CHAPTER 4

FINDINGS

The purpose of this study was to determine the characteristics of the turfgrass industry in the year 2020 in order to recommend content for turfgrass course work in agricultural education programs. The primary focus of this study in the turfgrass industry was golf turf management. The objectives of the study were accomplished by utilizing data collected from a panel of 25 nationally recognized experts in the turfgrass industry.

This was a national futures study utilizing the Delphi technique, such as was previously used by Flanders (1988), Varnadore (1989), and McAllister (1992). The top 38 experts in the turfgrass industry were selected to participate through a national nomination process. Nominations were taken from turfgrass specialists at all land grant institutions (teaching, research, and extension), college and technical school (teaching and demonstration), state turfgrass commodity commissions, and related professional associations. Thirty-four of the nominated experts agreed to participate in the study.

A structured Delphi instrument was developed from the literature and round one, validated and used in rounds two and three. Items for the first round were taken from the turfgrass literature dealing with industry emphasis and direction. The first round was an open discussion document asking for specific comments, and the panel's responses were used in the development of the instrument for rounds two and three. Respondents replied via facsimile to the three rounds of the Delphi process.

Thirty-four (90%) of the 38 nominated experts completed and returned the first round of the instrument. The responses were compiled and organized into the Delphi instrument which was evaluated by a 20-member review team. The second instrument

was circulated to the thirty-four experts with thirty (79%) completing and returning the instrument. The most common responses on each item from the second round were compiled and provided to 30 members of the panel of experts, along with the round three instrument. A 66% overall response rate (25 of 38) was attained in round three after two follow-ups of non-respondents. This chapter presents the findings of data collected in the three rounds of this study.

Description of the Population

Two national groups were involved in the process of completing this study. The first group was the nominators who were asked to provide the names of persons for a national panel of experts in the turfgrass industry. The second group was the national panel of experts nominated by the first group.

The persons used to nominate the members of the panel of experts came from an thorough personnel review including turfgrass specialists at all land grant institutions (teaching, research, and extension), college and technical schools (teaching and demonstration), and related professional associations executive memberships (Appendix A). This pool of human resources provided a diverse panel of experts from private and public sectors across the United States.

The 38 members of the chosen panel of experts were selected from a list of 428 total nominations which named 194 different people. A total of 110 nomination forms were returned with five or fewer nominations. These 194 individuals received from 1 to 37 nominations. The 38 individuals receiving 3 or more nominations were selected to be the panel of experts. Thirty-four of the 38 most frequently nominated experts agreed to serve on the panel. The 25 experts who answered all three instruments were distributed throughout the United States (Figure 2, p. 56).

When asked to indicate the category that best described their current affiliation with the turfgrass industry, 13 (52%) of the 25 members of the panel indicated that they were university educators (teaching, research, or extension), 4 (16%) were professional association directors, 3 (12%) were in turfgrass business and industry, 2 (8%) were turfgrass consultants, 2 (8%) were golf course superintendents, and 1 (4%) was a federal researcher.

All twenty-five experts were male and 24 (96%) Caucasian and one (4%) mixed race. They were well-educated with 3 having bachelor's degrees, 5 having master's degrees, and 17 having doctoral degrees. The group had a total of 806 years experience, a mean of 32.2 years in turfgrass. Respondents ranged from 44 to 83 years of age, a mean of 57.6 years. The nomination process was without bias to women or minorities. One woman was invited to participate from the original thirty-eight invitations but declined. The presence of women in this male-dominated field has been expanding in recent years.

A description of the experts is not necessary for the interpretation of the Delphi, but demographic data relative to the panel of experts were important for verification of the expert status of panel members. This information may also be important in the selection of groups for further study.

Use of the Delphi Technique to Derive Consensus for Selection of Curriculum Content

The use of the Delphi technique, as used for this research study, requires that the participants respond to two rounds of an instrument. An underlying principle was that in the third round the responses tend to converge toward the measure of central tendency, with decreasing variability in scores. A related principle to be measured when using the Delphi technique was stability. Responses are considered stable when the answers do not

change substantially from round to round. Delphi studies by Flanders (1988), Varnadore (1989) and McAllister (1992) showed similarity in stability.

Composite scores (Table 1) were calculated to rank order the items in the instrument (Dillon & Wright, 1980). The 147 items on the instrument were marked by the respondents on a five-point Likert-type scale. The categories ranged from Strongly Disagree to Strongly Agree. The points on the scale were assigned a numerical value for statistical analysis as follows:

Strongly Agree (SA)	=	5
Agree (A)	=	4
Undecided (U)	=	3
Disagree (D)	=	2
Strongly Disagree (SD)	=	1

Composite scores were calculated for each item in each of the rounds by adding the value of the individual responses. For example, if all 25 respondents had rated an item Strongly Agree, the composite score would have been 125 (25 x 5 = 125). Only round three of the results were considered for the discussion of composite scores since, by the nature of the Delphi technique, the results of the last round (round three) are the most accurate and therefore of the most value.

Table 2 reports the change in composite scores from round two to round three. Sixty-eight of the 147 items (46%) had increasing composite scores, 37 items (25%) had decreasing composite scores, and 42 items (29%) had no change in their composite scores. These data suggest that the objectives for consensus of this study were not met; however, there will be statistics presented in other tables to suggest that the objectives were met.

Table 1

Item Ranking by Composite Score in Round 3

Section I: Personnel Education and Staff Development

Number	Item	Score	Rank
1.	Admission into the two-year turfgrass programs of study will depend more on post-high school education and work experience in turfgrass management.	90	41.5
2.	An associate degree in turfgrass management from an accredited institution should be sufficient for entry level employment positions.	84	25.0
3.	All professional turfgrass-related associations will have well established certification programs for turfgrass professionals.	88	35.0
4.	All personnel involved with the application of pesticides will have to complete specialized programs of study (i.e. 2-year degrees or comparable certificate programs) specifically dealing with the safety and use of pesticides.	94	57.0
5.	Continuing education will be required for all professional turfgrass managers because of the rapid pace of change in the turfgrass industry and the commitment to lifelong education.	110	135.5
6.	Turfgrass managers must have at least a 2- or 4-year degree in an area of plant or soil sciences to be eligible for superintendent certification.	114	142.5
7.	More training will be available "on line" which should give turf managers better access to information on turfgrass management.	118	145.5
8.	Knowledge in and use of the Spanish language and culture will be needed by turf managers as becoming bilingual in the workplace receives attention.	99	81.5
9.	More emphasis will be placed on business and human resource management for turfgrass managers.	108	127.0
10.	More emphasis will be placed on meeting the requirements of the many environmental regulations.	113	139.0

Table 1: Item Ranking by Composite Score (continued)

Section II: Technology

Number	Item	Score	Rank
11.	Turfgrass managers will have to demonstrate by formal examination their competency in the understanding and use of current technology in which they are involved.	93	51.0
12.	Computers will play a major role in the educational, decision-making, and recordkeeping processes of the turf manager's job.	121	147.0
13.	New technology will require improved critical thinking and problem solving skills in the turf manager.	107	123.0
14.	More sophisticated equipment will be available for the maintenance of turfgrass sites.	118	145.5
15.	Most mapping for turfgrass management will be done using aerial photographs, Global Positioning Systems, and Geographic Information Systems.	103	100.5
16.	The impact of bio-engineering will require a better understanding of how to integrate this technology into existing facilities.	101	90.0
17.	Computerized control will become more commonplace throughout the turf industry with robotics reducing current concerns for safety in equipment operations.	93	51.0
18.	Laser mowing will become an integral part of improved technology.	78	14.5
19.	Water jet aeration will become a greater part of improved technology.	84	25.0
20.	Subsurface irrigation techniques will become more commonplace.	69	5.5
21.	Subair utilization systems and practices for heating and cooling and aeration of the soil will become more commonplace.	77	12.5
22.	Computer technology specialists will be hired by golf courses as an essential human resource element in the maintenance program	83	21.5

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
23.	More consultants will be available to provide education and on-site applied research for turf managers in a particular region.	99	81.5
24.	Advances will be made in determining the "quality" and "health" of the turf in the field as a way to help guide cultural programs.	103	100.5

Section III: Availability of Turfgrass Cultivars

25.	Seed production in yield per acre will be more important to producers.	93	51.0
26.	*Poa annua* cultivars will be available in the turfgrass industry.	100	86.0
27.	More pest-tolerant cultivars of the turfgrasses will be developed through genetic engineering.	104	110.0
28.	New cultivars with improved performance potential will continue to become more available.	114	142.5
29.	New cultivars will require a broader understanding of specific environments and cultural practices employed.	103	100.5
30.	Seeded varieties will become more dominant in both cool and warm season climates.	87	33.0
31.	Most seed and sod will be produced under a license agreement with a large agri-chemical company.	76	10.0
32.	The acceptance of new turfgrass cultivars will depend on their performance in the field under real-world conditions.	107	123.0
33.	Improved turfgrass cultivars will have the single most important impact on the industry in the future.	85	28.5
34.	Cultivars exhibiting improved color, density, and growth characteristics will be available.	109	131.0
35.	Bermudagrasses will move northward with more specific uses in the environment.	86	30.5
36.	Bentgrasses will be used further south with more disease and pest problems.	84	25.0

