

# Four-Year Turfgrass Management Programs in the United States: I. Structure, Requirements, Needs, and Future Outlook

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## ABSTRACT

Although many agronomy, horticulture, and related plant biology departments at 4-yr institutions offer specialized programs in turfgrass management, little comparative information is available on these programs. A survey of 32 land-grant institutions was conducted to determine structure, course requirements, needs, and future directions of 4-yr turfgrass management programs in the USA. Overall response was 100%. The greatest concentration of courses normally taken by turf students was in the applied sciences including entomology, plant pathology, soils, and weed science. Respondents indicated that 97% of students took inorganic and 88% organic chemistry. Although the lack of business skills was considered the primary deficiency of graduating students, business-related courses were taken less frequently than courses in math, basic science, and applied science. Lack of funding, teaching faculty, and support staff were considered the greatest limiting factors to success of turfgrass teaching programs. The greatest challenge facing turfgrass education over the next decade was believed to be attracting sufficient numbers of qualified students. Seventy-seven percent of respondents indicated that their efforts in teaching did not receive as much consideration as comparable efforts in research and extension in terms of tenure, promotion, and salary adjustments.

**T**URFGRASS is a multibillion dollar industry in the USA and is showing continual growth. There are currently more than 14 000 golf courses in the USA. To keep pace with the predicted growth and popularity of the sport, a new golf course will have to open every day for the next 20 yr (Nat. Golf Found., 1990).

The number of career opportunities continues to increase along with industry growth. A nationwide survey in 1988 showed that the number of job openings per graduating 4-yr turf management student ranged from about 4 to 7 or more, depending on the region of the country (Dudeck and Peacock, 1991). In addition to the current lack of turf graduates, 87% of respondents to that

survey indicated that future graduation rates would not be adequate to meet industry needs.

This high job-to-student ratio is reflected in increased enrollment of students in turfgrass management in various agronomy, horticulture, or plant/crop related departments throughout the USA. In some cases, students enrolled in turfgrass science are a significant percentage of the total in these departments. The percentage of agronomy majors specializing in turfgrass management was 50% at the University of Georgia, 70% at Pennsylvania State University, 50% at Michigan State University, and 55% at Ohio State University, respectively (1993, personal communication with, David Kissel, GA; Tom Watschke, PA; Dave Krauss, MI; and Karl Danneberger, OH). This situation is projected to continue for the next several years. For example, in the survey conducted by Dudeck and Peacock (1991), 93% of the 4-yr program respondents predicted an increase or no change in enrollment through 1993, whereas 7% predicted a decrease.

With the above facts in mind, it is important to consider the type of education experienced by the typical 4-yr turfgrass management student. Although Peacock and Dudeck (1991) surveyed both 2-yr and 4-yr turfgrass teaching programs in terms of teaching methods, organization, and topical content, detailed information concerning program structure, requirements, and outlook of the instructors was not provided. It would be desirable to know how turfgrass instructors at various universities view their current program as well as what they perceive as the greatest turfgrass educational needs of the future.

A survey was conducted of those land-grant institutions that offered a specialized 4-yr program of study in turfgrass management. Various questionnaires and surveys have been used effectively for obtaining information on course content and organization (Karnok and Connors, 1986; Connors and Karnok, 1986), student perceptions, and student qualifications (Murdock and Franklin, 1989; Schmitt, 1988), and a future program outlook and needs of crop science program and courses (Von Saal et al., 1988). Our objective was to gather basic information regarding: number of students, core curriculum requirements, number and type of turf courses offered, internship requirements, student recruitment, and teacher attitudes and perceptions. The survey also included questions concerning the first turfgrass science course for students who specialized in turfgrass management. Re-

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Table 1. Universities participating in a survey of 4-yr turfgrass management programs in the USA.

