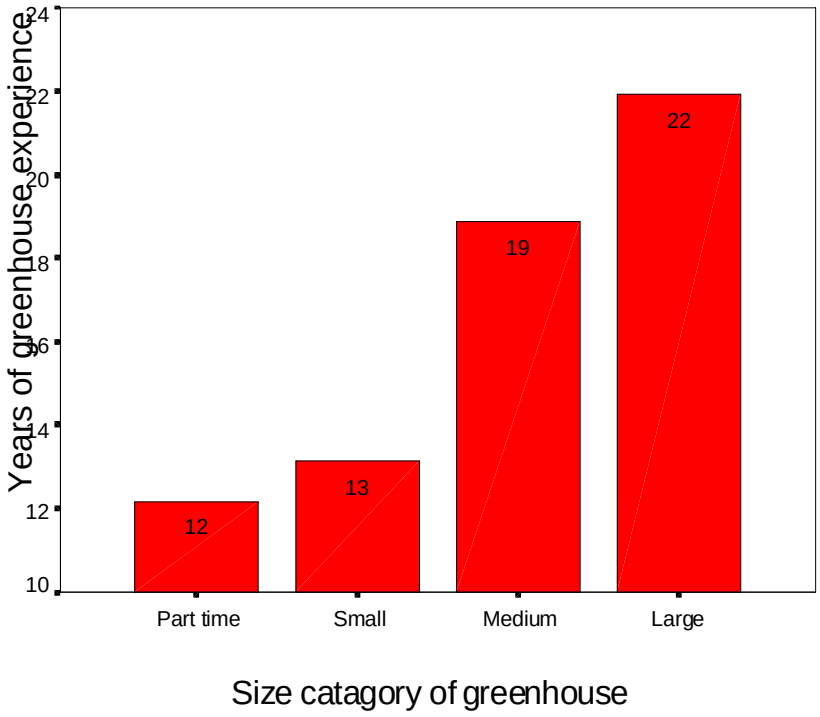


Table 2. Years of experience in greenhouse industry of individual completing survey (n=238).

Years in the greenhouse business	Greenhouse category			
	Other n=15	Small n=133	Medium n=44	Large n=38
Mean	12.2 b[w]	13.1 b	18.9 a	21.9 a
Median[x]	8.0	11.0	20.0	22.0
Mode[y]	3.0	3.0	20.0	12.0, 30.0[z]

[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level

[x] Median value is the number where half of the values are above and half are below this number.

[y] Mode is the number most frequently given by the respondents..

[z] More than one mode, both values cited an equal number of times

Professional or trade organizations

Respondents were asked to indicate in which of several professional or trade organizations, if any, they held memberships. Mailing lists from the Virginia Flower Growers Association, the Virginia Nursery and Landscape Association, and the Shenandoah Valley Nursery and Greenhouse Growers Association, were used in developing the mailing list for the survey, which may account for the relatively high percentage of members in these organizations (Table 3). Of particular interest is the fact that forty-five percent indicated that they had no memberships in professional or trade associations and another twelve percent of respondents declined to answer this question. "Other" responses noted were quite varied, ranging from local trade groups to national organizations focusing on a single species of plant, such as orchids or daylilies. Of the respondents who listed "other" organizations, nine cited the Ohio Florists Association, and eight listed the Perennial Plant Association.

Table 3. Respondent membership in professional organizations (n=242).

Organization	Members (%)
Virginia Nursery and Landscape Association	21
Virginia Flower Growers Association	14
Society of American Florists	2
Shenandoah Valley Nursery and Greenhouse Growers Association	12
Professional Plant Growers Association	4
Other	27
No professional group	45

Horticultural Training

Respondents were asked to indicate which of eight types of horticultural training or education they had. This question was answered by 97% of the respondents. There was probably some confusion as to definition of terms in this question. Some respondents indicated both a type of horticultural training completed, and no formal training in horticulture. For example, 24% of those claiming no formal education in horticulture have taken extension or community courses, and 4% of those indicated a four-year college degree under horticulture training (Table 4). Comments regarding horticulture training include "killed a lot of plants" and "grew up in the business."

Table 4. Horticultural training of survey respondents (n=266).

Type of horticulture training	Respondents who have this training (%)
No formal education in horticulture	50
Extension or community courses	40
Four year college	23
Two year community or technical college	11
VNLA certification programs	11
High school vocational program	9
Master Gardener certification	9
VFGA Greenhouse Operators certification	1

Education

The optional educational level question was completed by 99% of the respondents (Table 5). They were asked to indicate their highest level of education completed from a list of six choices. More than 75% of respondents report having some college education; of those completing four-year degrees, 21% majored in horticulture, and another 18% studied other branches of agriculture or plant science.

Table 5. Highest educational level completed by respondents (n = 271).

Highest educational level completed	Respondents (%)
Less than high school diploma	4
High school or GED	23
Some college	17
Two-year college degree	12
Four-year college degree	31
Post-graduate study	14

Crops Grown in Virginia Greenhouses

Respondents were asked to indicate which of twenty-five types of crops they were growing. Nine general categories of crops: bedding plants, foliage plants, perennials, vegetables, flowering potted plants, cut flowers, herbs, plugs, and other, were further divided into more specific groups. Some groups focused on the way in which the crop is grown, and others asked about specific plants.

Bedding plants are grown by the majority of the respondents to this survey, with more than 60% of them growing bedding plants in flats, baskets, or pots (Table 6). Bedding plants in pots are grown by 68% of the respondents. Foliage plants seem to be far less popular with Virginia growers, as only 35% of the respondents grow them in baskets and 39% grow them in baskets. Perennials are grown by a significant proportion of respondents, with nearly half, 49%, growing perennials in their greenhouses, and 61% growing them outdoors.

The situation with vegetables is interesting, as more than half of the respondents, 54%, grow vegetable plants as transplants, but only 8% grow greenhouse tomatoes, and only 12% grow other vegetables for consumptions. Similarly, herbs as containerized plants are grown by half the respondents, while only 10% grow herbs for consumption.

The popularity of flowering potted plants varies considerably with the specific potted plant; geraniums are grown by 53% of the respondents, but poinsettias are produced by only 24%. Falling between these two extremes are chrysanthemums, which are grown by 38% of the responding growers, and "other" flowering potted plants, which are grown by 47% of the respondents.

Plugs of annual bedding plants, perennials, and vegetables are grown by 21% to 26% of the respondents, with annual bedding plant plugs being grown most frequently. Cut flowers are produced by a small minority of the growers, with 10% of the respondents growing them in outdoor ground beds; 4% growing them as containerized plants in their greenhouses, and another 4% growing them in greenhouse ground beds. Aquatic plants are produced by 15% of the respondents.

There was a trend toward growing some crops in particular sizes of greenhouse operations. This appears to be true of flowering potted plants like poinsettias, chrysanthemums, geraniums, and "other flowering potted plants," which tended to be grown by large operations.

Most respondents report growing a variety of crops. While 193 respondents report growing perennials, only 15 grow exclusively perennials. Similarly, 62 respondents grow some tomatoes or vegetables for consumption, but only six report growing these crops exclusively. Eleven of the crops are grown by more than 40% of the respondents. Only food crops, and somewhat specialized crops, such as cut flowers are grown by a small number, approximately 10% or less, of growers. There were sixteen comments made in this section; one grower indicated that he grew over 50 other flowering potted plants. Only 2 % of the respondents declined to answer this question.

Table 6. Crops grown in Virginia greenhouses (n=268).

Type of crop grown by greenhouse operation		Respondents growing the crop (%)
Bedding Plants	Baskets	64
	Flats	63
	Pots	68
Foliage Plants	Baskets	39
	Pots	35
Perennials	In greenhouse	49
	Outdoors	61
Vegetables	Transplants	54
	Greenhouse tomatoes	8
	Other vegetables for consumption	12
Flowering Potted Plants	Chrysanthemums	38
	Geraniums	53
	Poinsettias	24
	Other flowering potted plants	47
Other	Aquatic plants	15
	Tobacco transplants	2
Cut Flowers	Greenhouse containerized	4
	Greenhouse ground beds	4
	Outdoor ground beds	10
Herbs	Containerized plants	50
	For consumption	10
Plugs	Annual bedding plants	26
	Perennials	22
	Vegetables	21

Plans to Add Crops

Respondents were asked whether they planned to add new kinds of crops in the next one to three years, and if so to identify the new category. An affirmative response was given by 41% of those who answered this question, with 7% failing to respond to the query. This question elicited a large number of comments. Ninety-five responses were recorded describing new crops to be added. Approximately one quarter of these respondents did not add a new category, but merely reiterated a category that they already grow. Some respondents are undecided; 12% of those who commented are investigating and watching the market. One of these respondents stated “undetermined at this time, but we never rule out the possibility, you must be able to adapt to the market with retail demands always changing.” Another said, “perennials or whatever VA Tech recommends.” Plans to add trees or shrubs were cited by another 12% of the commenting respondents.

Top Six Flowering Perennials

Perennials are grown throughout the state. One hundred and ninety three growers responding to the survey indicated that they grow perennial plants. More than half of these, 102, grow perennials both

in greenhouses and outdoors, but 61 grow only in greenhouses and 30 grow only outdoors. Within this group there is considerable variation, with some specializing in natives, including aquatics, and some growing a wide variety of commonly available flowering perennials for garden centers or mass marketers. Almost 5% of perennials growers list their number one market as "Other" which often means retail sales in a farmer's market type setting.

Respondents who indicated that they grow perennials were asked to list the six flowering perennials they grow in the largest quantities. Nearly 85% of those who grow perennials named at least one plant in response to this question. Perennials were listed in a variety of ways; some cited exact botanical names, while others named a type of plant, such as "ferns". After accounting for this variation and duplication, 126 perennials were named in the top six, with hosta, black-eyed Susan, and daylily as the top three crops (Table 7). Most plants are listed only once; 22 were cited ten or more times. There were seventeen comments in response to this question. They ranged from "we plan to discontinue perennial production" to "None in large quantities – lots in small quantities" to "we grow 500 + varieties of perennials – not sure which to call the top six."

Table 7. Perennial plants grown by ten or more greenhouse operations in Virginia (n = 162).

Perennial plant		Perennial growers producing this plant (%)
Common name	Latin name	
Hosta	*Hosta*	33
Black eyed Susan	*Rudbeckia*	32
Daylily	*Hemerocallis*	30
Purple coneflower	*Echinacea*	24
Coreopsis	*Coreopsis*	21
Sedum	*Sedum*	16
Verbena	*Verbena*	14
Foxglove	*Digitalis*	11
Phlox	*Phlox*	11
Columbine	*Aquilegia*	11
Candytuft	*Iberis*	11
Butterfly bush	*Buddleia*	10
Carnations	*Dianthus*	10
Chrysanthemum	*Chrysanthemum*	8
Salvia	*Salvia*	8
Ornamental grasses	various	8
Astilbe	*Astilbe*	6
Delphinium	*Delphinium*	6
Iris	*Iris*	6
Pincushion flower	*Scabiosa*	6
Hollyhock	*Alcea*	5
Lavender	*Lavendula*	5
Peony	*Paeonia*	5

Educational Interests and Needs of Virginia Greenhouse Operators

The survey sought to determine levels of interest in three areas of programming: plant production topics, specific crops, and business management topics. Within each area there were specific topics that varied significantly based on the size of the greenhouse operation. Differences were also observed, based on the type of crops the respondent grows.