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
37.	Shade- and heat-tolerant turfgrasses requiring less water will be developed.	110	135.5
38.	Turfgrass cultivars developed through "genetic engineering" will be adapted to regional areas.	98	77.0
39.	New cultivars will be more stress tolerant (heat, drought, salinity, cold, and wear) as they become adapted to more adverse environmental conditions.	105	116.5
40.	Biotechnology will make significant contributions to new cultivars.	102	94.0
41.	The longevity of cultivars will be only 3 or 4 years because of continuous improvements, genetic changes in population, and plant protection patents.	69	5.5
42.	Herbicide resistance will be the norm for several species of turfgrasses.	90	41.5
43.	Genetically engineered cultivars will be the norm in 20 years.	95	62.0
44.	Turf managers will need to better distinguish between general claims and research data that make a difference as they become more involved in cultivar testing and performance.	109	131.0

Section IV: Turfgrass Management Services

45.	More professional consulting services will be available to golf courses and athletic field areas.	104	110.0
46.	The use of specialized equipment in secondary practices (e.g. cultivation) will be through services, due to cost of equipment and interval of use.	96	67.0
47.	Specialized services (hydromulching, verti-draining, etc.) will become more popular than they are now.	96	67.0
48.	Services will increase, but the individual on-site superintendent will continue to be the core of the industry.	114	142.5

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
49.	There will likely be more consolidation of golf courses under management firms that will place their own superintendent on site.	102	94.0
50.	Regulations may require contractual services for aeration of turfgrass sites.	65	2.0
50.	Chemical (pesticide and fertilizer) application will only be available on a contractual basis and performed by individuals licensed by the federal government.	62	1.0
51.	Documentation required to make pesticide application and applicator licenses will encourage many turfgrass managers to contract management services.	80	16.0
53.	Pest scouting will increase to meet environmental regulations.	101	90.0
54.	Ecology services will increase to meet environmental regulations.	102	94.0
55.	There will be more contracted services available which will reduce the need for labor and will reduce staff risks associated with pesticides.	90	41.5
56.	There will be more contracted services available which will reduce the need for equipment and adjust the budget that the superintendent must plan.	84	25.0
57.	Turfgrass management companies will offer the golf course superintendent additional opportunities to grow in professionalism.	87	33.0
58.	Contractual management services will be standard by the year 2020 which will lower management costs and lessen liability expense.	72	7.5
59.	Management services will grow because they will have the capital to acquire and use equipment, materials, and other necessary supplies.	86	30.5
60.	Home owners will use management services because of reduced costs, more leisure time, and quality of services delivered.	85	28.5

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
61.	Complete soil and plant analysis will be routinely done on site by turfgrass managers trained in the use of specialized technology.	76	10.0
62.	Public institutions, grounds, and parks will primarily be managed by private firms on a contractual basis.	72	7.5
63.	The use of contract maintenance services will be partly driven by a need to shift liability for consequences resulting from pesticide applications and partly driven by an effort to reduce capital expenditures on seldom-used equipment.	95	62.0

Section V: Legal Issues

64.	Nutrient management plans will need governmental approval to help minimize inappropriate applications.	81	18.5
65.	Applying pesticides will be a more difficult task, requiring permits, justification, environmental impact, storage, etc.	104	110.0
66.	Federal, state, and municipal agencies will establish more rules and regulations that will severely restrict standard maintenance practices, especially the use of pesticides.	98	77.0
67.	Records of application for all chemicals will be required, indicating specific product information, application rates, environmental factors, and related site information.	109	131.0
68.	A greater emphasis on professional certification of superintendents, assistants, and maintenance personnel (with respect to pesticide handling, equipment operations, and general qualifications) will be recognized.	104	110.0
69.	Worker safety will be placed on an equal level with efficiency, productivity, and cost control.	97	72.0
70.	Environmental issues, including restrictions on fertilizer and pesticide use, will continue to impact the industry.	108	127.0
71.	Legal issues will be the driving force in environmental and labor problems facing turfgrass managers.	94	57.0

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
72.	Liability for actions taken by turf managers will require more licensing and certification, or insurance companies will cancel the facility's policy.	94	57.0
73.	Liability issues will include hearing loss due to operating loud equipment, back problems from lifting, and cancer (especially skin cancer) which will greatly impact medical coverages and policies.	91	45.5
74.	Turf managers will be required, on a regular basis, to sample water in lakes, streams, and wells associated with the property being managed.	96	67.0
75.	The golf course superintendent will be forced to be increasingly aware of risk management issues associated with equipment training and personal protective equipment.	104	110.0
76.	The golf course superintendent will be forced to be increasingly aware of risk management issues associated with union workplace violence and hiring and firing issues.	96	67.0
77.	The golf course superintendent will be forced to be increasingly aware of risk management issues associated with contract management, sexual harassment, environmental compliance, safe work practices, walking surfaces, and tree liability.	103	100.5
78.	Turf managers will need to establish and maintain a preventive risk management plan for loss, claims, and law suits.	98	77.0
79.	Compliance with environmental regulations will require golf course superintendents to be well-rounded in their understanding of these issues.	110	135.5
80.	Compliance with employee and accessibility regulations will require golf course superintendents to be well-rounded in their understanding of these issues.	106	119.0
81.	All turfgrass personnel, regardless of level, will be required to have a license to operate various pieces of maintenance equipment as an expression of competency.	68	4.0

Table 1: Item Ranking by Composite Score (continued)

Section VI: Chemical Issues

Number	Item	Score	Rank
82.	Availability and use of fertilizers and pesticides will be under more critical observation from the general public and turfgrass management teams in the future.	104	110.0
83.	Fewer pesticides will be available for use, due to development costs, regulation, newer pest-tolerant cultivars, and greater dependence on integrated pest management programs.	101	90.0
84.	Legislated restrictions on pesticide use will be the primary problem the industry faces.	81	18.5
85.	Chemical issues will play an important role in turf management, especially in the high-density urban environment.	104	110.0
86.	Demand for perfect turf is currently making it difficult for turf managers to implement sound integrated management programs.	106	119.0
87.	Pesticides will be more specific in their mode of action.	107	123.0
88.	Biological control of pests in turfgrass will become more popular and such methods will be used more frequently.	91	45.5
89.	Pesticides will be of the low-risk, quickly degradable, pest-specific, immobile type.	103	100.5
90.	From an environmental standpoint, golf courses will be using compounds that are "safe" in the environment and have minor environmental impact due to extremely low concentrations.	97	72.0
91.	Chemical use will be integrated closely with the new genetically engineered turfgrass cultivars.	99	81.5
92.	The development of new turfgrass cultivars that are resistant to a wide range of pests will reduce or eliminate the need for pesticides on turfgrass.	81	18.5
93.	Turf managers must have a better understanding of how minor elements affect turfgrass health.	93	51.0

Table 1: Item Ranking by Composite Score (continued)

Section VII: Environmental Issues

Number	Item	Score	Rank
94.	The fate of pesticides (fungicides, herbicides, insecticides, nematicides, etc.) and fertilizers applied to turf areas will be more critical and an integral component of the chemical management program.	107	123.0
95.	A more comprehensive approach to environmental issues will be employed, with respect to chemical fate, beautification, wildlife sanctuaries, exotic species preservation, people responses, and the loss of natural areas.	109	131.0
96.	Expanded use of treated water and less potable water will be the focus of turf managers.	113	139.0
97.	Best Management Practice programs will help to prevent or minimize pesticide runoff and leaching.	109	131.0
98.	Golf course management has positioned itself as an example of environmental stewardship and can take a leadership role for other industries to follow.	103	100.5
99.	The development of facilities on marginal soils for turfgrass areas (e.g. golf courses, sports fields) will require additional costs to develop.	104	110.0
100.	Greater emphasis will be placed on control of invasive, non-indigenous species of plants within local areas.	93	51.0
101.	The use of pesticides will be monitored from the standpoint of public health.	102	94.0
102.	Environmental issues of great concern will be the use of scarce water resources, and the prevention of water pollution.	114	142.5
103.	Southern turfgrasses will be developed for sodium tolerance.	107	123.0
104.	Turf managers will be responsible for informing and educating governmental agency personnel, environmental groups, and the general public on the environmental benefits of turfgrass at all maintenance levels.	100	86.0
105.	Golf courses will be a positive influence on wetland recovery for the country.	93	51.0

Table 1: Item Ranking by Composite Score (continued)

Section VIII: Best Management Practices

Number	Item	Score	Rank
106.	Bio-technology programs will be more available as alternative methods are developed through concern about the planet's natural resources.	93	51.0
107.	Turf managers will be responsible for developing and implementing an appropriate nutrient management program.	108	127.0
108.	Turf managers will be responsible for implementing integrated pest management programs, and held accountable for such programs.	110	135.5
109.	Turf managers will be expected to maintain desirable soil physical properties as a result of implementing best management practices.	95	62.0
110.	Turfgrass managers will be required to have fertilizer and pesticide application programs approved before they can be implemented.	84	25.0
111.	Integrated programs (e.g. integrated pest management and best management practices) that emphasize management steps to improve turf quality with limited pesticide use will be the primary emphasis.	100	86.0
112.	Pest scouting will be required before pesticides are applied.	96	67.0
113.	Increased monitoring of the weather and climate to document conditions favorable to pests will be required.	97	72.0
114.	The use of site-specific management and remote sensoring devices will increase.	104	110.0
115.	Variable rate fertility practices will be commonplace in cultural programs.	103	100.5
116.	Using appropriate portions of the landscape as buffers within the ecosystem will be more common.	106	119.0
117.	The use of growth regulators to reduce mowing and soil compaction will increase.	89	37.5

Table 1: Item Ranking by Composite Score (continued)