North Central Region	<u>Northeastern Region</u>
Purdue University + +	University of Maryland + +
University of Illinois + +	University of Massachusetts + +
Iowa State University + +	University of Rhode Island 4- 4-
Michigan State University +	Cornell University + +
University of Minnesota +	Pennsylvania State University + +
Kansas State University + +	Rutgers—Cook College +
University of Wisconsin + +	<u>Western Region</u>
University of Nebraska- + +	University of California, Riverside + +
University of Missouri + +	Oregon State University +
Ohio State University +	New Mexico State University 4- 4-
	University of Arizona + 4-
Southern Region	
Mississippi State University + +	
Clemson University +	
University of Florida + +	
Virginia Tech & State University + +	
Texas A&M University + +	
North Carolina State University + +	
University of Georgia +	
University of Tennessee + +	
University of Arkansas at Fayetteville + +	
Auburn University +	
University of Kentucky + 4-	
Oklahoma State University + +	

+ Quarter system, + + semester system.

Responses to these questions will be discussed in a companion paper.

## METHODS

To obtain information on 4-yr turfgrass management teaching programs in the USA, a questionnaire was sent to 32 land-grant institutions currently having an active 4-yr turfgrass management teaching program (Table 1). The questionnaire had 44 questions that were divided into two specific areas: (i) overall structure and requirements of the turf program, and (ii) format, teaching methods, and topical content of the lecture and laboratory of the first turf management course taken by students who specialized in turfgrass management. In addition, several questions pertained to attitude and perception of the primary turf instructor (respondent) regarding factors that limited their teaching programs and the greatest challenges facing turfgrass education over the next decade. Responses concerning overall structure and requirements of turf programs as well as attitudes and perceptions of the primary turf educator in these programs are discussed in this article. Remaining aspects of the questionnaire are discussed in a subsequent companion paper.

## RESULTS AND DISCUSSION

Response to the questionnaire was 100%. Responses indicated that 78% of the institutions surveyed were on a semester system, whereas 22% operated under a quarter system (Table 2). Forty-one percent of the turfgrass teaching programs were in agronomy and 34% were in horticulture. The rest were administered in crop or plant science departments. A wide range (0.4-7.5) of full-time equivalent (FTE) faculty were involved in turfgrass teaching, research, and extension at the different institutions.

Table 2. Questions and responses pertaining to structure and requirements of 4-yr turf programs in the USA.

a. What department houses the turf program at your institution?	Teaching	Research	Extension
Agronomy	41	41	34
Horticulture	34	31	41
Plant science	9	9	9
Other	16	19	16
Approximately how many faculty are there in turfgrass teaching, research, and extension at your institution (quickly approximate full-time equivalents)?	Full-time equivalents		
	Mean	Range	
	3.1	0.4-7.5	
Does your institution offer a 2-yr or certificate turfgrass management program?	Yes	No	
	19	81	
d. How many "turf majors" does your 4-yr turf program currently have?	<u>No. of turf majors</u>		
	Mean	Range	
	17	0-45	
e. What percent of the students majoring or specializing in turf are females?	Mean	Range	
	—————%—————		
	7	0-50	
f. The percentage of female turf students is			
	Increasing	15	
	Decreasing	15	
	Constant from year to year	70	
g. What does your department offer in terms of undergraduate clubs?	%		
	Turf Club	34	
	Agronomy Club	53	
	Horticulture Club	47	
	Other	16	
h. Are internships required of students specializing in turf?	Yes	41	
	No	59	
Approximately what percent of the students graduating from your turf program complete an internship?	Mean	66	
	Range	0-100	
Approximately what percent of the students in the turf program have turf work experience before graduation?	Mean	Mode	Range
	90	100	0-100

The mean FTE was 3.1. Nineteen percent indicated that their institution also offered a 2-yr or certificate turfgrass management program.