Plant production topics

Respondents were asked to rank their level of interest in ten plant production topics on a scale from one to four, with "1" indicating no interest and "4" indicating great interest. They were also given the opportunity to identify other areas of interest. Among the plant production topics in which interest did not vary by the size of operation, are fundamental issues that every grower must master: insect management, disease management, reduction of pesticide usage, and water quality (Fig. 5). In general, the topics that did show a variation in interest depending on the size of the operation are more advanced topics like automation (Table 8). "Other" growers were the least interested in automation, water quality management, nutritional management, and plant growth regulators.

The other topics suggested by respondents included production scheduling, organic techniques, facilities and equipment, alternative crops, methods of propagation, new plants, shade and water management, lighting, managing mammal pests, fertilizer usage, and good management practices.

The plant production interests of growers with different mixes of crops were observed to be somewhat different from the overall levels of interest. Perennial growers had a higher than average level of interest in plant growth regulators (2.8), field trial reports (2.8), reducing pesticide usage (3.2), and water quality (3.0), while food crop producers were more interested in nutrition (3.3), field trial results (2.8), waste water and runoff management (2.4), and ventilation and cooling (3.0). Cut flower growers showed higher than average interest in field trial reports (3.0). All three of these grower groups showed a higher than average interest in disease control (3.6 for food crops, 3.5 for the others).

Fig. 5. Mean level of interest in learning about plant production topics (average n = 249); Level of interest scale: 1 = no interest to 4 = great interest.

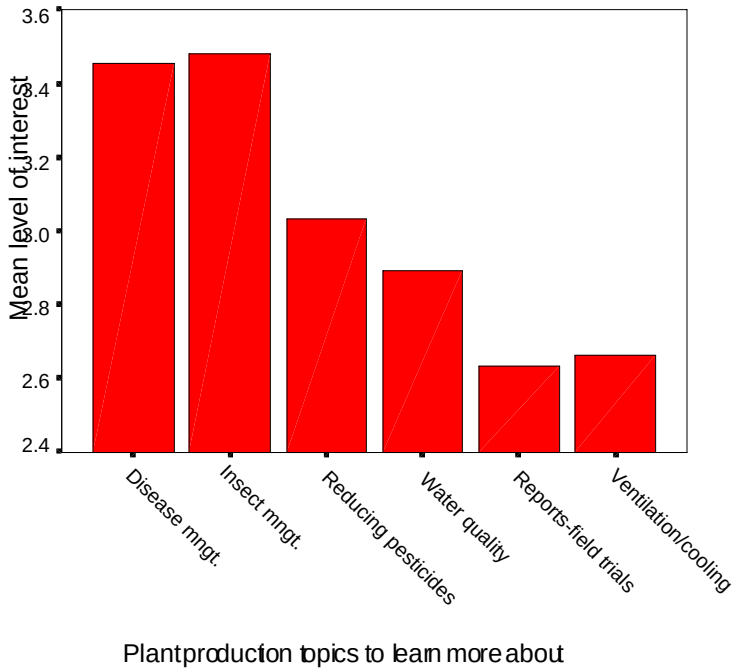


Table 8. Interest in learning about plant production topics by size of greenhouse operation.

Plant production topic	Mean level of interest by greenhouse category[y]							
	Other		Small		Medium		Large	
	n	Mean	n	Mean	n	Mean	n	Mean
Automation of greenhouse functions	18	1.9 c	139	2.6 b[z]	46	2.9 ab	37	3.2 a
Managing wastewater and runoff	19	1.8 b	138	2.2 ab	44	2.6 a	38	2.5 a
Nutritional management	20	2.5 b	136	3.1 a	46	3.4 a	38	3.3 a
Plant growth regulators	21	2.2 b	141	2.5 ab	47	2.9 a	38	3.0 a

[y] Level of interest scale: 1 = no interest to 4 = great interest.

[z] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level.

Crops to Learn More About

Respondents were asked to rank their level of interest in fourteen crops or types of crops on a scale of one to four, with "1" indicating no interest and "4" indicating great interest. There was a considerable range in the level of interest in the various crops, with cut flowers ranking 1.6 among medium sized growers and perennials ranking 3.2 overall. (Table 9, Fig. 6).

Not surprisingly, respondents seem most interested in learning about crops they already grow. For example, cut flower growers ranked their interest in learning about this crop at 3.4 while the overall ranking of cut flowers was only 1.9, the lowest of any crop listed. Similarly, respondents growing food crops were considerably more interested in learning more about edible herbs (3.3) and vegetables (3.1) than were growers overall, who only ranked edible vegetables at 2.3 and herbs at 2.7. When it comes to perennials, this comparison changes a bit. All three groups of growers, who were specializing in one type of crop, exhibited a higher level of interest in learning more about perennials (3.5 for these groups compared to the overall mean of 3.1), but perennial growers did not have a greater interest in learning about cut flowers (1.9) or edible vegetables (2.2).

The percent of respondents who failed to reply to these questions varied by crop, ranging from 12% for edible herbs to 20% for bedding plant plugs. Interest in learning more about geraniums and poinsettias varied significantly by size of the greenhouse operation. Large growers were significantly more interested in learning more about poinsettias; for other size categories, the level of interest declined with the size of the operation. Both medium and large growers expressed more interest in learning more about geraniums than did smaller growers. Interest in the other eleven crops did not vary significantly by size category (Table 9).

Fig. 6. Mean level of interest in learning about various crops (average n=229).

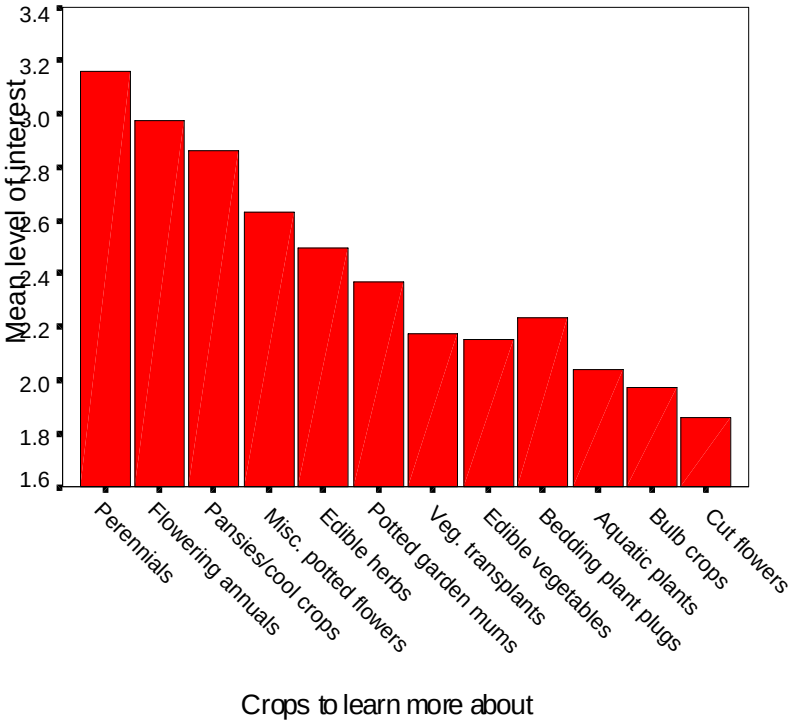


Table 9. Respondent interest in learning more about specific crops by size of greenhouse operation.

Crop to learn more about	Mean level of interest by greenhouse category[x]							
	Other		Small		Medium		Large	
	n	Mean	n	Mean	n	Mean	n	Mean
Geraniums	15	2.3 b[y]	130	2.6 ab	46	3.0 a	32	3.2 a
Poinsettias	15	1.5 c	125	1.9 bc	43	2.3 b	33	2.9 a

[x] Level of interest scale: 1 = no interest to 4 = great interest.

[y] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level.

Management Topics to Learn More About

Respondents were asked to rank their level of interest in twelve different management topics on a scale of one to four, with "1" indicating no interest and "4" indicating great interest. The percentage of respondents who did not reply to this question varied by topic, ranging from 9% who did not rank interest in learning about environmental regulation to 14% who failed to rank interest in learning about computerizing their business.

As with plant production topics, topics in which interest did not vary by the size of the greenhouse operation are the basics that must be handled well by all businesses, with marketing and pricing leading the list (Fig. 7). Interest in learning more about five topics, cost benefit analysis for automation decisions, and all four labor related topics, varied significantly by the size of the greenhouse operation. It is not surprising that large growers report far more interest in learning more about all of the labor related topics since they have many more employees to deal with than do smaller greenhouse operators (Table 10).

Additionally, differences based on the type of crops grown were also observed. All respondents appreciated the importance of marketing; perennial growers, edible crops growers, and cut flower growers all ranked interest in learning more about retail marketing (3.2 for all three) slightly higher than respondents overall (Fig. 7). Wholesale marketing was ranked about the same by perennial and cut flower growers as the overall ranking, and slightly lower by food producers (2.9). On two-thirds of the management topics, perennial grower rankings were similar to overall rankings, perhaps because perennial growers make up such a large proportion of all respondents. On the other third of the topics [pricing (3.1), cost-benefit analysis (2.5), retail marketing (3.2), and employee training (2.6)], perennial grower interest ratings were somewhat higher than the average ranking. Growers of edible crops reported greater than average interest in computerizing their greenhouses (3.0), retail marketing (3.2), and employee training (2.6). They had less than average interest in cost accounting (2.6), risk management (2.5), labor regulations (2.3), and attracting staff (2.6). On other topics, these growers had about the average level of interest. Likewise, cut flower growers exhibited a higher level of interest than the overall mean level of interest in all topics except wholesale marketing, and labor regulations, both of which had average interest rankings.

Fig. 7. Mean levels of interest in learning about management topics (average n =243; Level of interest scale: 1 = no interest to 4 = great interest).

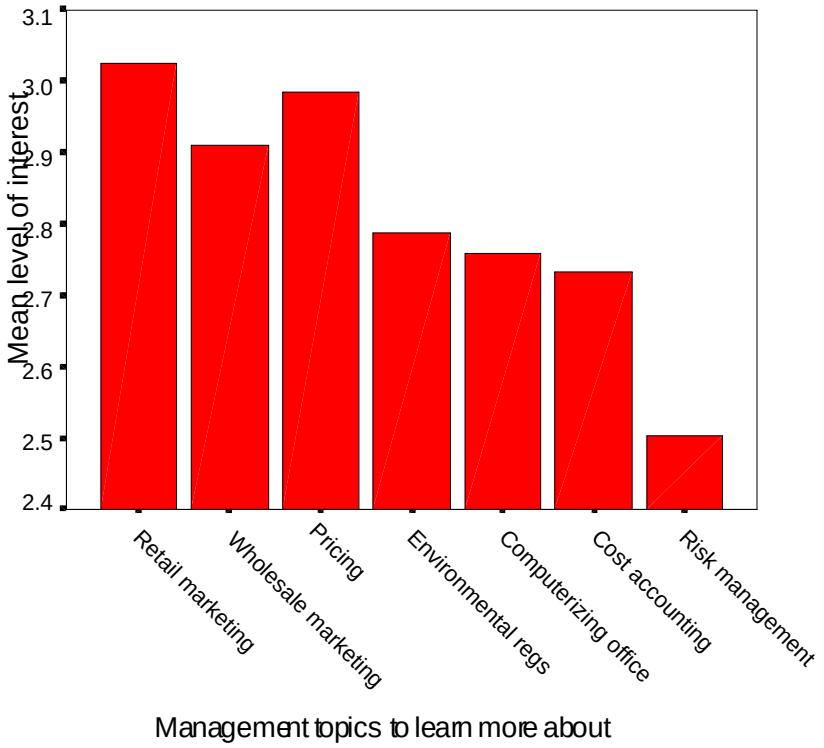


Table 10. Interest in learning about greenhouse business management topics by size of greenhouse operation.