Number	Item	Score	Rank
118.	The use of non-polluting electric motors on turf equipment will increase.	97	72.0
119.	Infrared spectrometry will be coupled with computer technology for improved diagnostic and prediction models in turfgrass.	95	62.0
120.	Tissue culture analysis will be coupled with computer technology for improved diagnostic and prediction models in turfgrass.	89	37.5
121.	Water flow and potential environmental impact predictions will precede fertilizer and pesticide application and use.	91	45.5
126.	Turfgrasses will play a major role in the planning process for development of undisturbed watersheds.	89	37.5
127.	The government (state or national) will mandate and define the "best management practices" which the golf course managers will have to follow.	76	10.0

Section IX: Other Issues and/or Circumstances

128.	Turf managers will be expected to identify and implement the best use of time for professional development.	98	77.0
129.	Turf managers will be more critically evaluated on membership in professional associations and receipt of trade journals, attendance at short courses and conferences, and how many and which ones to attend.	89	37.5
130.	Turf managers will be more critically evaluated on the best use of available funds in professional development.	97	72.0
131.	Turf managers will be more accountable in financial support to foundations, universities, and other organizations.	77	12.5
132.	Turf managers will be more accountable for the time that is reserved for supporting turf-related associations (officer, board member, committee member, etc.) at the local, state, national, and international levels.	83	21.5

Table 1: Item Ranking by Composite Score (continued)

Section IX: Other Issues and/or Circumstances

Number	Item	Score	Rank
133.	Turf managers will spend more time keeping records and practicing public relations.	104	110.0
134. to	In addition to technical skills, turf managers will need to know people management, risk management, environmental stewardship, communication skills, business administration, and foster favorable public relations and image management their employer and and to members of the community	113	139.0
135.	The demand for accredited educational programs that can be delivered to people who are employed full-time will increase.	100	86.0
136.	Staff development seminars and in-services will be a means of educating employees and exhibiting progressive management styles.	102	94.0
137.	Golf courses and other turfgrass areas will have on-site laboratories as a means of conducting various research programs, cooperating with state and federal agencies.	67	3.0
138.	More grants will be made available from the private sector for funding research.	78	14.5
139.	More ethnic minorities will seek employment on golf courses.	98	77.0
140.	Turf managers will foster an environment that encourages diversity from management to the labor force as "team efforts" continue to be the norm.	90	41.5
141.	Scheduling for successful maintenance will become more critical as play increases.	103	100.5
142.	Night-time maintenance, split shifts, part-time employees, etc. will be required to accomplish tasks while minimizing impact of the guests or members at golf courses.	91	45.5
143.	Mowers will be quieter, easier to operate, and offer higher safety.	105	116.5
144.	Mowers will operate on energy sources different from today's gasoline and diesel engines.	95	62.0

Table 1: Item Ranking by Composite Score (continued)

145.	Shear (reel) and impact (rotary) mowing equipment will remain basic to mowing	99	81.5
146.	Laser and other cutting methods will remain too expensive and produce unsatisfactory cutting units.	81	18.5
147.	There will be a need for even more specialized staff positions such as electrical mechanics that can diagnose and repair more high tech equipment	94	57.0

Table 2

Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
1	88	90	2
2	80	84	4
3	88	88	0
4	90	94	4
5	110	110	0
6	112	114	2
7	119	118	-1
8	101	99	-2
9	109	108	-1
10	111	113	2
11	93	93	0
12	121	121	0
13	106	107	1
14	116	118	2
15	102	103	1
16	101	101	0
17	89	93	4
18	78	78	0
19	85	84	-1
20	72	69	-3
21	75	77	2
22	82	83	1

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
23	99	99	0
24	102	103	1
25	95	93	-2
26	99	100	1
27	106	104	-2
28	113	114	1
29	101	103	2
30	84	87	3
31	79	76	-3
32	108	107	-1
33	84	85	1
34	108	109	1
35	86	86	0
36	86	84	-2
37	108	110	2
38	95	94	-1
39	100	100	0
40	103	102	-1
41	67	65	-2
42	92	90	-2
43	95	95	0
44	108	109	1
45	105	104	-1

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
46	96	96	0
47	97	96	-1
48	113	114	1
49	102	102	0
50	66	65	-1
51	63	62	-1
52	80	80	0
53	100	101	1
54	102	102	0
55	91	90	-1
56	83	84	1
57	87	87	0
58	72	72	0
59	85	86	1
60	85	85	0
61	78	76	-2
62	70	69	-1
63	94	95	1
64	80	81	1
65	101	104	3
66	97	98	1
67	109	109	0
68	104	104	0

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
69	97	97	0
70	109	108	-1
71	93	94	1
72	94	94	0
73	90	91	1
74	96	96	0
75	104	104	0
76	94	96	2
77	103	103	0
78	97	98	1
79	105	106	1
80	108	106	-2
81	70	68	-2
82	104	104	0
83	100	101	1
84	79	81	2
85	104	104	0
86	102	106	4
87	104	104	0
88	92	91	-1
89	103	103	0
90	97	97	0
91	100	99	-1

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
92	80	81	1
93	92	93	1
94	107	107	0
95	109	109	0
96	114	113	-1
97	108	109	1
98	103	103	0
99	102	104	2
100	92	93	1
101	103	102	-1
102	113	114	1
103	100	102	2
104	95	100	5
105	94	93	-1
106	95	93	-2
107	108	108	0
108	109	110	1
109	95	95	0
110	89	84	-5
111	100	100	0
112	94	96	2
113	96	97	1
114	105	104	-1

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
115	100	103	3
116	105	106	1
117	89	89	0
118	96	97	1
119	95	95	0
120	89	89	0
121	89	91	2
122	102	104	2
123	98	100	2
124	95	94	-1
125	84	87	3
126	88	89	1
127	75	76	1
128	97	98	1
129	88	89	1
130	93	97	4
131	76	77	1
132	84	83	-1
133	103	104	1
134	112	113	1
135	100	100	0
136	103	102	-1
137	68	67	-1

Table 2: Composite Scores for Round 2 and Round 3 and the Difference Between Composite Scores by Item (continued)

Item Number	Round 2 Composite Score	Round 3 Composite Score	Change in Composite Score R3 - R2
138	76	78	2
139	97	98	1
140	90	90	0
141	104	103	-1
142	88	91	3
143	104	105	1
144	93	95	2
145	99	99	0
146	79	89	2
147	94	94	0

Table 3 reports the items of highest and lowest rank by composite score. The highest-ranked items received a composite score of 113 or higher (90% of 125). These items dealt with the need for computer applications, more sophisticated maintenance equipment, more "on-line" training, environmental issues, contract services, new and better turfgrass cultivars, more education and certification, effective communication and people management skills, expanded "treated water" use programs, integrated pest management, and best management practices. These items suggest that the experts are interested in attracting better employees into the workplace, improving employee quality through training and development, and protecting the environment through effective stewardship.

The lowest ranked items received a composite score of 72 or lower [62 + (10% of 125)]. These items dealt concern for governmental licensing in chemical application, contractual management services, "on-site" research laboratories, equipment licensing, subsurface irrigation and aeration, longevity of new cultivars, seed and sod production licensing, "on-site" soil and plant analyses, government mandates, laser mowing, and grants for research. These items suggest that the experts recognize government intrusion and expensive ("big-ticket") items, and may or may not want to get involved in such items.

Table 4 reports the frequencies of answers for each item in round three. The number of respondents in agreement or disagreement is given with the percentages identified in parenthesis. The highest frequency of the respondents was for the Undecided category for item numbers 18, 21, 22, 31, 58, 61, 62, 127, and 146.

Table 5 reports composite scores and the number of respondents in agreement by item in round three. Consensus was indicated on an item if both of the following conditions were met: (1) at least 60% (15 of 25) of the respondents were in agreement

Table 3

Items of Highest and Lowest Rank by Composite Score in Round 3

Highest Ranked Items

Number	Item	Score	Rank
12.	Computers will play a major role in the educational, decision-making, and recordkeeping processes of the turf manager's job.	121	1.0
14.	More sophisticated equipment will be available for the maintenance of turfgrass sites.	118	2.5
7.	More training will be available "on line" which should give turf managers better access to information on turfgrass management.	118	2.5
102.	Environmental issues of great concern will be the use of scarce water resources, and the prevention of water pollution.	114	5.5
48.	Services will increase, but the individual on-site superintendent will continue to be the core of the industry.	114	5.5
28.	New cultivars with improved performance potential will continue to become more available.	114	5.5
6.	Turfgrass managers must have at least a 2- or 4-year degree in an area of plant or soil sciences to be eligible for superintendent certification.	114	5.5
134.	In addition to technical skills, turf managers will need to know people management, risk management, environmental stewardship, communication skills, business administration, and foster public relations and image management to their employer and to members of the community.	113	9.0
96.	Expanded use of treated water and less potable water will be the focus of turf managers.	113	9.0
10.	More emphasis will be placed on meeting the requirements of the many environmental regulations.	113	9.0

Table 3: Items of Highest and Lowest Rank by Composite Score in Round 3 (continued)