Average number of "turf majors" was 17; the range extended from 0 to 45. The mean percentage of females

**Table 3. Courses that are normally taken by students in 4-yr turf programs at 32 universities in the USA.**

Course	Response	
	Quarter	Semester
	Academic calendar	
	<u>Applied science</u>	
Basic entomology	86	96
basic plant pathology	86	92
Basic soils	100	100
Ecology	43	21
Landscape contracting	0	33
Ornamental plant systematics	71	88
Soil fertility	71	79
Weed science	100	100
	<u>Math and Science</u>	
Biochemistry	29	21
Calculus	29	25
College algebra	86	92
Genetics	57	54
Inorganic chemistry	100	100
Organic chemistry	100	88
Plant anatomy	0	13
Plant physiology	71	67
Physics	71	54
Trigonometry	71	58
	<u>Business</u>	
Accounting	57	67
Business law	29	33
Computers	100	79
Economics	86	88
Personnel management	29	63

majoring or specializing in turfgrass management was relatively low at 7%. Most (70%) respondents indicated that enrollment of female students in turfgrass management was constant; however, 15% believed the number was increasing, whereas 15% thought the number was decreasing. All departments offered some sort of undergraduate club; 34% indicated a specific club for turfgrass majors.

Only 59% of the universities required internships of students specializing in turfgrass management, but 66% of the undergraduate turf students completed an internship before graduation. Although not a formal internship, almost all (90% mean, 100% mode) of their turf students obtained some turf work experience prior to graduation.

Respondents indicated from a list provided, courses normally taken by students in their turf program (Table 3). Of the applied sciences, basic entomology, plant pathology, soils, and weed science were most often included. In terms of mathematics, most students took college algebra. All respondents indicated that their students took inorganic chemistry. Of the nonscience and math courses, 86% on the quarter system and 88% of the semester system indicated their students took a course in economics. Overall, the business-related courses were least often taken by turf majors.

The survey asked the question, "Upon graduation, what do you think is the greatest weakness of your turf students?" Thirty-four and 33% indicated business skills and personal management, respectively (Table 4). Those areas were followed by turf work experience (30%) and communication skills (17%). Thirteen percent indicated math was the greatest weakness of their students. Other

**Table 4. Upon graduation, what do you think is the greatest weakness of your turf students?**

Weaknesses	Responses,
Business skills	34
Personnel management	33
Turf work experience	30
Communication skills	17
Math	13
Other	20

**Table 5. What do you think is (are) the most limiting factor(s) to having the strongest undergraduate turfgrass program possible at your institution?**

Limiting factor	Response, %
Lack of financial support for programs	28
Lack of turf faculty and support personnel	28
Time to develop teaching program	22
Lack of students	16
Other factors	31

comments included: "inability of students to formulate a comprehensive fertility program," "lack of maturity and leadership skills," and "students completing the 4-yr program are sorely deficient in chemistry and physics."

To the question, "What do you think is (are) the most limiting factor(s) to having the strongest undergraduate turfgrass program possible at your institution?" (Table 5), the two most common responses were lack of financial support for the program (28%) and lack of turf faculty and supporting personnel (28%). This belief is supported by findings of Peacock and Dudeck (1991). They reported that 28% of 4-yr turfgrass program respondents believed that there was an inadequate number of teaching faculty involved in their program. Sixty-two percent believed that the number of teaching assistants was inadequate. In the present study, 22% of the respondents indicated that time to develop their teaching program the way they would like was the greatest limitation. A lack of students was indicated by 16% as being a severe limitation to their program. However, when asked if they actively recruited students for their program, 58% of the instructional program leaders responded *no*, whereas 42% said *yes*. Many of those who indicated *no* explained that lack of time and/or funds prevented them from doing so. Other factors listed as limiting the teaching program included: a general lack of support for teaching by the administration; need for more involvement of all turf faculty in teaching; competition with 2- and 3-yr programs in attracting students; and lack of teaching facilities.

Some believe that teaching does not receive the same consideration as research and extension in salary and promotion considerations. To the question "At your institution, in terms of tenure, promotion, and salary adjustments, do you think your teaching efforts are recognized the same as your efforts in research and/or extension?" Twenty-three percent responded *yes*, whereas 77% indicated *no*. Although no written comments were requested for this particular question, several respondents offered thoughts on the matter. One indicated that regardless of appointment time (assignment to teaching, research, and extension), one should concentrate on pub-

lications, particularly peer-reviewed publications. Others expressed the view that although poor teaching performance could hurt an individual in promotion-tenure and and salary considerations, good teaching was not likely to strengthen one's position in such considerations.