Management topic to learn more about	Mean level of interest by greenhouse category[w,x]							
	n	Other	n	Small	n	Medium	n	Large
Cost benefit analysis for automation decisions	17	1.8 c[y]	132	2.4 ab	45	2.2 bc	37	2.9 a
State and federal labor regulations	18	2.0 c	135	2.3 bc	47	2.7 ab	39	2.8 a
Strategies for attracting and keeping good employees	17	2.0 c	137	2.5 b	46	2.9 ab	39	3.2 a
Techniques for providing in-house employee training	17	1.9 c	135	2.4 bc	46	2.6 ab	39	3.1 a
Other employee management issues	17	1.7 c	131	2.2 c	45	2.4 b	38	3.0 a

[w] Level of interest scale: 1 = no interest to 4 = great interest.

[x] n=17 for other; n ranges from 131 to 135 for small; n ranges from 45 to 46 for medium; n ranges from 38 to 39 for large

[y] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level.

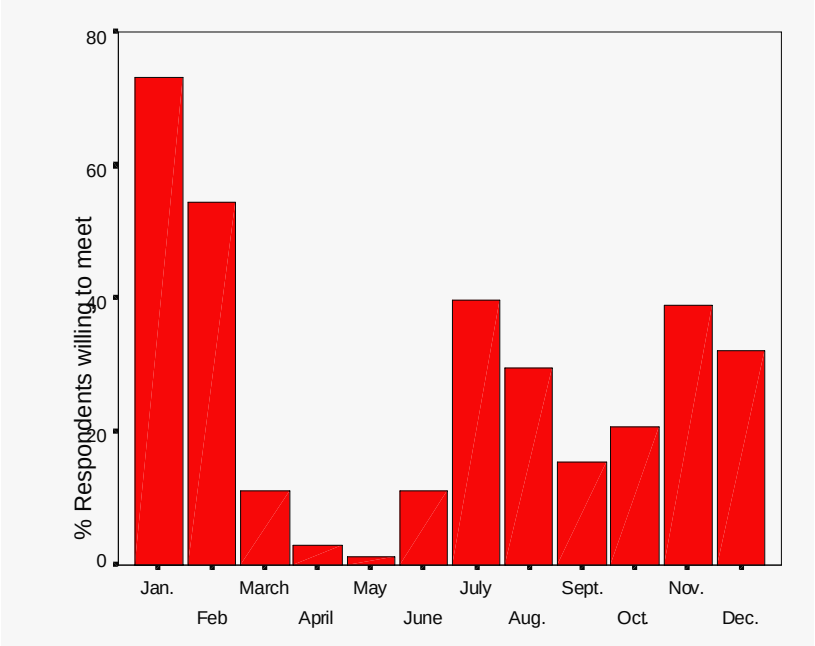
Preferred Meeting Months, Locations, and Formats

In addition to topics of interest, growers were queried regarding their preferences as to months to meet, areas of the state for meetings, and the format of meetings they were most likely to attend. These questions were answered by more than 95% of the respondents.

Months to Meet

Respondents were asked to indicate which months, from a list of all twelve, they would be most likely to attend educational programs. Willingness to meet in a given month ranged from a high of 73% willing to attend a program in January, to a low of 1% willing to attend a program in May (Fig. 8). It appears that during the busy season in the industry, few growers are willing to attend educational meetings. When there are plants needing attention or plants being sold, most respondents are reluctant to leave their greenhouses. There were few comments about the months for meetings. One respondent said, "all – anytime," and another indicated it would depend on where the meetings were to be held.

Fig. 8. Percent respondents likely to attend educational programs in different months (n=262).



Preferred Locations for Meetings

Respondents were asked to rank their top three choices for areas of the state in which to hold meeting or educational programs from a list of eight options. There is a strong preference for the central part of the state, the area where many greenhouses are located (Table 11). Forty percent of respondents listed either Charlottesville or Richmond as their first choice meeting location. Both the Tidewater area and Roanoke had almost as many first choice votes, but neither were the second or third choice of many respondents. Several additional locations were suggested by respondents, including the Eastern Shore, Blacksburg, Harrisonburg, and Abingdon. One grower asked, "Does Virginia end at Roanoke?"

Table 11. Respondents ranking of locations for meetings/educational programs (n = 260).

Meeting area	Respondent ranking of area as 1st, 2nd, or 3rd most preferred (%)
Charlottesville	58
Richmond	52
Roanoke	29
Meetings that move around VA	28
Tidewater	28
Winchester	24
Northern Virginia	22
South Hill	14

Meeting Format

Respondents were asked to rank their top three choices for meeting or educational program formats from a list of five options. Respondents expressed a strong preference for single day meetings, held during the day (Table 12). All of the comments made regarding this issue supported the use of tours.

Table 12. Respondents preferred meeting formats (n=261).

Meeting type	Respondent ranking meeting format as 1st, 2nd, or 3rd choice (%)
Workshops (lasting up to 4 hours)	77
Day meetings (lasting up to 8 hours)	75
Tours	54
Evening meetings (lasting up to 3 hours)	39
Multi- day meetings	27

Evaluation of Information Resources

Available Resources Currently Used

In order to determine where Virginia greenhouse growers are currently obtaining information, respondents were asked to indicate which of sixteen currently available resources they use. Although "other growers" and "print resources" are used by the largest numbers of respondents, almost half use Internet web sites, and nearly 30% access e-mail newsletters or listserves (Table 13). Although the yes or no format of this question cannot be subjected to statistical analysis, some trends emerged. Sales representatives are an interesting case, in that 88% of respondents from large greenhouse operations report using them as a resource, compared to 65% of medium sized operations, and far fewer small and "Other" respondents. It seems reasonable that sales representatives will be more available to those who make large expenditures, and similarly, that those making large expenditures will expend more effort to make sure they are making appropriate purchases. With 75% of respondents planning to have internet access within the next two years, it is reasonable to expect that these sources of information will increase in importance to greenhouse growers (See Table 33).

Table 13. Available resources currently used by respondents (n=266).

Available resources currently used	Respondents using resource (%)
Other growers	85
Books on specific topics	77
Trade journals	70
Local extension agent	61
Sales representatives	50
Publications on specific topics	49
Internet web sites	45
Professional association newsletters	41
Extension fact sheet	37
Extension newsletters	34
Extension specialists	34
E-mail newsletters, listserves	30
CD-ROM (data base)	21
Audio cassettes on specific topics	13
Private consultants	12
Video cassettes on specific topics	10

Respondents were also asked to identify the most important of the resources listed. "Books on specific topics" and "other growers" accounted for the most important resource used by nearly half of the respondents, with slightly more citing books as their most important resource (Table 14). Even though 70% of respondents use trade journals, only 14% list them as their most important resource. Similarly, while both sales representatives and internet sites were acknowledged as a resource in use by a large number of respondents, each was the most important resource of only 5% of the respondents. Neither audio nor videocassettes were selected as a most important resource by anyone.

While only 3% of the respondents failed to indicate use of any resources, 12% declined to specify one resource as most important. Several growers chose more than one as most important. Where more than one resource was listed as most important, the first one was entered into the table for analysis. One commented that he had switched from trade journals to web sites in the last year.

Technical support from plug and plant growers was cited as another resource. Two extension agents were named, and one grower said, “sales reps--- I have good ones.”

Table 14. Most important information source used by respondents (n = 260).

Most important resource used	Respondents using resource (%)
Books on specific topics	24
Other growers	23
Trade journals	14
None chosen	12
County Extension Agent	7
Internet web sites	5
Sales representatives	5
Extension specialists	3
Publications on specific topics	3
Professional association newsletters	2
E-mail newsletters, listserves	1
CD-ROMS (data base)	<1
Extension fact sheets	<1
Consultants	<1
Other	<1

Potential New Resources

To help plan useful new means of communicating greenhouse operation information to growers, respondents were asked to identify which, if any, of four potential new resources they would use. More than half of the respondents, 55%, expressed willingness to receive e-mail alerts of current information, and nearly half, 46%, would use FAX alerts (Table 15). Almost as many, 43%, would use the Virginia Tech floriculture web site, while 35% expressed willingness to use a Virginia growers' listserve for information exchange. No response to this question was given by 7% of the respondents, and another 19% indicated they would use none of the suggested new resources.

Table 15. Respondent willingness to use new resources.

Potential New Resource	Respondents willing to use resource (%)
E-mail alerts of current information	55
Fax alerts of current information	46
Virginia Tech floriculture web site	43
Virginia growers listserve for information exchange	35

Awareness of Virginia Cooperative Extension

Growers were asked about their awareness and use of services available from Virginia Cooperative Extension. Only 2% of respondents failed to answer these questions. Only 18% of respondents said they were not aware of services from Virginia Cooperative Extension, while 45% said they were aware, and 37% were unsure about services. There does not appear to be a relationship between a respondent's years of experience in the greenhouse business and his awareness of extensions services. However, those who have taken an extension or community sponsored horticulture class seemed more likely to be aware of Virginia Cooperative Extension.

Nearly half the respondents, 49%, stated that they had contacted a Virginia Cooperative Extension office for assistance in the previous 12 months; 37% had done so in the previous six months.

Characterization of the Greenhouse Operations

In order to determine the scope of the greenhouse business in Virginia, the survey included a series of questions asking about the age of the business, the proportion of sales that was wholesale versus retail, gross receipts, numbers of employees, and space devoted to the operation. As expected, responses to all of the questions in this section, other than questions regarding amount of unheated space and outdoor space, varied significantly with the size of the greenhouse operation.

Age of greenhouse business

Respondents were asked how long their greenhouse has been in business under current ownership. While the reported age of the businesses ranged from 0.2 years to 66 years, the overall mean was 13.4 years, and the overall median was 10 years (Table 16). Although the mean and median ages of the greenhouses increased as the size of the business increased, both the oldest and the newest reporting greenhouses were in the small category. There were twenty responses each of three, five, and 15 years. No reply to this question was provided by 13% of the “Other” greenhouse operations and by 2% of the small operations. All of the medium and all but one of the large greenhouses responded to this question.

Table 16. Years the greenhouse has been in business under the current ownership.