Lowest Ranked Items

Number	Item	Score	Rank
51.	Chemical (pesticide and fertilizer) application will only be available on a contractual basis and performed by individuals licensed by the federal government.	62	147.0
50.	Regulations may require contractual services for aeration of turfgrass sites.	65	146.0
137.	Golf courses and other turfgrass areas will have on-site laboratories as a means of conducting various research programs, cooperating with state and federal agencies.	67	145.0
81.	All turfrass personnel, regardless of level, will be required to have a license to operate various pieces of maintenance equipment as an expression of competency.	68	144.0
20.	Subsurface irrigation techniques will become more commonplace.	69	142.5
41.	The longevity of cultivars will be only 3 or 4 years because of continuous improvements, genetic changes in population, and plant protection patents.	69	142.5
58.	Contractual management services will be standard by the year 2020 which will lower management costs and lessen liability expense.	72	140.5
62.	Public institutions, grounds, and parks will primarily be managed by private firms on a contractual basis.	72	140.5

Table 4

Frequency of Responses and Percentage of Group Agreement and Disagreement by Item

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
1	0 (0%)	6 (24%)	6 (24%)	2 (8%)	13 (52%)	4 (16%)	17 (68%)
2	2 (8%)	5 (20%)	7 (28%)	4 (16%)	10 (40%)	4 (16%)	14 (56%)
3	1 (4%)	3 (12%)	4 (16%)	4 (16%)	16 (64%)	1 (4%)	17 (68%)
4	1 (4%)	2 (8%)	3 (12%)	5 (20%)	11 (44%)	6 (24%)	17 (68%)
5	0 (0%)	1 (4%)	1 (4%)	1 (4%)	10 (40%)	13 (52%)	23 (92%)
6	0 (0%)	0 (0%)	0 (0%)	1 (4%)	9 (36%)	15 (60%)	24 (96%)
7	0 (0%)	0 (0%)	0 (0%)	1 (4%)	5 (20%)	19 (76%)	24 (96%)
8	1 (4%)	1 (4%)	2 (8%)	2 (8%)	15 (60%)	6 (24%)	21 (84%)
9	0 (0%)	0 (0%)	0 (0%)	2 (8%)	13 (52%)	10 (40%)	23 (92%)
10	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (48%)	13 (52%)	25(100%)
11	0 (0%)	3 (12%)	3 (12%)	4 (16%)	15 (60%)	3 (12%)	18 (72%)
12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (16%)	21 (84%)	25(100%)
13	0 (0%)	1 (4%)	1 (4%)	1 (4%)	13 (52%)	10 (40%)	23 (92%)
14	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (28%)	18 (72%)	25(100%)
15	0 (0%)	2 (8%)	2 (8%)	3 (12%)	10 (40%)	10 (40%)	20 (80%)
16	0 (0%)	1 (4%)	1 (4%)	4 (16%)	13 (52%)	7 (28%)	20 (80%)
17	1 (4%)	0 (0%)	1 (4%)	8 (32%)	12 (48%)	4 (16%)	16 (64%)
18	0 (0%)	3 (12%)	3 (12%)	16(64%)	6 (24%)	0 (0%)	6 (24%)
19	1 (4%)	4 (16%)	5 (20%)	5 (20%)	15 (60%)	0 (0%)	15 (60%)
20	3(12%)	8 (32%)	11(44%	7 (28%)	6 (24%)	1 (4%)	7 (28%)
21	3(12%)	2 (8%)	5 (20%)	11(44%)	8 (32%)	1 (4%)	9 (36%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
22	0 (0%)	3 (12%)	3 (12%)	12(48%)	9 (36%)	1 (4%)	10 (40%)
23	0 (0%)	1 (4%)	1 (4%)	2 (8%)	19 (76%)	3 (12%)	22 (88%)
24	0 (0%)	0 (0%)	0 (0%)	1 (4%)	20 (80%)	4 (16%)	24 (96%)
25	0 (0%)	4 (16%)	4 (16%)	3 (12%)	14 (56%)	4 (16%)	18 (72%)
26	0 (0%)	1 (4%)	1 (4%)	3 (12%)	16 (64%)	5 (20%)	21 (84%)
27	0 (0%)	1 (4%)	1 (4%)	2 (8%)	14 (56%)	8 (32%)	22 (88%)
28	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (44%)	14 (56%)	25(100%)
29	0 (0%)	1 (4%)	1 (4%)	2 (8%)	15 (60%)	7 (28%)	22 (88%)
30	1 (4%)	4 (16%)	5 (20%)	6 (24%)	10 (40%)	4 (16%)	14 (56%)
31	1 (4%)	5 (20%)	6 (24%)	12 (48%)	6 (24%)	1 (4%)	7 (28%)
32	0 (0%)	0 (0%)	0 (0%)	2 (8%)	14 (56%)	9 (36%)	23 (92%)
33	1 (4%)	5 (20%)	6 (24%)	6 (24%)	9 (36%)	4 (16%)	13 (52%)
34	0 (0%)	0 (0%)	0 (0%)	0 (0%)	16 (64%)	9 (36%)	25(100%)
35	1 (4%)	5 (20%)	6 (24%)	3 (12%)	14 (56%)	2 (8%)	16 (64%)
36	1 (4%)	4(16%)	5 (20%)	5 (20%)	15 (60%)	0 (0%)	15 (60%)
37	0 (0%)	0 (0%)	0 (0%)	1 (4%)	13 (52%)	11 (44%)	24 (96%)
38	0 (0%)	2 (8%)	2 (8%)	4 (16%)	13 (52%)	6 (24%)	19 (76%)
39*	0 (0%)	0 (0%)	0 (0%)	1 (4%)	13 (54%)	10 (42%)	23 (96%)
40	0 (0%)	2 (8%)	2 (8%)	2 (8%)	13 (52%)	8 (32%)	21 (84%)
41	1 (4%)	11(44%)	12(48%)	7 (28%)	5 (20%)	1 (4%)	6 (24%)
42	0 (0%)	3 (12%)	3 (12%)	5 (20%)	16 (64%)	1 (4%)	17 (68%)
43	0 (0%)	4 (16%)	4 (16%)	4 (16%)	10 (40%)	7 (28%)	17 (68%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
44	0 (0%)	0 (0%)	0 (0%)	2 (8%)	12 (48%)	11 (44%)	23 (92%)
45	0 (0%)	0 (0%)	0 (0%)	2 (8%)	17 (68%)	6 (24%)	23 (92%)
46	0 (0%)	1 (4%)	1 (4%)	5 (20%)	16 (64%)	3 (12%)	19 (76%)
47	0 (0%)	1 (4%)	1 (4%)	5 (20%)	16 (64%)	3 (12%)	19 (76%)
48	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (44%)	14 (56%)	25 (100%)
49	0 (0%)	0 (0%)	0 (0%)	2 (8%)	19 (76%)	4 (16%)	23 (92%)
50	2 (8%)	10(40%)	12(48%)	10 (40%)	2 (8%)	1 (4%)	3 (12%)
51	3(12%)	12(48%)	15(60%)	6 (24%)	3 (12%)	1 (4%)	4 (16%)
52	1 (4%)	6 (24%)	7 (28%)	8 (32%)	7 (28%)	3 (12%)	10 (40%)
53	0 (0%)	0 (0%)	0 (0%)	4 (16%)	16 (64%)	5 (20%)	21 (84%)
54	0 (0%)	1 (4%)	1 (4%)	1 (4%)	18 (72%)	5 (20%)	23 (92%)
55	0 (0%)	3 (12%)	3 (12%)	7 (28%)	12 (48%)	3 (12%)	15 (60%)
56	0 (0%)	6 (24%)	6 (24%)	8 (32%)	7 (28%)	4 (16%)	11 (44%)
57	1 (4%)	3 (12%)	4 (16%)	6 (24%)	13 (52%)	2 (8%)	15 (60%)
58	2 (8%)	6 (24%)	8 (32%)	10 (40%)	7 (28%)	0 (0%)	7 (28%)
59	0 (0%)	2 (8%)	2 (8%)	10 (40%)	13 (52%)	0 (0%)	13 (52%)
60	1 (4%)	2 (8%)	3 (12%)	8 (32%)	14 (56%)	0 (0%)	14 (56%)
61	1 (4%)	6 (24%)	7 (28%)	10 (40%)	7 (28%)	1 (4%)	8 (32%)
62	0 (0%)	9 (36%)	9 (36%)	10 (40%)	6 (24%)	0 (0%)	6 (24%)
63	0 (0%)	1 (4%)	1 (4%)	5 (20%)	17 (68%)	2 (8%)	19 (76%)
64	0 (0%)	7 (28%)	7 (28%)	6 (24%)	11 (44%)	1 (4%)	12 (48%)
65	0 (0%)	1 (4%)	1 (4%)	1 (4%)	16 (64%)	7 (28%)	23 (92%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
66	0 (0%)	1 (4%)	1 (4%)	4 (16%)	16 (64%)	4 (16%)	20 (80%)
67	0 (0%)	0 (0%)	0 (0%)	1 (4%)	14 (56%)	10 (40%)	24 (96%)
68	1 (4%)	0 (0%)	1 (4%)	0 (0%)0	17 (68%)	7 (28%)	24 (96%)
69	0 (0%)	2 (8%)	2 (8%)	2 (8%)	18 (72%)	3 (12%)	21 (84%)
70	0 (0%)	1 (4%)	1 (4%)	0 (0%)	14 (56%)	10 (40%)	24 (96%)
71	0 (0%)	3 (12%)	3 (12%)	3 (12%)	16 (64%)	3 (12%)	19 (76%)
72	0 (0%)	0 (0%)	0 (0%)	8 (32%)	15 (60%)	2 (8%)	17 (68%)
73	0 (0%)	2 (8%)	2 (8%)	6 (24%)	16 (64%)	1 (4%)	17 (68%)
74	0 (0%)	1 (4%)	1 (4%)	5 (20%)	16 (64%)	3 (12%)	19 (76%)
75	0 (0%)	0 (0%)	0 (0%)	1 (4%)	19 (76%)	5 (20%)	24 (96%)
76	0 (0%)	1 (4%)	1 (4%)	5 (20%)	16 (64%)	3 (12%)	19 (76%)
77	0 (0%)	0 (0%)	0 (0%)	1 (4%)	20 (80%)	4 (16%)	24 (96%)
78	0 (0%)	0 (0%)	0 (0%)	4 (16%)	19 (76%)	2 (8%)	21 (84%)
79	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15 (60%)	10 (40%)	25 (100%)
80	0 (0%)	0 (0%)	0 (0%)	1 (4%)	17 (68%)	7 (28%)	24 (96%)
81	1 (4%)	11(44%)	12(48%)	7 (28%)	6 (24%)	0 (0%)	6 (24%)
82	1 (4%)	0 (0%)	1 (4%)	0 (0%)	17 (68%)	7 (28%)	24 (96%)
83	0 (0%)	0 (0%)	0 (0%)	5 (20%)	14 (56%)	6 (24%)	20 (80%)
84	1 (4%)	4 (16%)	5 (20%)	9 (36%)	10 (40%)	1 (4%)	11 (44%)
85	0 (0%)	1 (4%)	1 (4%)	0 (0%)	18 (72%)	6 (24%)	24 (96%)
86	0 (0%)	1 (4%)	1 (4%)	2 (8%)	12 (48%)	10 (40%)	22 (88%)
87	0 (0%)	0 (0%)	0 (0%)	4 (16%)	10 (40%)	11 (44%)	21 (84%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
88	1 (4%)	2 (8%)	3 (12%)	7 (28%)	10 (40%)	5 (20%)	15 (60%)
89	0 (0%)	0 (0%)	0 (0%)	3 (12%)	16 (64%)	6 (24%)	22 (88%)
90	0 (0%)	0 (0%)	0 (0%)	5 (20%)	18 (72%)	2 (8%)	20 (80%)
91	0 (0%)	4 (16%)	4 (16%)	3 (12%)	8 (32%)	10 (40%)	18 (72%)
92	1 (4%)	6 (24%)	7 (28%)	5 (20%)	12 (48%)	1 (4%)	13 (52%)
93	0 (0%)	4 (16%)	4 (16%)	2 (8%)	16 (64%)	3 (12%)	19 (76%)
94	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (72%)	7 (28%)	25 (100%)
95	0 (0%)	0 (0%)	0 (0%)	0 (0%)	16 (64%)	9 (36%)	25 (100%)
96	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (48%)	13 (52%)	25 (100%)
97	0 (0%)	0 (0%)	0 (0%)	2 (8%)	12 (48%)	11 (44%)	23 (92%)
98	0 (0%)	0 (0%)	0 (0%)	2 (8%)	18 (72%)	5 (20%)	23 (92%)
99	0 (0%)	0 (0%)	0 (0%)	1 (4%)	19 (76%)	5 (20%)	24 (96%)
100	0 (0%)	1 (4%)	1 (4%)	7 (28%)	15 (60%)	2 (8%)	17 (68%)
101	0 (0%)	0 (0%)	0 (0%)	2 (8%)	19 (76%)	4 (16%)	23 (92%)
102	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (44%)	14 (56%)	25 (100%)
103	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (72%)	7 (28%)	25 (100%)
104	0 (0%)	1 (4%)	1 (4%)	2 (8%)	18 (72%)	4 (16%)	22 (88%)
105	0 (0%)	1 (4%)	1 (4%)	8 (32%)	13 (52%)	3 (12%)	16 (64%)
106	0 (0%)	2 (8%)	2 (8%)	5 (20%)	16 (64%)	2 (8%)	18 (72%)
107	0 (0%)	0 (0%)	0 (0%)	0 (0%)	17 (68%)	8 (32%)	25 (100%)
108	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15 (60%)	10 (40%)	25 (100%)
109	0 (0%)	0 (0%)	0 (0%)	7 (28%)	16 (64%)	2 (8%)	18 (72%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
110	1 (4%)	5 (20%)	6 (24%)	4 (16%)	14 (56%)	1 (4%)	15 (60%)
111	1 (4%)	0 (0%)	1 (4%)	2 (8%)	17 (68%)	5 (20%)	22 (88%)
112	0 (0%)	1 (4%)	1 (4%)	7 (28%)	12 (48%)	5 (20%)	17 (68%)
113	0 (0%)	0 (0%)	0 (0%)	6 (24%)	16 (64%)	3 (12%)	19 (76%)
114	0 (0%)	0 (0%)	0 (0%)	1 (4%)	19 (76%)	5 (20%)	24 (96%)
115	0 (0%)	0 (0%)	0 (0%)	3 (12%)	16 (64%)	6 (24%)	22 (88%)
116	0 (0%)	0 (0%)	0 (0%)	1 (4%)	17 (68%)	7 (28%)	24 (96%)
117	0 (0%)	4 (16%)	4 (16%)	4 (16%)	16 (64%)	1 (4%)	17 (68%)
118	0 (0%)	1 (4%)	1 (4%)	4 (16%)	17 (68%)	3 (12%)	20 (80%)
119	0 (0%)	1 (4%)	1 (4%)	6 (24%)	15 (60%)	3 (12%)	18 (72%)
120	0 (0%)	1 (4%)	1 (4%)	10 (40%)	13 (52%)	1 (4%)	14 (56%)
121	0 (0%)	1 (4%)	1 (4%)	8 (32%)	15 (60%)	1 (4%)	16 (64%)
122	0 (0%)	0 (0%)	0 (0%)	0 (0%)	21 (84%)	4 (16%)	25 (100%)
123	0 (0%)	0 (0%)	0 (0%)	4 (16%)	17 (68%)	4 (16%)	21 (84%)
124	0 (0%)	1 (4%)	1 (4%)	7 (28%)	14 (56%)	3 (12%)	17 (68%)
125*	0 (0%)	3 (13%)	3 (13%)	6 (25%)	12 (50%)	3 (13%)	15 (63%)
126	0 (0%)	4 (16%)	4 (16%)	4 (16%)	16 (64%)	1 (4%)	17 (68%)
127	1 (4%)	5 (20%)	6 (24%)	11 (44%)	8 (32%)	0 (0%)	8 (32%)
128	0 (0%)	1 (4%)	1 (4%)	2 (8%)	20 (80%)	2 (8%)	22 (88%)
129	0 (0%)	2 (8%)	2 (8%)	8 (32%)	14 (56%)	1 (4%)	15 (60%)
130	1 (4%)	0 (0%)	1 (4%)	3 (12%)	18 (72%)	3 (12%)	21 (84%)
131	1 (4%)	7 (28%)	8 (32%)	8 (32%)	7 (28%)	2 (8%)	9 (36%)