A final optional question was, "What do you think are going to be the greatest challenges facing turfgrass education over the next 10 years?" Eighty-two percent of those completing the survey responded. A summary of the comments revealed many different opinions concerning exactly what would constitute the greatest challenges during the decade of the 90's. In fact, 22 distinctly different "challenges" were presented by the respondents. The most frequent of these (27% of all challenges mentioned) was concern over being able to attract sufficient numbers of qualified students to a 4-yr program. The next most frequently mentioned challenge (17%) referred to the task of keeping abreast of turfgrass-environmental concerns and educating students to be environmentally sensitive. Other challenges mentioned included: maintaining any kind of turf program with impending budget cuts; retaining as well as hiring high quality faculty; keeping up with new technology in fertilizer, pesticide, equipment, and irrigation industries; use of computers in turfgrass management programs; meeting student needs with limited faculty numbers; and improving recognition of the importance of undergraduate teaching by college and university administrators.

#### SUMMARY AND CONCLUSIONS

The results of this study offer some interesting anomalies. For example, although many respondents indicated that internships were not required in their program, when asked what was the greatest weakness of their graduating turf students the lack of work experience was ranked second. Likewise, the respondents indicated that the primary weakness of their turf students was a lack of business skills and personnel management. However, when enumerating courses normally taken in the turfgrass curriculum, business and related courses had the lowest response. Similarly, when asked about the greatest challenges facing turfgrass education over the next 10 yr, the most frequent response was the ability to attract sufficient numbers of qualified students. Yet, when asked if

they actively recruited students, 58% responded *no*. Perhaps a partial answer to these apparent contradictions lies in the response to the question, "What do you think is(are) the most limiting factor(s) to having the strongest undergraduate turfgrass program possible at your institution?" The overwhelming response was lack of financial support and turf faculty. This was followed by lack of time to develop the teaching program as they would like. Internship programs, student recruitment, and curriculum development require both funding and faculty-staff time. In addition, there was a strong suggestion that with limited resources, available time and funds could be more effectively utilized, from a career standpoint, in research or extension activities. This thought is supported by the question, "At your institution, in terms of tenure, promotion and salary adjustments, do you think your teaching efforts are recognized the same as your efforts in research and/or extension?" Seventy-seven percent responded *no*. It appears that one challenge may be to convince administrators that attainment and especially maintenance of excellence in teaching requires appropriate incentives.

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# Four-Year Turfgrass Management Programs in the United States: II. Organization and Content of Introductory Turfgrass Management Courses

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## ABSTRACT

Introductory turfgrass management courses are offered at many land-grant institutions. The objective of this study was to determine format, topical content, and teaching methods in these courses. A questionnaire with 44 questions was sent to 32 land-grant institutions with an active 4-yr turfgrass management teaching program. Ninety-four percent of introductory turfgrass management courses had prerequisites. Usually a basic soils class, a course in biology or botany, or both were required. Lecture content of almost all the courses included; turfgrass growth characteristics, establishment, mowing, and fertilization. Less than half of the courses covered pesticide laws and regulations. Median time allotted to topics on turfgrass and the environment, pesticide safety and handling, and pesticide laws and regulations was 50 min each. Eighty-four percent of the courses had a laboratory. The primary topics in the laboratory included identification of cool-season turfgrasses, weed identification, and sprayer/spreader calibration. Other laboratory topics mentioned by some respondents included: use and interpretation of stimpmeters, turfgrass-landscape math, and sod production practices. There was much commonality among introductory turfgrass management courses taught at land-grant institutions. However, each institution maintains a uniqueness by having slight differences in course content and emphasis placed on specific lecture and/or laboratory topics.