Time under current owner	Greenhouse category[v]			
	Other	Small	Medium	Large
Mean	10.0 b[w]	10.3 b	17.2 a	21.3 a
Median[x]	7.5	8.0	15.0	20.5
Mode[y]	2.0	3.0, 6.0[z]	25.0	15.0

[v] n for other =20; n for small =149; n for medium=50; n for large =39
[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level.
[x] Median value is the number where half of the values are above and half are below this number.
[y] Mode is the number most frequently given by the respondents.
[z] More than one mode, both values cited an equal number of times

Wholesale, Retail, or Other?

Respondents were asked to indicate the percent of their greenhouse business devoted to wholesale, retail and other categories of business. The mix of wholesale, retail, and other sales varied from all wholesale to all retail, with a large number of variations (Table 17). Responses varied significantly with the size of the greenhouse operation, with large operations more apt to be involved in wholesale business. Comments indicate that 32% of the "other" business was related to landscaping or property maintenance, while another 35% of the "other" is for farm or personal use. When businesses indicating that 51% or more of their sales are wholesale are examined, it is found that 75% of large growers are in this group, but only 31% of the small growers and 39% of medium growers meet this criterion.

Table 17. Percentage of greenhouse business considered wholesale, retail or other as reported by greenhouse operations of various sizes.

Greenhouse category[x]	Other		Small		Medium		Large	
	Mean	Median[y]	Mean	Median[y]	Mean	Median[y]	Mean	Median[y]
Wholesale	33b[z]	23	36b	20	47b	40	74a	90
Retail	63a	75	56a	75	51a	60	28b	10
Other	4	0	7	0	1	0	<1	0

[x] n for other =22; n for small =145; n for medium=49; n for large =39
[y] Median value is the number where half of the values are above and half are below this number.
[z] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level

Markets

In order to develop an understanding of the significance of specific markets to Virginia's greenhouse operators, respondents were asked to rank their top three markets, from a list of twelve outlets, in order of importance in generating revenue. The twelfth choice was an opportunity to name another outlet. Retailing directly from the greenhouse is by far the outlet most important to the largest number of greenhouses in the state, with 43% reporting this as their most important market (Table 18).

The proportion of a respondent's business that was wholesale impacted the importance of the various markets. Among growers who reported more than 51% wholesale business, only six, or 6%, considered direct sales from their greenhouse their most important market, while overall, this was the most important market for 43% of the respondents. Among these wholesale growers, the most important market was wholesaling to garden centers (40%), their own or other landscapers (22%) or mass marketers (10%)

The type of crop grown also influences the market. Among growers who only grow perennials, 47% sell primarily to landscapers; in 44% of those cases, to their own landscape business. Only one of the perennials-only growers sells his whole crop at retail, and that crop is sold on the internet. Of the seven growers who produce only vegetables or herbs for human consumption, two retail from their greenhouses, while the remaining five wholesale to other retailers. Among cut flower growers, 12% cite wholesale to florists as their number one market.

Table 18. Respondent's ranking of the most important markets to greenhouse operators (n=258).

Market	Respondents ranking market as 1st, 2nd, or 3rd most important (%)	Respondents ranking market as most important (%)
Retail direct from greenhouse	59	43
Wholesale to garden centers	41	17
Wholesale to landscapers	37	6
Wholesale to other retailers	17	4
Other (see text)	17	4
Retail from adjoining store	16	6
Wholesale to florists	14	3
Wholesale to own landscape business	13	5
Wholesale to property management firms	9	<1
Wholesale to mass marketers	8	4
Internet sales	3	<1
Mail order sales	3	<1

This marketing question included two opportunities to specify other outlets; one asked the respondent to specify other retailers to whom they wholesale products and the final part asked for any other markets. Other retailers to whom greenhouse operators wholesale their product are primarily grocery stores, which were cited 13 times, and hardware stores which were mentioned five times. Farmers markets or produce stands were named four times as other retailers. Farmers markets were the dominant "other" market, with 17 of 44 citations, followed by shows or fairs which were listed nine times. "Wholesaling to other wholesalers" was noted as another market by six respondents.

Point of Purchase programs

In a related marketing question, respondents were asked to indicate in which of four branding or point of purchase (POP) programs they participate, and offered an opportunity to identify other POP programs they use. More than half, 57% of the respondents failed to answer this question. None of the growers producing only perennials report involvement with a POP program.

Proven Winners is the dominant POP program in Virginia, with 71% of those reporting POP participation using this program (n=119**)**. Flower Fields is a distant second, with 29% of the growers using its program. Of those responding, 6% participate in Athens Select, and 19% use Blooms of Bressingham. "Other" programs were listed by 16% of those answering this question. Two growers participate in the state's Virginia Finest program and two more mentioned Etera. Among others listed were the Big Tag brand, Kings Court Daylilies, Waves, GroLink, and Color Link. Although one respondent stated, "plants need to sell themselves – not plastic stickers," three growers indicated they do purchase branded plants for resale.

Gross Receipts

Respondents were asked to indicate annual gross receipts for the greenhouse portion of their business for 1999. More than a third, 35.8%, of respondents declined to answer this question, with the percentage declining to answer increasing with smaller operations. This information was provided by 85% of the large greenhouse operations, but by only 61% of the small operations. Total gross receipts reported by respondents were $80,274,166 (Table 19). The overall mean for gross receipts, for the 176 greenhouse operations that provided this information, was $456,103, while the overall median was $90,000. The mode was $20,000, with nine operations stating this amount.

Examination of the "Total" row of Table 19, gives one an idea of the economic importance of the large growers. The revenue reported by 34 large growers is nearly five times that reported by 92 small greenhouse businesses. Since large greenhouse operations reported income in a much larger percentage than small or "Other" operations, it may be that the total for the industry is not as understated as it might at first appear to be.

Table 19. Gross receipts for the greenhouse portion of the business in calendar year 1999 as affected by the size of the greenhouse operation.

Gross receipts in dollars	Greenhouse category[u]			
	Other	Small	Medium	Large
Total	$120,420	$11,738,509	$10,086,755	$58,328,482
Mean	10,035 b[w]	130,427 b	265,441 b	1,767,530 a
Median[x]	7,500	55,000	160,000	800,000
Mode[y]	$10,000	$20,000	$90.000	$500,000; 800,000

[u] n for other =12; n for small =90; n for medium=38; n for large =33

[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level.

[x] Median value is the number where half of the values are above and half are below this number.

[y] Mode is the number most frequently given by the respondents.

Year-round, Full Time Employees

To develop an estimate of the number of people employed in the greenhouse industry in Virginia, as well as a better understanding of the greenhouse businesses, the survey asked how many people, other than family members, were employed by the business on a year-round, full time basis. All but 4% of the respondents replied to this question, but 50% had no employees fitting this description (Table 20). The overall mean was 5.1 year-round, full time employees, but both the median and mode were zero. The growers reported a total of 1,343 year-round, full time employees, 56% of whom work for one of the 39 large greenhouse operations responding to this question (Fig. 9, Table 20). For medium and small operations, more people are employed in full time, year-round jobs in small greenhouses than in medium ones due to the fact that there are so many more small greenhouse operations than medium ones (Table 20). Small greenhouses employ 29% and medium greenhouses employee 15% of the year-round, full time greenhouse workers reported in this survey.

Fig. 9. Total non-family employees of responding greenhouse operations (average n =262).

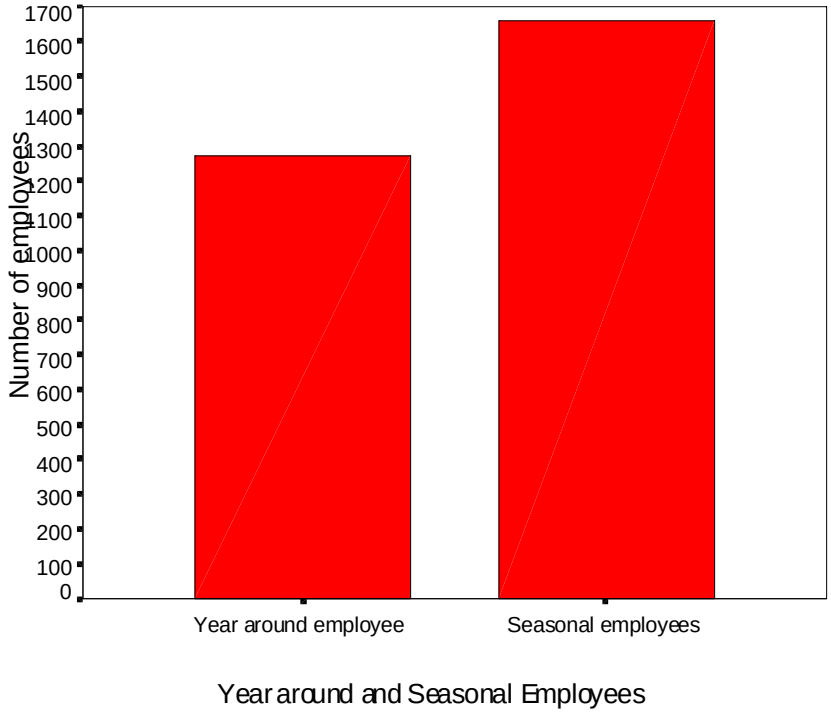


Table 20. Year around, full time employees by size of greenhouse operation.

Number of full time, year-round employees	Greenhouse category[w]			
	Other	Small	Medium	Large
Total	0	392	196	755
Mean	0 b[x]	2.6 b	3.9 b	19.4 a
Median[y]	0	0	1.0	7.0
Mode[z]	0	0	0	0

[w] n for other =22; n for small =152; n for medium=50; n for large =39

[x] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level

[y] Median value is the number where half of the values are above and half are below this number.

[z] Mode is the number most frequently given by the respondents.

Seasonal Employees

Respondents also were asked how many people, other than family members, they employed on a seasonal basis. The overall mean for seasonal employees was 6.4 people with a median of two seasonal employees. Eighty greenhouse operations reported no seasonal employees, and nineteen businesses reported employing more than 20 seasonal employees. Growers reported using 24% more seasonal than year-round employees, for a total of 1,666 seasonal workers employed by responding greenhouse operations (Fig. 9). The distribution of seasonal employees among the various size categories of greenhouse operations was somewhat different than for year-round full time employees (Table 21).

Large greenhouse operations employed 49% of the seasonal workers, while 16% worked in medium sized greenhouses, 34% worked in small greenhouses, and 2% worked for "Other" operations. Comments from respondents indicated that a part time category would have helped clarify the employment patterns.

Table 21. Seasonal employees by category of greenhouse operation.

Number of full time, year-round employees	Greenhouse category[v]			
	Other	Small	Medium	Large
Total	26	571	259	810
Mean	1.1 b[w]	3.8 b	5.3 b	21.3 a
Median[x]	0	1.5	3.0	9.0
Mode[y]	0	0	2.0	3.0, 4.0[z]

[v] n for other =23; n for small =151; n for medium=49; n for large =38
[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level
[x] Median value is the number where half of the values are above and half are below this number.
[y] Mode is the number most frequently given by the respondents.
[z] More than one mode, both values cited an equal number of times

Production Space

The survey inquired about four types of production space: heated greenhouse area, unheated space under cover, outdoor container production area, and field production area for herbaceous perennials. Heated greenhouse space was the variable used to determine the size categories of the reporting greenhouse operations.