Table 4: Frequency of Responses and Percentage of Group Agreement and Disagreement by Item (continued)

	Disagree				Agree		
Item	SD 1	D 2	SD + D	U 3	A 4	SA 5	A + SA
132	1 (4%)	3 (12%)	4 (16%)	8 (32%)	13 (52%)	0 (0%)	13 (52%)
133	0 (0%)	0 (0%)	0 (0%)	0 (0%)	21 (84%)	4 (16%)	25 (100%)
134	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (48%)	13 (52%)	25 (100%)
135*	0 (0%)	0 (0%)	0 (0%)	2 (8%)	16 (67%)	6 (25%)	22 (92%)
136	0 (0%)	0 (0%)	0 (0%)	2 (8%)	19 (76%)	4 (16%)	23 (92%)
137	1 (4%)	10(40%)	11(44%)	10 (40%)	4 (16%)	0 (0%)	4 (16%)
138	2 (8%)	5 (20%)	7 (28%)	8 (32%)	8 (32%)	2 (8%)	10 (40%)
139	0 (0%)	1 (4%)	1 (4%)	3 (12%)	18 (72%)	3 (12%)	21 (84%)
140*	0 (0%)	0 (0%)	0 (0%)	8 (33%)	14 (58%)	2 (8%)	16 (66%)
141	0 (0%)	0 (0%)	0 (0%)	1 (4%)	20 (80%)	4 (16%)	24 (96%)
142	0 (0%)	2 (8%)	2 (8%)	6 (24%)	16 (64%)	1 (4%)	17 (68%)
143	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (80%)	5 (20%)	25 (100%)
144	0 (0%)	1 (4%)	1 (4%)	7 (28%)	13 (52%)	4 (16%)	17 (68%)
145	0 (0%)	1 (4%)	1 (4%)	3 (12%)	17 (68%)	4 (16%)	21 (84%)
146	0 (0%)	2 (8%)	2 (8%)	16 (64%)	6 (24%)	1 (4%)	7 (28%)
147	0 (0%)	2 (8%)	2 (8%)	5 (20%)	15 (60%)	3 (12%)	18 (72%)

Table 5

Composite Scores and Highest Frequency of Group Agreement

Item	Composite Score	Highest Number in Agreement	Item	Composite Score	Highest Number in Agreement
1	90	17	23	99	22
2	84*	14*	24	103	24
3	88	17	25	93	18
4	94	17	26	100	21
5	110	23	27	104	22
6	114	24	28	114	25
7	118	24	29	103	22
8	99	21	30	87*	14*
9	108	23	31	76*	7*
10	113	25	32	107	23
11	93	18	33	85*	13*
12	121	25	34	109	25
13	107	23	35	86*	16
14	118	25	36	84*	15
15	103	20	37	110	24
16	101	20	38	98	19
17	93	16	39	105	23
18	78*	6*	40	102	21
19	84*	15	41	69*	12*
20	69*	11*	42	90	17
21	77*	9*	43	95	17
22	83*	10*	44	109	23