**I**NTRODUCTORY turfgrass management courses are taught at many land-grant institutions. Often these courses serve as a cornerstone to various options or specializations in turfgrass or landscape management. With this in mind, it would be valuable to new teachers as well as to current teachers to have information about structure or organization, content, and teaching methods used at various 4-yr institutions that offer an introductory turfgrass management course as part of their undergraduate turf program.

Questionnaires have been used as an effective method for evaluating agronomy courses and programs. For example, Sims (1974) used a questionnaire to elicit agriculture student attitudes toward various aspects of agronomy instruction in the USA. Likewise, Fessenden and Armson (1975) surveyed soil science education and related areas in the USA and Canada. Karnok and Connors (1986) and Connors and Karnok (1986) surveyed crop science courses in the USA. They reported on or-

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ganization, course content, and teaching methods used for both the lecture and laboratory segments of these courses. More recently, Dudeck and Peacock (1991) and Peacock and Dudeck (1991) surveyed both 2- and 4-yr turfgrass teaching programs in the USA. Their survey focused on enrollment, job opportunities, starting salaries, and general comparisons of program organization and content.

We conducted a survey of those land-grant institutions that currently offer a specialized 4-yr program of study in turfgrass management. Our purpose was to gather basic information regarding number of students, core curriculum requirements, number and type of turf courses offered, internship requirements, student recruitment efforts, and teacher attitudes and perceptions. In addition, questions concerning the first turfgrass management course for students specializing in turfgrass management were included. Questions regarding overall program structure and teacher attitudes were discussed in our first paper of this two-paper series (Karnok et al., 1993). This paper will discuss those questions specifically related to the first turfgrass management course taken by students specializing in turfgrass management.

## METHODS

To obtain information about 4-yr turfgrass management teaching programs in the USA, a questionnaire was sent to 32 land-grant institutions having an active 4-yr turfgrass management teaching program. The questionnaire had 44 questions on various aspects of the undergraduate teaching program. The questionnaire was divided into two specific areas: (i) overall structure and requirements of the turf program, and (ii) format, teaching methods, and topical content of the lecture and laboratory of the first turfgrass management course taken by students specializing in turfgrass management.

## RESULTS AND DISCUSSION

Overall response to the questionnaire was 100%. Instructors of introductory turfgrass management courses in the USA averaged 10 yr of teaching their course. Teaching experience ranged from less than 1 yr to 27 yr.

The course organization segment of the questionnaire is summarized in Table 1. Seventy-eight percent of the respondents indicated their institutions were on a semester system, while 22% were on quarters. Most institutions (72%) offered their introductory turfgrass course as a 3-credit-hour course. These institutions were usually on a semester system. Courses taught under the quarter system were primarily offered as 4- or 5-credit-hour courses. In most cases (88%), regardless of academic calendar

**Table 1. Questions and responses pertaining to course organization and format of introductory turfgrass management courses.**

a. How many credit hours is the course?				
Credit hours		Response, %		
2		6		
3		72		
4		16		
5		6		
b. How many times is this turf course taught each academic year?				
Once	Twice	Alternate years		
88	6	6		
c. How many times does the lecture meet each week?				
2	3	4	5	Other
66	22			
d. How many minutes is each individual lecture?				
Mean	Median	Range		
	min			
56	50	48-95		
e. How many total lectures are there in a given quarter or semester?				
Mean	Median	Range		
-----no. of lectures-----				
36	30	20-48		
f. What are the prerequisites for taking this turf course?				
Prerequisite	Response, %			
Basic soils	75			
Biology or botany	56			
Introductory agronomy or horticulture	43			
Chemistry	21			
None	6			

used, the introductory turfgrass course was offered once each year.

In terms of prerequisites, only two (6%) respondents indicated that there were no prerequisites for the course. Seventy-five percent of the respondents indicated that basic soils was a prerequisite for the course, whereas 56% indicated that a course in biology or botany was a prerequisite. In some cases, a soils course and a course in either biology, botany, introduction to agronomy, or horticulture were required. Twenty-one percent listed a course in chemistry as a prerequisite. Although not indicated specifically, it might be assumed that those students who completed basic soils would also have completed some minor chemistry requirement.