The amount of heated space respondents reported ranged from 80 sq. ft. to 40 acres. The relatively few larger operations have the vast majority of heated space in production; 73% of reported heated space is operated by 39 large growers (Tables 22). Only 54 greenhouse operations, out of 226 reporting on heated space, have more than the overall mean of 22,000 sq. ft. of heated space.

There are similar variations in ownership of unheated space, outdoor container production area, and field production area (Table 23). Unheated space ranged from 190 sq. ft. to 7.9 acres; container production area ranged from 0.01 acre to 150 acres, and field production area ranged from 0.2 acres to 30 acres.

However, unheated space under cover, outdoor container production area and field production area of herbaceous perennials did not vary significantly with the size of the greenhouse operation as defined by heated space. Production space information was provided by all but 6% of the respondents.

Table 22. Amount of heated greenhouse space by size of greenhouse operation.

Heated Greenhouse Space	Greenhouse category[v]				
	Other	Small	Medium	Large	Overall
Total	71,470	451,877	792,578	3,697,500	5,017,125
Mean	4,204 b[w]	3,829 b	16,175 b	94808 a	22,200
Median[x]	2,000	3,698	15,000	50,000	6,000
Mode[y]	No mode	3,000	10,000	50,000	3000

n for other =17; n for small =118; n for medium=49; n for large =39

[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level

[x] Median value is the number where half of the values are above and half are below this number.

[y] Mode is the number most frequently given by the respondents.

Table 23. Amount of other, unheated floricultural production space.

Type production space	Mean	Median[z]	Mode[y]	Respondents with none (%)	Total
Unheated production space under cover (n = 120)	12,040 sq.ft.	2,625 sq.ft.	1,000 sq.ft.	56	1,444,757 sq. ft. (33 acres)
Outdoor container production area (n=170)	4.0 acres	1 acre	1 acre	38	671acres
Field production of herbaceous perennials (n=55)	2.0 acres	1 acre	1 acre	80	107 acres

[z] Median value is the number where half of the values are above and half are below this number.

[y] Mode is the number most frequently given by the respondents.

Cultural Practices

To better understand the nature of the industry and to provide background for development of educational programming, growers were asked about a variety of cultural practices employed in their greenhouses. Questions ranged from whether or not growers keep "pet" plants in their greenhouses to equipment calibration and their use of media testing. Questions were asked in a yes or no format, with "Not applicable" as an option. Response rate to this series of questions ranged from 97% answering the question regarding use of controlled release fertilizer, to 92% responding to the question about testing media during a crop cycle. On average, the questions in this group were answered on 95% of the returned surveys. Several cultural practices are utilized by a vast majority of the responding growers. At least eighty percent of the respondents use controlled release fertilizer, horizontal airflow fans, and rotate among different insecticide chemistries for multiple treatments of the same insect problem (Table 24). Sanitation of greenhouse floors, benches, and other structures is done with bleach or other commercial products after each crop cycle by 69% of the respondents. Less than a quarter, 21%, report use of screening to exclude insects from their greenhouses.

While the responses to this question could not be analyzed statistically, some trends emerged. Generally, larger greenhouses utilize more sophisticated cultural practices. For example, of those responding to this survey, only 11% of “Other” growers test their growing media during a crop cycle, while 68% of large growers do so. When it comes to adjusting fertilizer or irrigation based on results of such tests, 27% of the “Other” growers make adjustments, while 77% of the large growers do so. In both of these examples, the percentage of small and medium respondents using these practices falls between those reported by the “Other” and large operations.

Table 24. Responses to questions on cultural practices in the greenhouse[z].

Survey questions: Do you…	Respondent answers (%)		
	Yes	No	NA
keep "pet" (not for commercial use) plants in your greenhouse?	36	61	3
use controlled release fertilizer?	80	16	4
use screening to exclude insects from your greenhouse?	21	74	5
use horizontal airflow fans in some or all of your greenhouses?	82	15	3
test your irrigation water for alkalinity and mineral content annually?	41	54	5
test your growing media during a crop cycle?	39	56	5
adjust fertilizer/ irrigation practices based on results of growing media tests?	48	43	8
calibrate your fertilizer injector during a crop cycle?	45	38	17
rotate among different insecticide chemistries for multiple treatments of the same insect problem?	81	12	7
calibrate your spray equipment on a regular basis?	37	47	16
sanitize your greenhouse floors, benches, and other structures with bleach or other commercial products after each crop cycle?	69	25	7

[z] n ranges from 255 to 266

Automation of Greenhouse Functions

Respondents were asked to indicate which of eleven greenhouse functions they have automated or plan to automate within the next two years. Only two functions, fertilizer application and irrigation, are automated by more than half the respondents, while two other functions, media mixing and pot filling, are automated by approximately a quarter of the respondents (Table 25). Although these responses could not be analyzed statistically, an examination of the responses sorted by the size of the operations shows that larger greenhouses have more automation in place. With the exception of "packaging for shipping," the percentage of large operations that have automated a particular function greatly exceeds the overall percentage of reported automation of that function.

For planned automation, larger greenhouses may be planning to add less automation of basic functions such as fertilizer application and irrigation than smaller operations, because more of the larger greenhouses already have this automation in place. Of the fifteen comments related to this question, eight noted that irrigation is partially automated in their greenhouse, while fertilizer application, pot filling, and plant transport within the greenhouse were qualified as partially automated once each.

Table 25. Existing or planned (within 2 years) automation of greenhouse functions (n = 205).

Automated greenhouse function	Respondents with automation in place (%)	Respondents planning to add automation (%)
Fertilizer application	54	12
Irrigation	52	18
Media mixing	23	7
Pot filling	24	10
Pruning	2	4
Transplanting	4	8
Plant transport within greenhouse	8	8
Labeling: bar coding	5	9
Labeling: tagging	9	8
Packaging for shipping	< 1	2
Loading	4	6

Irrigation Systems

When asked to indicate which of nine types of irrigation systems they used, many growers indicated more than one system. Although 52% of growers who responded to the query regarding automation reported having automated irrigation, 91% use hand watering (Table 26). There was a trend toward larger operations utilizing more automated systems such as boom irrigators, drip irrigation, ebb and flow benches, and overhead micro sprinklers. The response rate for this question was 96%, and it elicited ten comments. Two respondents use capillary mats, and one mentioned float beds. One noted that overhead micro sprinklers are used for propagation only; another respondent uses hand watering inside and drip irrigation outside.

Table 26. Irrigation systems used by greenhouse operations (n = 264).

Type system	Respondents reporting use (%)
Hand watering	91
Drip irrigation	47
Overhead impact sprinklers	26
Overhead micro sprinklers	22
Saucers	4
Trough systems	4
Ebb and flow floors	3
Boom irrigators	3
Ebb and flow benches	2

Insect Pest and Disease Management

To help determine educational and research needs in the areas of insect pest and disease management, growers were asked which of fourteen techniques they currently use and/or would be interested in learning more about. Roughly half the respondents are scouting or using sticky cards to monitor pest problems (Table 27). While nearly three quarters of the respondents report using conventional pesticides, fewer than half are using "softer" techniques of pest control such as horticultural oils, insecticidal soaps, and IGRs.

Differences show up when one looks at respondents who grow tomatoes, other vegetables, and herbs for human consumption. These growers are more likely to use beneficial nematodes (13%) and only 60% use conventional pesticides, as compared to 73% of overall respondents using these products. Those growing food products in their greenhouses reported more use of insecticidal soap, sticky cards, weed free buffer areas, and "other biologicals" than the average respondent.

Interest in learning more about various techniques was generally inversely proportional to the level of current usage. For example only 8% of responding growers are using beneficial nematodes, and only 1% are using test kits to monitor for viruses, but 29% are interested in learning more about beneficial nematodes and 28% want to know more about test kits.

Ninety five percent of the respondents answered this question, however the topic generated only four comments. One grower noted that his use of conventional pesticides was minimal, and another commented on the expense of beneficial nematodes and said he was testing them.

Table 27. Techniques used for insect pest and disease control (n = 261).

Insect pest and disease management techniques	Respondents using the technique (%)	Respondents interested in learning more about it (%)
Beneficial nematodes	8	29
Conventional pesticides	73	14
Horticultural oils	43	16
Insect Growth Regulators (IGRs)	41	24
Insecticidal soaps	48	17
Isolation of new plants until they can be visually inspected	28	10
Maintain a 10' – 20' weed free barrier around greenhouse	35	18
Other biological control materials	17	26
Request pesticide history from plug or liner suppliers	5	21
Scouting	51	10
Submit samples to VA Tech Plant Disease Clinic	19	21
Use test kits to monitor for viruses	1	28
Use sticky cards to check new material for insect pests	48	11
Use weed barrier cloth for mechanical weed management	56	11

Technology

Growers were asked about six technologies, and offered an opportunity to list others, which might be used in operating their greenhouses. They were also asked to indicate which technologies they plan to add within the next two years. Both currently, and with planned additions, FAX capability is the most widely used technology in managing the greenhouse businesses (Table 28). Internet capability appears to be primarily for e-mail, as the rates of use and planned additional capacity are virtually identical. Only 20% of respondents have their own greenhouse web sites, but an additional 29% plan to add one within 2 years.

Table 28. Technology currently being used or planning to be added within 2 years in greenhouse operations (n=230).

Technology	Respondents using technology (%)	Respondents planning to add technology within 2 yr (%)
Computer for financial management	59	16
Computerized inventory control	24	21
E-mail	63	11
FAX	77	7
Internet	63	12
Web site for greenhouse	20	29

Respondents made fifteen comments on the technology questions, mentioning other uses for computers such as desktop publishing, mailing list management, and on-line ordering. One large grower is using computerized crop and space planning, and four reported using computerized environmental controls.

Identification of Issues Facing the Greenhouse Industry

One of the primary objectives of the needs assessment survey was to determine the importance to growers of various issues facing the industry. Growers were asked to indicate the importance of nine different industry issues in terms of the impact of that issue on their business.

The response rate varied from 86% to 92% among the different issues, with most of the largest number of responses being made to issues of labor availability and state and federal regulations. The fewest responses were made to the issue of crop patenting, which also had the lowest ranked interest.

Of the six issues that were of importance to respondents regardless of size of operation, marketing was the most important (Fig. 10). This seems consistent with the high level of interest in learning more about both retail and wholesale marketing that was expressed by respondents of all sizes. Financial management, the general state of the economy, compliance with governmental regulations, and environmental quality concerns were seen as slightly less important. Crop patenting seems to be regarded as much less important than the other issues. Respondents were also invited to list and rank other industry issues. Other issues listed were dominated by concerns about competition from box stores. Leadership, fuel costs, and weather were also mentioned.

Three issues, labor availability, new crop development, and pesticide availability, varied significantly by size of greenhouse operation (Table 29). The issue with the greatest difference in importance based on size of the respondent's operation was the availability of competent labor. This is not surprising; given that half the respondents (primarily small growers) have no employees who are not family members, and large growers hire 56% of the year around employees and 49% of the seasonal workers in the greenhouse industry. "Other" growers saw new crop development as much less important than did all of the larger growers. Generally, availability of pesticides seems to be of the greatest importance to medium and large growers.