Table 5: Composite Scores and Highest Frequency of Group Agreement (continued)

Item	Composite Score	Highest Number in Agreement	Item	Composite Score	Highest Number in Agreement
45	104	23	68	104	24
46	96	19	69	97	21
47	96	19	70	108	24
48	114	25	71	94	19
49	102	23	72	94	17
50	65*	12*	73	91	17
51	62	15	74	96	19
52	80*	10*	75	104	24
53	101	21	76	96	19
54	102	23	77	103	24
55	90	15	78	98	21
56	84*	11*	79	110	25
57	87*	15	80	106	24
58	72*	8*	81	68*	12*
59	86*	13*	82	104	24
60	85*	14*	83	101	20
61	76*	8*	84	81*	11*
62	72*	9*	85	104	24
63	95	19	86	106	22
64	81*	12*	87	107	21
65	104	23	88	91	15
66	98	20	89	103	22
67	109	24	90	97	20

Table 5: Composite Scores and Highest Frequency of Group Agreement (continued)

Item	Composite Score	Highest Number in Agreement	Item	Composite Score	Highest Number in Agreement
91	99	18	114	104	24
92	81*	13*	115	103	22
93	93	19	116	106	24
94	107	25	117	89	17
95	109	25	118	97	20
96	113	25	119	95	18
97	109	23	120	89	14*
98	103	23	121	91	16
99	104	24	122	104	25
100	93	17	123	100	21
101	102	23	124	94	17
102	114	25	125	87*	15
103	107	25	126	89	17
104	100	22	127	76*	8*
105	93	16	128	98	22
106	93	18	129	89	15
107	108	25	130	97	21
108	110	25	131	77*	9*
109	95	18	132	83*	13*
110	84*	15	133	104	25
111	100	22	134	113	25
112	96	17	135	100	22
113	97	19	136	102	23

Table 5: Composite Scores and Highest Frequency of Group Agreement (continued)

Item	Composite Score	Highest Number in Agreement	Item	Composite Score	Highest Number in Agreement
137	67*	11*	143	105	25
138	78*	10*	144	95	17
139	98	21	145	99	21
140	90	16	146	81*	7*
141	103	24	147	94	18
142	91	17			

* Indicates criteria for consensus were not met.

and (2) the composite score was greater than 87.5 (70% of 125) or less than 62.5 (50% of 125). In other words, the composite scores had to be in either the agreement or disagreement range.

The two required conditions indicating consensus were met on 114 of the 147 items (78%) with 113 items scoring in the agreement range and one item scoring in the disagreement range. This one item concerned pesticide and fertilizer applications being available only on a contractual basis and performed by individuals licensed by the federal government (#51). Thus, thirty-three items (23%) failed to meet the required criteria for consensus. However, three of those items, #57, #110, and #125 were closely approaching consensus but did not meet the criteria with the composite score only. Turfgrass management companies will offer the golf course superintendent additional opportunities to grow in professionalism (#57, composite score of 87). Turfgrass managers will be required to have fertilizer and pesticide application programs approved before they can be implemented (#110, composite score of 84). And, low-input, sustainable turfgrass management will be the key (#125, composite score of 87).

Two items had 15 or more respondents that marked choice number 3 (Undecided) on the survey instrument. These items were #18: Laser mowing will become an integral part of improved technology, and #146: Laser and other cutting methods will remain too expensive and produce unsatisfactory cutting units.

Table 6 reports the means and standard deviations by item for round two and round three. The standard deviation decreased in 87 (59%) of the 147 items from round two to round three. Twenty-six items (18%) showed no change in the standard deviation from round two to round three. Thirty-four items (23%) had an increase in the standard deviation from round two to round three. In two cases, items 6 and 122, the change was

Table 6

Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
1	25	3.52	1.160	3.60	1.041	-0.119
2	25	3.20	1.259	3.36	1.221	-0.038
3	25	3.52	1.046	3.52	0.919	-0.127
4	25	3.60	1.155	3.76	1.052	-0.103
5	25	4.40	0.817	4.40	0.764	-0.049
6	25	4.48	0.823	4.56	0.584	-0.239*
7	25	4.76	0.436	4.72	0.542	0.106
8	25	4.04	0.841	3.96	0.935	0.094
9	25	4.36	0.638	4.32	0.628	-0.010
10	25	4.44	0.507	4.52	0.510	0.003
11	25	3.72	0.843	3.72	0.843	0
12	25	4.84	0.375	4.84	0.375	0
13	25	4.24	0.724	4.28	0.738	0.014
14	25	4.64	0.490	4.72	0.459	-0.031
15	25	4.08	0.954	4.12	0.928	-0.026
16	25	4.04	0.735	4.04	0.790	0.055
17	25	3.56	0.961	3.72	0.891	-0.070
18	25	3.12	0.600	3.12	0.600	0
19	25	3.40	0.958	3.36	0.908	-0.050
20	25	2.88	1.093	2.76	1.091	-0.002
21	25	3.00	1.041	3.08	1.038	-0.003
22	25	3.28	0.792	3.32	0.749	-0.043

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
23	25	3.96	0.612	3.96	0.612	0
24	25	4.08	0.400	4.12	0.440	0.040
25	25	3.80	1.000	3.72	0.937	-0.063
26	25	3.96	0.790	4.00	0.708	-0.082
27	25	4.24	0.779	4.16	0.747	-0.032
28	25	4.52	0.510	4.56	0.507	-0.003
29	25	4.04	0.735	4.12	0.726	-0.009
30	25	3.36	1.037	3.48	1.085	0.048
31	25	3.16	0.899	3.04	0.889	-0.010
32	25	4.32	0.557	4.28	0.614	0.057
33	25	3.36	1.288	3.40	1.119	-0.169
34	25	4.32	0.477	4.36	0.490	0.013
35	25	3.44	1.228	3.44	1.045	-0.183
36	25	3.44	1.084	3.36	0.908	-0.176
37	25	4.32	0.628	4.40	0.578	-0.050
38	24	3.96	0.807	3.92	0.881	0.074
39	23	4.35	0.648	4.35	0.573	-0.075
40	25	4.12	0.882	4.08	0.863	-0.019
41	24	2.79	1.063	2.71	0.955	-0.108
42	25	3.68	0.691	3.60	0.764	0.073
43	25	3.80	1.000	3.80	1.041	0.041
44	25	4.32	0.803	4.36	0.638	-0.165
45	25	4.20	0.578	4.16	0.554	-0.024

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
46	25	3.84	0.800	3.84	0.688	-0.112
47	25	3.88	0.726	3.84	0.688	-0.038
48	25	4.52	0.586	4.56	0.507	-0.079
49	25	4.08	0.494	4.08	0.494	0
50	25	2.64	0.861	2.60	0.913	0.052
51	25	2.52	0.963	2.48	1.005	0.042
52	25	3.20	1.081	3.20	1.081	0
53	25	4.00	0.708	4.04	0.612	-0.096
54	25	4.08	0.703	4.08	0.641	-0.062
55	25	3.64	0.908	3.60	0.867	-0.041
56	25	3.32	0.989	3.36	1.037	0.048
57	25	3.48	1.046	3.48	0.963	-0.083
58	25	2.88	0.928	2.88	0.928	0
59	25	3.40	0.708	3.44	0.651	-0.057
60	25	3.40	0.867	3.40	0.817	-0.050
61	25	3.12	0.972	3.04	0.935	-0.037
62	24	2.92	0.830	2.88	0.798	-0.032
63	25	3.76	0.664	3.80	0.646	-0.018
64	25	3.20	0.958	3.24	0.926	-0.032
65	25	4.04	0.790	4.16	0.688	-0.102
66	25	3.88	0.782	3.92	0.703	-0.079
67	25	4.36	0.569	4.36	0.569	0
68	25	4.16	0.851	4.16	0.800	-0.051

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
69	25	3.88	0.726	3.88	0.726	0
70	25	4.36	0.700	4.32	0.691	-0.009
71	25	3.72	0.891	3.76	0.831	-0.060
72	25	3.76	0.598	3.76	0.598	0
73	25	3.60	0.764	3.64	0.700	-0.064
74	25	3.84	0.688	3.84	0.688	0
75	25	4.16	0.473	4.16	0.473	0
76	25	3.76	0.779	3.84	0.688	-0.091
77	25	4.12	0.440	4.12	0.440	0
78	25	3.88	0.526	3.92	0.494	-0.032
79	24	4.38	0.495	4.42	0.504	0.009
80	25	4.32	0.477	4.64	0.523	0.046
81	25	2.80	0.867	2.72	0.891	0.024
82	25	4.16	0.625	4.16	0.800	0.175
83	25	4.00	0.764	4.04	0.676	-0.088
84	25	3.16	0.899	3.24	0.926	0.027
85	25	4.16	0.625	4.16	0.625	0
86	25	4.08	0.997	4.24	0.779	-0.218
87	24	4.33	0.702	4.33	0.702	0
88	25	3.68	1.070	3.64	1.037	-0.033
89	25	4.12	0.600	4.12	0.600	0
90	25	3.88	0.526	3.88	0.526	0
91	25	4.00	1.081	3.96	1.099	0.018