Fig. 10. Mean level of interest in issues facing the greenhouse industry
(average n= 241; number represents the average ranking, from 1 = no importance to 4 = great importance, of respondents in each greenhouse category).

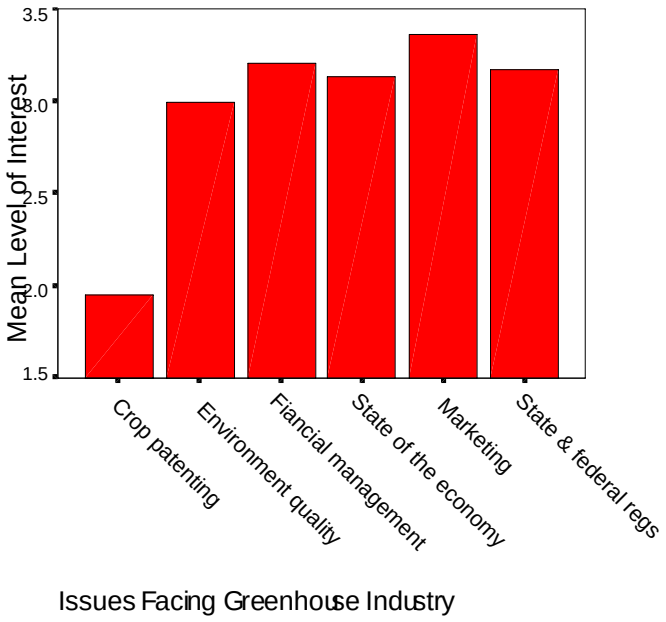


Table 29. Importance of issues facing the greenhouse industry as affected by the size of greenhouse operation (average n =241).

Issue	Respondents ranking of issue importance[y]							
	Other		Small		Medium		Large	
Availability of competent labor	n=19	2.5 c[z]	n=137	3.1 b	n=47	3.4 ab	n=39	3.7 a
New crop development	n=15	2.3 b	n=137	3.1 a	n=47	3.4 a	n=36	3.1 a
Pesticide availability	n=15	2.9 b	n=139	3.0 ab	n=47	3.4 ab	n=38	3.3 a

[y] Number represents the average ranking, from 1 = no importance to 4 = great importance, of respondents in each greenhouse category

[w] Values within a row, not followed by a letter in common, are significantly different by Duncan's multiple range test, 0.05 level

Summary of Grower Focus Group Sessions

Focus group interviews were conducted by Dr. Mike Lambur (VCE Extension Programming) with Dr. Joyce Latimer assisting as a follow-up to the needs assessment survey to more thoroughly explore the issues rated as important in terms of their impact on the greenhouse industry. Six issues were identified for further exploration in the focus group interviews: 1) labor, 2) state and federal regulations, 3) environmental quality, 4) marketing, 5) pesticide availability, and 6) energy costs. In addition, a discussion on ideas for how Virginia Tech could provide assistance to the greenhouse operators was also conducted.

Three focus group interviews were conducted with a total of 16 commercial greenhouse growers. The interviews were held in Charlottesville (February 27, 2001), Roanoke (February 28, 2001), and Williamsburg (March 7, 2001). Key results from the focus group interviews for each of the six issues are presented below.

Labor

_There is a lack of and high turnover in unskilled labor because of low entry and beyond entry pay and lack of benefits (all groups).
_Paying higher wages does not guarantee a productive worker. As one Williamsburg respondent said, "Paying more doesn't make them work better or smarter." Related to this, the Roanoke group did reveal that a strong work ethic was evident in Mexicans they hired (more so overall as a group than Americans). They indicated that they could train them if they could get them. In one Roanoke respondent's words, "Paying more wouldn't improve the type of people attracted, but it may help retention." A Williamsburg respondent also said the challenge was, "to find quality labor at a reasonable wage."
_There is also a lack of skilled labor for management positions - can't pay them enough to attract or keep them in the industry (Charlottesville).
_There is a problem with profitability of the industry – greenhouse operators don't charge what it actually costs to produce the product, therefore, they can't be competitive with labor (all groups).
_There is a problem with the seasonal and general nature of the industry – this limits industry ability to attract and keep consistent labor (Charlottesville and Roanoke).

State and Federal Regulations

Growers were divided in their perspectives on this issue. The Charlottesville group indicated that state and federal regulations were "killing the business" because they can't operate and comply at the same time. They also felt that the industry was not big enough to fight these issues because it is a low wage industry. On the other hand, the Roanoke group didn't perceive this issue as a problem. Rather, they indicated that practicing best management practices (BMPs), as they relate to state and federal regulations, was a normal part of conducting business and they found it to be more a mindset that transfers down from the producer to the workers. In the words of one producer, "If you're living on the edge, you get caught." They also indicated the need to enforce the law and not hound those who are legal. The Williamsburg group did not have much to say on this issue.

Environmental Quality

There was little discussion on this issue among the groups (it appeared to be related to state and federal regulations). The Charlottesville group indicated that it was important and questioned the inconsistent enforcement of regulations among the greenhouse industry. They also wondered why the greenhouse industry was singled out on this issue and were concerned that they were not informed of regulations more. The Roanoke group indicated no problems and this issue was not discussed by the Williamsburg group.

Marketing

_There is no time to spend on marketing because "we're too busy producing the product" (Charlottesville and Williamsburg).
_We're losing the service aspect of the business because we're trying to compete with and become like the big stores (Charlottesville). The Roanoke group took the opposite position on this issue by indicating that small growers need to develop niche markets for their products so they don't try to compete with the big growers. As one respondent put it, "We need to offer what box stores don't." The "don't" was primarily customer service.
_Other issues mentioned related to marketing included: better education of consumers, use of the internet, small producers need to band together for marketing purposes, competition with other countries producing products, the short time to sell products, and linking with programs such as Virginia's Finest.

Pesticide Availability

_Growers indicated that pesticides are available if you are willing to pay the price (Charlottesville and Williamsburg).
_There should be more study before removing pesticides from the market. This can be very controversial and driven more by public perception than scientific fact (Roanoke and Charlottesville).
_It is difficult to compete with other countries that don't have limited availability of certain pesticides because of regulations (Charlottesville and Williamsburg).
_Other issues included: biological pest management methods lead to blemishes; how can we better manage using beneficial insects and mites; and there is no good practical information in Virginia on pesticides and pest management.

Energy Costs

_Producers should practice conservation all the time (Charlottesville).
_Producers need to band together to get lower prices (Charlottesville).
_Several growers are passing higher energy costs along to consumers via a fuel surcharge (Charlottesville and Roanoke).
_Some producers locked in fuel rates for a specified period of time (Charlottesville and Roanoke).
_The industry should be looking for alternative fuel supply options (e.g., corn and coal) (Williamsburg).

Assistance Needed

Topics: _Technical information on crops and technical support (e.g., state inspector of greenhouses).
_Scouting.
_Organic production.
_Vegetable production.

Methods: _More co-ops and cooperation among growers.
_Periodic newsletter (monthly or quarterly with alerts).

_Internet newsletter.
_Listserv.
_New research in written (hard copy) form.
_Annual meeting of greenhouse growers.

Summary of the Virginia Cooperative Extension Focus Group

A final focus group meeting of six VCE agents was conducted by Dr. Lambur (with Dr. Latimer assisting) on May 21, 2001, to discuss how VCE can address the issues facing the greenhouse industry.

Labor

Labor is a problem throughout agriculture, especially horticulture – the educational problem is that we set up meetings with speakers on labor issues and we don't get enough producers attending to hold the class. Only pest control (re-certification) classes bring in the producers. We have to stick labor issues into meetings with other topics. We need to develop some train the trainer lesson plans as a generalized education plan for employees.

Marketing

What gets grower's attention? Anything they see as impacting profitability. Marketing produces profitability. The problem for small businesses is determining when to hire additional people. At what point do you hire labor? Quality goes down with dollars increased to marketing – we need help from Agricultural Economics. There is a different set of concerns with size – small growers are not aware of costs and think they must stay cheap in order to compete. We preach profitability to small growers, trying to convince them not to compete with box stores (don't cut your prices), and to teach them how to determine costs of production. We need crop specific budgets for the greenhouse (are there any computer programs available?). Some agents are promoting co-operative marketing and purchasing as more sustainable than niche marketing (eventually niches get flooded).

Program assistance

To summarize, the VCE audience is primarily medium to small growers. VCE needs to offer more hands–on programs as well as more written information. Information developed needs to be more appropriately scaled to the audience, e.g., need WPS flip charts for worker training, not videos. Educational programs need to start at the beginning with fact sheets on basic topics, such as "How to Read a Fertilizer Bag." Start at beginning because small growers don't know the basics. We need more programs in the Charlottesville area and more big name speakers in all parts of the state. VCE agents need to be more involved with growers associations.

Identification of Needs to Enhance the Profitability of the Greenhouse Industry in Virginia

The survey provided detailed information on the topics on which growers would like to have more information as well as the format, location and time of year to hold meetings. The survey also told us that the growers use other growers as their primary resource for information, 85% use other growers. Another benefit to holding greenhouse meetings is to allow additional networking among growers. Although fewer growers are interested in using electronic communications, provision of a grower listserve would also enhance grower-to-grower communications for those who do use more technology. Another important point from the survey is that 61% of the respondents use their Extension agent for information, but only 37% are using Extension fact sheets. This suggests that Virginia Tech needs to place more emphasis on the training of unit agents and providing resource material for them. However, 44% of the small operations, 57% of the medium respondents and 65% of the large operation use publications on specific topics. Therefore, Extension publications should be developed that are more detailed and focused on a single area of production or management.

Information collected from the survey and focus group sessions is already in use, helping to design research and education programs to enhance the profitability of greenhouse operators in Virginia. The Virginia Agricultural Council has subsequently funded a research project on developing an integrated production management plan for herbaceous perennials, one of the primary crops being grown by Virginia greenhouse operators. This area of research will be a primary focus for the floriculturists with support from the "new" faculty in entomology and plant pathology.

Virginia Tech also has developed educational programs based on the survey results. "A Pricing Primer" was offered at the Professional Horticulture Conference in January 2001. "Retailing Greenhouse Crops" was conducted in Richmond in April 2001. A "Perennial Plants Production Seminar" was held in Louisa County on November 2, 2001, targeting all growers, and a "Geranium Production Seminar" was held on January 15, 2002, in Richmond, primarily for the medium and large growers. Two "Quickbooks for Greenhouse/Nursery Operations" were scheduled for Fall 2001 to teach computerized accounting to small to medium sized growers. However, they were cancelled for lack of participation. Virginia Tech put on "Basic Greenhouse Production Seminars" as regional programs around the state in January and February 2002, to make it easy to send greenhouse employees to solid greenhouse training programs with pesticide re-certification credit. For a current list of programs, visit Virginia Tech's Floriculture Website "Events" calendar: http://www.floriculture.vt.edu/.

In addition, as a result of the survey and focus group requests, we established a VA Greenhouse Growers Listserve based at Virginia Tech to allow growers to interact with one another on production or

marketing questions or problems. Currently 35 growers have signed up for this service. (See Appendix 2 for more information.)