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
92	25	3.20	1.000	3.24	1.012	0.012
93	25	3.68	0.900	3.72	0.891	-0.009
94	25	4.28	0.459	4.28	0.459	0
95	25	4.36	0.490	4.36	0.490	0
96	25	4.56	0.507	4.52	0.510	0.003
97	25	4.32	0.691	4.36	0.638	-0.053
98	25	4.12	0.600	4.12	0.526	-0.074
99	25	4.08	0.641	4.16	0.473	-0.168
100	25	3.68	0.803	3.72	0.679	-0.124
101	25	4.12	0.526	4.08	0.494	-0.032
102	25	4.52	0.510	4.56	0.507	-0.003
103	24	4.17	0.565	4.25	0.443	-0.122
104	25	3.80	0.708	4.00	0.646	-0.062
105	25	3.76	0.779	3.72	0.738	-0.041
106	25	3.80	0.646	3.72	0.738	0.092
107	25	4.32	0.477	4.32	0.477	0
108	25	4.36	0.490	4.40	0.500	0.010
109	25	3.80	0.578	3.80	0.578	0
110	25	3.56	0.961	3.36	0.995	0.034
111	25	4.00	0.817	4.00	0.817	0
112	25	3.76	0.880	3.84	0.800	-0.080
113	25	3.84	0.625	3.88	0.600	-0.025
114	25	4.20	0.500	4.16	0.473	-0.027

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
115	25	4.00	0.764	4.12	0.600	-0.164
116	25	4.20	0.500	4.24	0.523	0.023
117	25	3.56	0.870	3.56	0.821	-0.049
118	25	3.84	0.688	3.88	0.666	-0.022
119	25	3.80	0.708	3.80	0.708	0
120	25	3.56	0.769	3.56	0.651	-0.118
121	25	3.56	0.712	3.64	0.638	-0.074
122	25	4.08	0.572	4.16	0.375	-0.197*
123	25	3.92	0.641	4.00	0.578	-0.063
124	25	3.80	0.764	3.76	0.724	-0.040
125	24	3.50	0.979	3.625	0.876	-0.103
126	25	3.52	0.872	3.56	0.821	-0.051
127	25	3.00	0.913	3.04	0.841	-0.072
128	25	3.88	0.600	3.92	0.572	-0.028
129	25	3.52	0.823	3.56	0.712	-0.111
130	25	3.72	0.891	3.88	0.782	-0.109
131	25	3.04	1.099	3.08	1.038	-0.061
132	25	3.36	0.811	3.32	0.853	0.042
133	25	4.12	0.332	4.16	0.375	0.043
134	25	4.48	0.510	4.52	0.510	0
135	24	4.17	0.565	4.167	0.565	0
136	25	4.12	0.526	4.08	0.494	-0.032
137	25	2.72	0.843	2.68	0.803	-0.040

Table 6: Means and Standard Deviations for Rounds 2 and 3 and the Difference in Standard Deviation by Item (continued)

		Round 2		Round 3		
Item	N	Mean	SD	Mean	SD	R3 - R2
138	25	3.04	0.935	3.12	1.093	0.158
139	25	3.88	0.726	3.92	0.641	-0.085
140	24	3.75	0.608	3.75	0.608	0
141	25	4.16	0.473	4.12	0.440	-0.033
142	25	3.52	0.823	3.64	0.700	-0.123
143	25	4.16	0.375	4.20	0.409	0.034
144	25	3.72	0.738	3.80	0.764	0.026
145	25	3.96	0.612	3.96	0.676	0.064
146	25	3.16	0.688	3.24	0.664	-0.024
147	25	3.76	0.779	3.76	0.779	0

* Denotes a significant ($P<0.05$) change in the standard deviation using the formula

$$F_{(24,24)} = \frac{(\text{Maximum standard deviation})^2}{\text{Minimum standard deviation}}$$

significant. The standard deviations were a measure of variability in the scores. The smaller standard deviations as reported on round three indicated decreasing variance.

Table 7 reports the Pearson product-moment correlation coefficients for round two and three responses by item. The responses were found to be very stable from round two to round three in 145 (99%) of the items as indicated by the Pearson product-moment correlation coefficient procedure (Cohen, 1988). This indicates that there was little value in a fourth round of the Delphi technique in this study. The procedure indicated stability in the data.

Table 8 reports that the Wilcoxon matched-pairs signed-ranks test was performed on each item of the 147 items. In the case of this statistical procedure, the lesser of the signed ranks of scores was used for this calculation. The p value was based on the probability of getting zero difference in the matched pairs score, signifying no change in answers from round two to round three. Twenty-seven items (18%) had a p value of 1.0000 indicating that there was no change in answers from round two to round three. In analyzing Table 7, p values less than .05 indicate significance. In this study no items were found to be significant at the .05 level. None of the 147 items changed significantly from round 2 to round 3. This statistical procedure also indicated stability in the data.

Summary

The major portion of Chapter IV reflects the findings and data collected from a panel of 25 experts in the turfgrass industry, utilizing three rounds of the Delphi technique. The panel of experts was selected by a nationwide nomination process utilizing nominations from turfgrass specialists at all land grant institutions (teaching, research, and extension), college and technical schools (teaching and demonstration), state turfgrass commodity commissions, and related professional associations. All

Table 7

Pearson Product-Moment Correlation Coefficients for Round 2 and Round 3 Responses by Item

Item	N	r	p	Item	N	r	p
1	25	0.87039	0.0001	24	25	0.89077	0.0001
2	25	0.90063	0.0001	25	25	0.96123	0.0001
3	25	0.70469	0.0001	26	25	0.97026	0.0001
4	25	0.70661	0.0001	27	25	0.86326	0.0001
5	25	0.86860	0.0001	28	25	0.76131	0.0001
6	25	0.80614	0.0001	29	25	0.92820	0.0001
7	25	0.93895	0.0001	30	25	0.91504	0.0001
8	25	0.95681	0.0001	31	25	0.87896	0.0001
9	25	0.95013	0.0001	32	25	0.82428	0.0001
10	25	0.69034	0.0001	33	25	0.93813	0.0001
11	25	0.88263	0.0001	34	25	0.73601	0.0001
12	25	0.70238	0.0001	35	25	0.88307	0.0001
13	25	0.96267	0.0001	36	25	0.84955	0.0001
14	25	0.64588	0.0005	37	25	0.89756	0.0001
15	25	0.93069	0.0001	38	24	0.91330	0.0001
16	25	0.93076	0.0001	39	23	0.88488	0.0001
17	25	0.77504	0.0001	40	25	0.91908	0.0001
18	25	0.88426	0.0001	41	24	0.96643	0.0001
19	25	0.93046	0.0001	42	25	0.85339	0.0001
20	25	0.93585	0.0001	43	25	0.96077	0.0001
21	25	0.92593	0.0001	44	25	0.82439	0.0001
22	25	0.96782	0.0001	45	25	0.93831	0.0001
23	25	1.00000	0.0001	46	25	0.93569	0.0001

Table 7: Pearson Product-Moment Correlation Coefficients for Round 2 and Round 3 Responses by Item (continued)

Item	N	r	p	Item	N	r	p
47	25	0.96137	0.0001	71	25	0.91909	0.0001
48	25	0.94323	0.0001	72	25	1.00000	0.0001
49	25	1.00000	0.0001	73	25	0.88846	0.0001
50	25	0.92324	0.0001	74	25	1.00000	0.0001
51	25	0.93718	0.0001	75	25	1.00000	0.0001
52	25	1.00000	0.0001	76	25	0.85842	0.0001
53	25	0.96440	0.0001	77	25	1.00000	0.0001
54	25	0.91164	0.0001	78	25	0.92498	0.0001
55	25	0.86959	0.0001	79	24	0.91652	0.0001
56	25	0.98158	0.0001	80	25	0.85038	0.0001
57	25	0.96203	0.0001	81	25	0.95070	0.0001
58	25	1.00000	0.0001	82	25	0.94742	0.0001
59	25	0.95999	0.0001	83	25	0.96875	0.0001
60	25	0.70711	0.0001	84	25	0.90422	0.0001
61	25	0.95851	0.0001	85	25	1.00000	0.0001
62	24	0.96930	0.0001	86	25	0.83302	0.0001
63	25	0.95366	0.0001	87	24	1.00000	0.0001
64	25	0.97800	0.0001	88	25	0.98244	0.0001
65	25	0.83152	0.0001	89	25	1.00000	0.0001
66	25	0.96918	0.0001	90	25	1.00000	0.0001
67	25	1.00000	0.0001	91	25	0.94817	0.0001
68	25	0.94063	0.0001	92	25	0.93911	0.0001
69	25	1.00000	0.0001	93	25	0.97510	0.0001
70	25	0.95871	0.0001	94	25	0.80159	0.0001

Table 7: Pearson Product-Moment Correlation Coefficients for Round 2 and Round 3 Responses by Item (continued)