Dissemination of Survey Results

A summary of the survey results related to program preferences and educational topics was distributed to all growers and other clients who have attended greenhouse educational programs as well as to all VCE agents on September 27, 2001. Prior to this mailing, Dr. Latimer made two presentations of survey results to grower groups. Dr. Latimer presented preliminary results at the Professional Horticulture Conference of Virginia in January 2001 to an audience of about 45 Virginia growers. She also presented a more detailed summary of results at the Southeast Greenhouse Conference, a regional conference in Greenville SC, in June 2001 for an audience of about 35 participants.

After review and appropriate revision of this report of the survey results, we will print copies of the report and distribute them to the grower associations, all survey participants who requested a copy, VCE agents, all VT and VSU faculty who deal with the greenhouse industry, and Virginia Tech administrators in Horticulture, Entomology and Plant Physiology and Weed Science as well as VCE administration.

Dr. Scoggins has also completed a draft of the first of two refereed manuscripts for submission to *HortTechnology* an applied horticulture journal of the American Society for Horticultural Science that targets other applied scientists, Extension agents, consultants, and industry personnel. The titles of these manuscripts are: *Scope of the Virginia Commercial Greenhouse Industry and Current Practices* and *Future Needs Assessment of the Virginia Commercial Greenhouse Industry.*

Appendix 1

Copy of the Greenhouse Needs Assessment survey and the cover letter for the initial mailing to 908 potential greenhouse operations in Virginia.

Department of Horticulture
Blacksburg, VA 24061-0327
540-231-5451

September 13, 2000

«Field2» «ID»
«Address1»
«City» «State» «Zip»

Dear Greenhouse Grower:

We are writing to ask for your help in a project planned to improve the support Virginia Tech provides to greenhouse growers in our state. In order to serve you better, we need a clear picture of the scope, concerns, and training needs of your industry. Please help us serve you by taking 15-20 minutes to complete and return the enclosed needs assessment survey which has been designed to provide this picture.

Virginia Tech has greatly increased its commitment to the floriculture and greenhouse industry by filling four new faculty positions over the last 2 years. Due to the resulting new program opportunities, both the Virginia Flower Growers Association and the Virginia Nursery and Landscape Association are supporting this effort to learn how Virginia Tech can work for you most effectively. Therefore, we are asking you to tell us about the nature of your business, your educational interests, and your view of the critical issues facing the greenhouse industry.

It is important that the survey be completed by the person in your company who has the best understanding of both your business and the industry as a whole. The survey is coded for mailing purposes, but you can be assured that your responses will be kept strictly confidential. Information from the surveys will only be reported in a summarized form and will not be identified with individual businesses. If you have any questions about any portion of the survey, please call Joyce Latimer or Holly Scoggins at the number above.

Thank you for taking time to tell us about your business and its needs. We will use what we learn from you to provide research and educational programs to help YOU grow and sell high quality plants more profitably.

Sincerely yours,

Joyce Latimer
Extension Specialist, Greenhouse Crops

Holly Scoggins
Assistant Professor, Floriculture

Mark Landa, President
Virginia Flower Growers Assn.

Jeff Miller, Executive Director
Virginia Nursery & Landscape Assn.

— Greenhouse Needs Assessment —

If you are working in the greenhouse industry in Virginia, please help us help you by taking time to complete and return this survey. We are trying to learn how we can better support greenhouse growers. It is important that the survey be completed by the person in your company who has the best understanding of both your business and the industry as a whole. ***Please return this survey by October 6, 2000. Please return the survey by folding it so the postage paid, return address is on the outside, staple it closed, and mail it.***

If you are not currently engaged in the greenhouse business or the production of herbaceous perennials, please check here 9 , and return this survey (reply mail is postage paid, just fold, staple and mail).

Professional Background - *Responses should apply to person completing this survey*

1. Please indicate the job title which most closely describes your role in your greenhouse. *(Check one)*
   - 9 a) Administrative Assistant
   - 9 b) General Manager
   - 9 c) Head Grower
   - 9 d) Owner/Grower
   - 9 e) Owner
   - 9 f) Other _____*(Please specify.)*

2. How many years have you worked in the greenhouse industry? (*Could be many different jobs*) _____ years

3. Are you a member of any of the following professional or trade organizations? *Check all that apply.*

T	*ORGANIZATION*
	a) Professional Plant Growers Association
	b) Shenandoah Valley Nursery and Greenhouse Growers Association
	c) Society of American Florists
	d) Virginia Flower Growers Association
	e) Virginia Nursery and Landscape Association
	f) Other _____
	g) None

4. Are tobacco transplants the only crop in your greenhouse? _____Yes _____No
If **YES**, skip to **question # 10.**

5. What kinds of crops do you grow in your greenhouse or nursery operation? *Check all that apply.*

T	*CATEGORY*
Bedding Plants:	
	a) Baskets
	b) Flats
	c) Pots
Foliage Plants:	
	d) Baskets
	e) Pots
Perennials	
	f) In greenhouse
	g) Outdoors

T	*CATEGORY*
Vegetables:	
	h) Transplants
	i) Greenhouse tomatoes
	j) Other vegetables for consumption
Flowering Potted Plants:	
	k) Chrysanthemums
	l) Geraniums
	m) Poinsettias
	n) Other Flowering Potted Plants
Other:	
	o) Aquatic plants
	p) Tobacco transplants

T	*CATEGORY*
Cut Flowers:	
	q) Greenhouse containerized
	r) Greenhouse ground beds
	s) Outdoor ground beds
Herbs:	
	t) Containerized plants
	u) For consumption
Plugs:	
	v) Annual bedding plants
	w) Perennials
	x) Vegetables

6. Do you plan to add new kinds of crops in the next one to three years? _____Yes _____No

If **Yes**, what categories? _____

_____

7. If you checked **"Perennials"** above, please list the six flowering perennials you produce in the largest quantities.

1.	2.	3.
4.	5.	6.

8. Do you participate in any of the following branding or point of purchase (POP) programs? *Check all that apply.*

9 a) Athens Select
9 b) Blooms of Bressingham
9 c) Flower Fields
9 d) Proven Winners
9 e) Other _____ *(Please specify.)*

9. Please rank your top three markets in order of their importance in generating revenue. *1 = most important, 2 = next most important, etc.*

RANK	MARKET
	a) Retail direct from greenhouse
	b) Retail from adjoining store
	c) Wholesale to garden centers
	d) Wholesale to mass marketers
	e) Wholesale to florists
	f) Wholesale to landscapers

RANK	***MARKET***
	g) Wholesale to other retailers - please specify_____
	h) Wholesale to your own landscape business
	i) Wholesale to property management firms
	j) Internet sales
	k) Mail order
	l) Other_____*(please specify)*

Educational Interests and Needs

10. Please indicate your level of interest in learning more about the following plant production topics. *Circle one number for each topic; 1=No interest, 4=Great interest*

PLANT PRODUCTION TOPICS	***No interest***			***Grea inter***
a) Automation of greenhouse functions	1	2	3	4
b) Disease management	1	2	3	4
c) Insect management	1	2	3	4
d) Managing wastewater and run off	1	2	3	4
e) Nutritional management	1	2	3	4
f) Plant growth regulators	1	2	3	4
g) Reducing pesticide use	1	2	3	4
h) Reports on field trials	1	2	3	4
i) Ventilation & cooling	1	2	3	4
j) Water quality	1	2	3	4
k) Other _____	1	2	3	4

11. Please indicate which months you would be most likely to attend educational programs. *Circle all that apply.*

January	**February**	**March**	**April**	**May**	**June**
July	**August**	**September**	**October**	**November**	**December**

12. Please indicate your interest in learning more about these crops. *Circle one number for each crop; 1=No interest, 4=Great interest*

CROPS TO LEARN MORE ABOUT		***No interest***			***Gre inte***
a) Aquatic Plants		1	2	3	4
b) Bulb Crops		1	2	3	4
c) Cut Flowers		1	2	3	4
d) Perennials		1	2	3	4
e) Bedding Plants	e) Flowering Annuals	1	2	3	4
	f) Geraniums	1	2	3	4
	g) Pansies & other cool season crops	1	2	3	4
	h) Plug Production	1	2	3	4
	i) Vegetable Transplants	1	2	3	4
Edible Crops	j) Herbs	1	2	3	4
	k) Vegetables	1	2	3	4
Flowering Potted Plants	l) Poinsettias	1	2	3	4
	m) Garden mums	1	2	3	4
	n) Other Flowering Potted Plants	1	2	3	4

13. Please rank the top three areas where you would prefer meetings or educational programs. *1 = most preferred, 2 = second most preferred, 3 = third most preferred*

	a) Charlottesville area		e) Northern Virginia area		h) Tidewater area
	b) Roanoke area		f) Richmond area		
	c) Winchester area		g) South Hills area		
	d) Meetings that move from area to area throughout the state				

14. How would you like meetings/educational programs organized/formatted? *1 = most preferred, 2 = second most preferred, 3 = third most preferred*

	a) Day meetings (lasting up to 8 hours)		d) Workshops (lasting up to 4 hours)
	b) Multi - day meetings		e) Tours
	c) Evening meetings (lasting up to 3 hours)		

15. Please indicate your level of interest in learning more about these business management topics.
Circle one number for each topic; 1= No interest, 4=Great interest

MANAGEMENT TOPICS TO LEARN MORE ABOUT		***No interest***			***G in***
a) Computerizing your business		1	2	3	4
Financial Management	b) Pricing	1	2	3	4
	c) Basic Cost Accounting	1	2	3	4
	d) Cost Benefit Analysis for Automation Decisions	1	2	3	4
Marketing	e) Retail	1	2	3	4
	f) Wholesale	1	2	3	4
g) Risk Management Issues		1	2	3	4
h) State & Federal Environmental Regulation		1	2	3	4
i) State & Federal Labor Regulations		1	2	3	4
j) Strategies for attracting and keeping good employees		1	2	3	4
k) Techniques for providing in-house employee training		1	2	3	4
l) Other employee management issues		1	2	3	4

16. For the sources listed below, please check all those that you currently use,

AVAILABLE RESOURCES CURRENTLY USED			
	a) Audio cassettes on specific topics		i) Internet web sites
	b) Books on specific crops		j) Other growers
	c) CD - ROM (data base		k) Private consultants
	d) County extension agent		l) Professional association newsletters
	e) E-mail newsletters, listserves		m) Publications on specific topics
	f) Extension fact sheets		n) Sales representatives
	g) Extension newsletters		o) Trade journals
	h) Extension specialists		p) Video cassettes on specific topics

17. The **most important** of the resources listed above (in Question #16) that I use, is

_____

18. If available, which of these sources would you use for greenhouse operation information? *Check all that apply.*

9 a) E-mail Alerts of Current Information
9 b) FAX Alerts of Current Information
9 c) Virginia Growers Listserve for Information Exchange
9 d) VA Tech Floriculture Web Site
9 e) None of the above

19. Are you aware of services available from the Virginia Cooperative Extension?
( ) Yes ( ) No ( ) Not sure

If yes, have you contacted a Virginia Cooperative Extension office for assistance in:
( ) the last 6 months ( ) the last 12 months

If tobacco transplants are the only crop in your greenhouse, skip to question # 30.