Item	N	r	p	Item	N	r	p
95	25	0.82639	0.0001	119	25	1.00000	0.0001
96	25	0.92260	0.0001	120	25	0.93043	0.0001
97	25	0.86309	0.0001	121	25	0.82981	0.0001
98	25	0.87665	0.0001	122	25	0.71700	0.0001
99	25	0.78211	0.0001	123	25	0.90167	0.0001
100	25	0.90074	0.0001	124	25	0.96528	0.0001
101	25	0.92498	0.0001	125	24	0.93950	0.0001
102	25	0.92260	0.0001	126	25	0.97387	0.0001
103	24	0.87039	0.0001	127	25	0.92304	0.0001
104	25	0.73030	0.0001	128	25	0.94286	0.0001
105	25	0.89411	0.0001	129	25	0.90516	0.0001
106	25	0.92825	0.0001	130	25	0.84812	0.0001
107	25	1.00000	0.0001	131	25	0.87441	0.0001
108	25	0.91856	0.0001	132	25	0.97233	0.0001
109	25	1.00000	0.0001	133	25	0.84611	0.0001
110	25	0.86987	0.0001	134	25	0.92308	0.0001
111	25	0.93750	0.0001	135	24	1.00000	0.0001
112	25	0.89077	0.0001	136	25	0.92498	0.0001
113	25	0.94742	0.0001	137	25	0.97162	0.0001
114	25	0.91695	0.0001	138	25	0.93384	0.0001
115	25	0.81832	0.0001	139	25	0.96481	0.0001
116	25	0.92449	0.0001	140	24	1.00000	0.0001
117	25	0.94333	0.0001	141	25	0.90635	0.0001
118	25	0.95688	0.0001	142	25	0.91753	0.0001

Table 7: Pearson Product-Moment Correlation Coefficients for Round 2 and Round 3 Responses by Item (continued)

143	25	0.60010	0.0015	146	25	0.91667	0.0001
144	25	0.93254	0.0001	147	25	1.00000	0.0001
145	25	0.90417	0.0001				

Table 8

Wilcoxon Matched-Pairs Signed-Ranks Test for Round 2 and Round 3 Responses by Item

Item	N	z	2-Tailed p	Item	N	z	2-Tailed p
1	25	-0.1375	0.8907	24	25	-0.3341	0.7383
2	25	-0.4524	0.6510	25	25	0.3692	0.7120
3	25	0.0652	0.9480	26	25	-0.0341	0.9728
4	25	-0.4570	0.6477	27	25	0.4628	0.6435
5	25	0.1196	0.9048	28	25	-0.2697	0.7874
6	25	0.0226	0.9819	29	25	-0.4213	0.6735
7	25	0.0654	0.9479	30	25	-0.3790	0.7047
8	25	0.2406	0.8099	31	25	0.5393	0.5897
9	25	0.2385	0.8115	32	25	0.1671	0.8673
10	25	-0.5492	0.5828	33	25	-0.0602	0.9520
11	25	0.0000	1.0000	34	25	-0.2837	0.7766
12	25	0.0000	1.0000	35	25	0.1454	0.8844
13	25	-0.2405	0.8100	36	25	0.3725	0.7095
14	25	-0.5882	0.5564	37	25	-0.4050	0.6855
15	25	-0.1242	0.9011	38	24	0.0558	0.9555
16	25	-0.0216	0.9827	39	23	0.0866	0.9310
17	25	-0.5336	0.5936	40	25	0.2123	0.8318
18	25	0.0000	1.0000	41	24	0.1649	0.8690
19	25	0.1525	0.8788	42	25	0.3238	0.7461
20	25	0.3221	0.7474	43	25	-0.0206	0.9836
21	25	-0.3196	0.7493	44	25	0.0644	0.9487
22	25	-0.1470	0.8831	45	25	0.2561	0.7979
23	25	0.0000	1.0000	46	25	0.1341	0.8933

Table 8: Wilcoxon Matched-Pairs Signed-Ranks Test
for Round 2 and Round 3 Responses by Item (continued)

Item	N	z	2-Tailed p	Item	N	z	2-Tailed p
47	25	0.2015	0.8403	71	25	-0.1956	0.8449
48	25	-0.1120	0.9108	72	25	0.0000	1.0000
49	25	0.0000	1.0000	73	25	-0.2851	0.7755
50	25	0.2897	0.7720	74	25	0.0000	1.0000
51	25	0.2271	0.8204	75	25	0.0000	1.0000
52	25	0.0000	1.0000	76	25	-0.2909	0.7712
53	25	-0.0341	0.9728	77	25	0.0000	1.0000
54	25	0.0354	0.9717	78	25	-0.2782	0.7809
55	25	0.1451	0.8847	79	24	-0.2799	0.7796
56	25	-0.1009	0.9196	80	25	0.4900	0.6241
57	25	0.0523	0.9582	81	25	0.3600	0.7189
58	25	0.0000	1.0000	82	25	-0.2669	0.7896
59	25	-0.1190	0.9053	83	25	-0.0433	0.9655
60	25	0.1207	0.9040	84	25	-0.2377	0.8121
61	25	0.3362	0.7367	85	25	0.0000	1.0000
62	24	0.1536	0.8779	86	25	-0.3472	0.7284
63	25	-0.2432	0.8078	87	24	0.0000	1.0000
64	25	-0.1243	0.9011	88	25	0.1244	0.8869
65	25	-0.4687	0.6393	89	25	0.0000	1.0000
66	25	-0.0454	0.9638	90	25	0.0000	1.0000
67	25	0.0000	1.0000	91	25	0.1027	0.9182
68	25	0.0690	0.9450	92	25	-0.0636	0.9493
69	25	0.0000	1.0000	93	25	-0.1898	0.8495
70	25	.2545	0.7991	94	25	0.0000	1.0000

Table 8: Wilcoxon Matched-Pairs Signed-Ranks Test
for Round 2 and Round 3 Responses by Item (continued)

Item	N	z	2-Tailed p	Item	N	z	2-Tailed p
95	25	0.0000	1.0000	119	25	0.0000	1.0000
96	25	0.2697	0.7874	120	25	0.0214	0.9829
97	25	-0.1395	0.8890	121	25	-0.3423	0.7322
98	25	0.2153	0.8296	122	25	-0.2910	0.7711
99	25	-0.2533	0.8001	123	25	-0.4668	0.6406
100	25	-0.1300	0.8965	124	25	0.1716	0.8637
101	25	0.2782	0.7809	125	24	-0.3865	0.6991
102	25	-0.2697	0.7874	126	25	-0.0795	0.9366
103	24	-0.4549	0.6492	127	25	-0.1232	0.9019
104	25	-1.0561	0.2909	128	25	-0.2814	0.7784
105	25	0.1528	0.8738	129	25	-0.1708	0.8644
106	25	0.3122	0.7549	130	25	-0.7500	0.4532
107	25	0.0000	1.0000	131	25	-0.0101	0.9919
108	25	-0.2769	0.7819	132	25	0.1072	0.9146
109	25	0.0000	1.0000	133	25	-0.3873	0.6985
110	25	0.6601	0.5092	134	25	-0.2688	0.7881
111	25	0.0000	1.0000	135	24	0.0000	1.0000
112	25	-0.2700	0.7872	136	25	0.2782	0.7809
113	25	-0.2362	0.8131	137	25	0.1348	0.8928
114	25	0.2919	0.7704	138	25	-0.2539	0.7996
115	25	-0.4429	0.6578	139	25	-0.0368	0.9706
116	25	-0.2790	0.7802	140	24	0.0000	1.0000
117	25	-0.0221	0.9824	141	25	0.3095	0.7569
118	25	-0.2311	0.8173	142	25	-0.4146	0.6784

Table 8: Wilcoxon Matched-Pairs Signed-Ranks Test
for Round 2 and Round 3 Responses by Item (continued)

143	25	-0.3498	0.7265	146	25	-0.4439	0.6571
144	25	-0.3834	0.7014	147	25	0.0000	1.0000
145	25	0.0000	1.0000				

members of the panel of experts were male, and 24 (96%) Caucasian and one (4%) mixed race. They were well-educated with 4 having bachelor's degrees, 6 having master's degrees, and 20 having doctoral degrees. The group had a total of 806 years experience, a mean of 32.2 years in turfgrass. Respondents ranged from 44 to 83 years of age, a mean of 57.6 years. All of the participants had high-level positions in turfgrass. The nomination process was without bias to women or minorities. One woman was invited to participate from the original thirty-eight invitations but declined. The presence of women in this male-dominated field has been expanding in recent years.

A composite score was calculated on round three data for each item and was used to rank the items in order of agreement (Table 1, p. 66). The highest-ranked items dealt with the need for computer applications, more sophisticated maintenance equipment, more "on-line" training, environmental issues, contract services, new and better turfgrass cultivars, more education and certification, effective communication and people management skills, expanded "treated water" use programs, integrated pest management, and best management practices. The items ranked lowest were concerned with governmental licensing for chemical application, contractual management services, "on-site" research laboratories, equipment licensing, subsurface irrigation and aeration, longevity of new cultivars, seed and sod production licensing, "on-site" soil and plant analyses, government mandates, laser mowing, and grants for research.

The standard deviations (Table 6, p. 101) indicated that the group answers were moving toward consensus. As measured by standard deviations, 59% of the items moved toward the mean. Stability of the responses from round two to round three was measured using the Pearson product-moment correlation coefficients (Table 7, p. 109) and the Wilcoxon matched-pairs signed-ranks test (Table 8, p. 113). Responses were found to be very stable (not significantly changed) in 145 (99%) of the items as measured by the

Pearson product-moment correlations and in 147 (100%) of the items as measured with the Wilcoxon matched-pairs signed-ranks test.

The medians and interquartile ranges for all items on round two and three and the change in interquartile ranges from round two to round three are listed in Appendix P. Appendix Q shows the statistics for all the responses received, whereas earlier tables represented matched responses. Appendix R identifies precisely the expert name, affiliation, city, and state as members of the Delphi panel. Also, comments from rounds one, two and three are listed in Appendices G, N and O, respectively. Respondents made 512 comments in round one, 140 in round two, and 20 in round three.