Greenhouse Operation Information

20. How long has your greenhouse been in business under the current ownership? _____ years

21. Please indicate the percent of your greenhouse business devoted to each of these categories**.**

%	***BUSINESS CATEGORY***
	a) Wholesale
	b) Retail
	c) Other (specify) _____

22. Please indicate annual gross receipts for the greenhouse portion of your business for 1999: _____

23. How many people **, other than family members,** do you employ in your business on a **year around, full time** basis? _____

24. How many people, **other than family members**, do you employ in your business on a **seasonal** basis?_____

25. Production space: fill in box with approximate area:

PRODUCTION SPACE	***TOTAL AREA***
a) Heated greenhouse area (square feet):	
b) Unheated but under cover area (square feet):	
c) Outdoor container production area (acres):	
d) Field production of herbaceous perennials (acres):	

26. Cultural practice questions. *Check YES, NO, or NOT APPLICABLE.*

CULTURAL PRACTICE	***YES***	***NO***	***N/A***
Do you:			
a) keep "pet" plants (not for commercial use) in your greenhouse?			
b) test your irrigation water for alkalinity and mineral content on an annual basis?			
c) test your growing media during a crop cycle?			
d) adjust fertilizer or irrigation practices based on the results of growing media tests?			
e) calibrate your fertilizer injector during a crop cycle?			
f) use controlled release fertilizer?			
g) rotate among different insecticide chemistries for multiple treatments of the same insect problem?			
h) calibrate your spray equipment on a regular basis?			
i) use screening to exclude insects from your greenhouse?			
j) sanitize your greenhouse floors, benches and other structures with bleach or other commercial products after each crop cycle?			
k) utilize horizontal air flow fans in some or all of your greenhouses?			

27. Please indicate which functions are automated in your greenhouse business or those functions you plan to automate in the next two years. *Check all that apply.*

FUNCTION	***AUTOMATED T***	***PLAN TO AUTOMATE within 2 YEARS T***
a) Fertilizer application		
b) Irrigation		
c) Media mixing		
d) Pot filling		
e) Pruning		
f) Transplanting		
g) Plant transport within the greenhouse		
h) Labeling: Bar coding		
i) Labeling: Tagging		
j) Packaging for shipping		
k) Loading		

28. What type of irrigation system do you use in your greenhouse operation? *Check all that apply.*

IRRIGATION SYSTEMS			
	a) Hand watering		
	b) Boom irrigators		f) Drip irrigation
	c) Ebb & flow benches		g) Ebb & flow floors
	d) Overhead impact sprinklers		h) Overhead micro sprinklers
	e) Saucers		i) Trough systems

29. INSECT PEST AND DISEASE MANAGEMENT: Please indicate which of the following techniques you currently use or are interested in learning more about: *Check all that apply*

TECHNIQUE	***CURRENTLY USE T***	***WOULD LIKE M INFORMATION***
a) Beneficial nematodes		
b) Conventional pesticides		
c) Horticultural oils		
d) Insect growth regulators		
e) Insecticidal soaps		
f) Isolation of new plants until they can be visually inspected		
g) Maintain a 10-20' grass and weed free buffer around the greenhouse		
h) Other biological control materials		
i) Request pesticide history from plug or liner suppliers		
j) Scouting		
k) Submit samples to VA Tech Plant Disease Clinic		
l) Use test kits to monitor for viruses		
m) Use sticky cards to check new material for insect pests		
n) Use weed barrier cloth for mechanical weed management		

30. Please indicate the technologies you currently use, and those you plan to add within the next two years. *Check all that apply.*

TECHNOLOGY	***IN USE T***	***PLAN TO ADD within 2 YEARS T***
a) Computer for financial management		
b) Computerized inventory control		
c) E-mail		
d) FAX		
e) Internet		
f) Web site for your greenhouse		
g) Other_____ (please specify)		

31. What type of horticultural training/education have you had? *Check all that apply.*

T	*HORTICULTURE TRAINING*
	a) Extension or community courses
	b) Four year college
	c) High school vocational program
	d) Master Gardener certification
	e) No formal education in horticulture
	f) Two year community or technical college
	g) VFGA Greenhouse Operators Certification
	h) VNLA certification programs

32. Please indicate the importance of each of the following issues facing the greenhouse industry in terms of its impact on your business. *1 = No importance, 4 = Great importance*

INDUSTRY ISSUES	*Not important*			*Very importan*
a) Availability of competent labor	1	2	3	4
b) Compliance with state and federal regulations	1	2	3	4
c) Crop patenting	1	2	3	4
d) Environmental quality concerns	1	2	3	4
e) Financial management	1	2	3	4
f) General state of the economy	1	2	3	4
g) Marketing	1	2	3	4
h) New crop development	1	2	3	4
i) Pesticide availability	1	2	3	4
j) Other - please specify_____	1	2	3	4

(Optional)

33. What is the highest level of education you have completed? *Check one.*

T	***EDUCATION***
	a) Less than high school diploma
	b) High school or GED
	c) Some college , *please specify major* _____
	d) Two-year college degree, *please specify major* _____
	e) Four-year college degree, *please specify major*_____
	f) Post-graduate study, *please specify major*_____

34. Any other comments you would like to make:

Thank you for your time and effort in answering our questions. If you would like to receive a copy of the results of this survey, please detach and return the form below.

---------- B ----------

As a followup to the written survey, we will be conducting a series of focus groups to discuss and interpret the survey results. These meetings will be held in several parts of the state in November. If you would like to be added to the pool of growers considered for one of these meetings, please note on the form below and return to the address below.

___ Yes, I would like to receive a written copy of the results of this survey.

___ Yes, I would like my name added to the pool of candidates for the focus group meetings.

Name _____

Address _____

_____

Phone # _____

Return form to: Joyce Latimer, Department of Horticulture, Virginia Tech, Blacksburg, VA 24061-0327

Appendix 2

A summary of portions of the needs assessment survey that was mailed to greenhouse operators and other interested parties on September 27, 2001.

Virginia Greenhouse Operators Needs Assessment Survey:
Summary of Program Preferences and Educational Topics

Late last year, Virginia Tech conducted a needs assessment survey, funded by the Virginia Agricultural Council, that has provided valuable insight into the preferences of Virginia greenhouse operators for meeting times, places and formats, as well as interest levels in learning about various production techniques, crops, and business management topics. This brief summary presents some of the results of the survey and presents a calendar of educational opportunities developed in response to the needs and interests identified by the survey.

The overall response rate for the needs assessment survey was 63% for a total of 274 usable responses. The respondents were classified by size based on the amount of heated greenhouse space. The majority of the respondents (152 operations, 57% of the total) were classified as small operations, i.e., less than 10,000 sq.ft. heated greenhouse space. Nineteen percent (50 operations) were classified as medium with 10,000 to 29,999 sq.ft. Only 14% (39 operations) had more than 30,000 sq.ft. Another small group (9%, 23 operations) were classified as part time operations based on limited activity without regard to greenhouse space. In some cases response to the survey questions varied with the size of the operation.

When, Where, & In What Format

January is the most popular month to meet, with nearly three quarters of the respondents indicating they would be likely to attend a meeting held then. Fifty-four percent of growers said they would likely attend a meeting in February, the next most popular month for meetings. In July, nearly 60% of the medium and large operations also were willing to attend meetings, as compared to only about 30% of the small or part-time operations.

The central part of the state garnered the most votes for where meetings should be held, with over fifty percent of growers choosing either Charlottesville or Richmond from a list of potential meeting sites representing different parts of the Commonwealth. These locations ranked far above the next highest choices, Roanoke and the Tidewater, each of which were selected by about 29% of respondents.

As for meeting format, approximately three quarters of those completing the survey preferred either four-hour workshops or all day meetings (up to eight hours). The next most popular format was tours, with 54% of respondents selecting tours as their first, second, or third most preferred meeting type. Although the number of comments made was relatively small, all comments on this subject focused on the value of tours.

Educational Topics

Growers were asked to indicate their interest in learning more about a variety of subjects in three broad categories – specific crops, production techniques, and business management. Respondents were asked to rank their interest in the various topics by assigning

each topic a score between 1 and 4, with 1 indicating “no interest” and 4 indicating “great interest.”

Growers indicated the greatest interest in information that will help them produce healthier crops – insect, disease, and nutritional management. These three topics ranked from 3.2 to 3.5 using the system described above. A little lower on the scale, but still ranking high enough to indicate considerable interest were reducing pesticide usage and managing water quality, ranking 3.1 and 2.9, respectively.

The crops that growers showed an interest in learning more about are generally the most widely grown crops, as well. The greatest interest was indicated in learning more about perennials (ranking 3.2) and flowering annual bedding plants (3.0), closely followed by pansies (2.9). The next greatest level of interest was in edible herbs and garden mums, ranking from 2.7 and 2.5, respectively. Interest in learning more about growing vegetables, either as transplants or for consumption, ranked 2.3. There was some variation related to the size of the greenhouse operation; e.g., medium (ranking 3.0) and large (3.2) firms were more interested in learning more about growing geraniums and, only large (2.9) firms expressed an interest in learning more about poinsettias.

Growers were asked about their interest in training on topics that might help them manage their businesses more efficiently and profitably. Retail and wholesale marketing, and pricing, all scored 3.1 or 3.0. Interest was nearly as great in learning more about environmental regulations, computerizing a business, and cost accounting, which scored 2.9 or 2.8. Interest in employee issues and state/federal regulations increased with the size of the greenhouse operations.

So, What Did Virginia Tech Do With This Information?

The goal of the survey and the follow-up meetings with growers around the state was to assist Virginia Tech in designing research and education programs that would ultimately enhance the profitability of greenhouse operators in Virginia. Since 60% of Virginia’s growers are growing perennials, Virginia Tech has initiated a research project on developing an integrated production management plan for herbaceous perennials. This project has also received funding from the Virginia Agricultural Council.

Virginia Tech also has developed educational programs based on the survey results. “A Pricing Primer” was offered at the Professional Horticulture Conference in January 2001. “Retailing Greenhouse Crops” was conducted in Richmond in April 2001. A “Perennial Plants Production Seminar” will be held in Louisa County on November 2, 2001, targeting all growers, and a “Geranium Production Seminar” is scheduled for January 2002, primarily for the medium and large growers. We have two “Quickbooks for Greenhouse/Nursery Operations” scheduled this fall for small to medium sized growers. Virginia Tech is planning “Basic Greenhouse Production Seminars” as regional programs around the state for January 2002 to make it easy to send greenhouse employees to solid greenhouse training programs with pesticide recertification credit. Look for flyers in this mailing on some of these educational programs. For a current list of programs, see the attached “Floricultural Happenings” calendar. Visit Virginia Tech’s Floriculture Website frequently for updates on this calendar: http://www.floriculture.vt.edu/.

In addition, as a result of the survey and focus group requests, Virginia Tech established a VA Greenhouse Growers Listserv to allow growers to interact with one another on production or marketing questions or problems (see enclosed flyer).

More detailed survey results will be published in the newsletters of the Virginia Flower Growers Association and the Virginia Nursery and Landscape Association.

Summary prepared by: Vicky Barden, Joyce Latimer and Holly Scoggins, Horticulture, Virginia Tech, Blacksburg, VA 24061, Sept. 2001; For more information: Joyce Latimer 540-231-7906: jlatime@vt.edu.