### Lecture Portion

Under a semester system, the turf course met for lecture two or three times each week; under a quarter system, the course usually met three or four times each week. The average length of each lecture was 56 min with a median of 50 min. Questions pertaining to the use of various teaching methods and approaches in the lecture are shown in Table 2. The use of various teaching aids including slides, video tapes, movies, etc. was indicated by 71 % of the respondents. Although the number of respondents using videotapes was not determined in this survey, Peacock and Dudeck (1991) found that almost 80% of U.S. 4-yr turfgrass teaching programs utilized videos.

**Table 2. Questions and responses pertaining to teaching methods or techniques used in introductory turfgrass management courses.**

a. Does a laboratory supplement the lecture portion of the course?		
Yes	No	
84	16	
b. Are audio-tutorial aids (slides, tapes, movies, etc.) used or available for student use?		
Yes	No	
<b>%</b>		
71	29	
c. Are computers used in the lecture portion of the course?		
Yes	No	
7	93	
d. Are guest speakers used in the lecture?		
Yes	No	
71	29	
e. Are field trips included in the course?		
Yes	No	
87	13	
f. If the course does include field trips, how many?		
No. of field trips	Response, %	
	21	
	25	
	25	
	11	
	18	

The use of videos in beginning agronomy and turfgrass management courses has been shown to be an effective supplemental teaching aid (McCrimmon et al., 1992). Ninety-three percent indicated that computers were not used in the lecture portion of the course.

To better understand the responses concerning topical content covered in both the lecture and laboratory portions of the course, several questions were asked concerning the availability of *other* turf courses offered in the respondents department. For example, 34% of the institutions offered an advanced or some other turfgrass management course above the introductory level. A few indicated that they were in the process of developing advanced courses. About 25% indicated they offered a specific course in turfgrass diseases. A course in turfgrass insects was offered by 16% and a turfgrass weeds course by 10%. Although often difficult to ascertain, the responses suggest that many programs offer a turf and/or landscape course that covered *pests* (i.e., diseases, insects, and weeds) in general. Other types of turf courses mentioned included: Urban and Sports Turf Soils, Growth and Development of Perennial Grasses, Current Issues in the Turfgrass Industry, Turf Site Construction, Sports Turf Management, and Golf Course Operations.

Only four institutions (16%) offered a survey or a *non-major* turf course (something at a lower level than the first course taken by turf majors). Survey courses have been found to be beneficial for creating interest in a par-

**Table 3. Response and time allotted to various lecture topics used in introductory turfgrass management courses in 32 U.S. universities.**

Lecture	Response	Range	Median
	%	—min	
Turfgrass growth characteristics	97	25-190	50
Turfgrass establishment	97	48-570	100
Mowing	97	50-288	150
Turfgrass fertilization	97	25-250	100
Cool-season turfgrasses	94	25-100	50
Turfgrass renovation	94	50-200	100
Turfgrass diseases and their control	94	25-100	50
Turfgrass insects and their control	94	17-200	100
Turfgrass weeds and their control	94	17-175	96
Thatch	94	17-225	100
Importance of turfgrasses to man and the environment	91	50-190	50
Irrigation and drainage	91	25-190	50
Environmental stresses	91	50-285	150
Warm-season turfgrasses	88	17-100	50
Turfgrass communities	84	25-225	100
Traffic and wear	84	25-250	100
Pesticide safety and handling	78	25-100	50
Sod production	63	20-80	50
Athletic field management	63	25-100	50
Chemical lawn care	63	20-250	50
Golf course management systems	53	17-100	50
Pesticide laws and regulations	48	17-80	50

ticular subject matter. For example, at the University of Georgia, a turfgrass management survey source was initiated in 1984 by the senior author. The course is currently offered once each year and meets once for 2 h each week. The lecture content is very general and presents an overview of turfgrass management including career opportunities. Over the past 7 yr, enrollment increased from 15 to a high of 70 students for one quarter, with a yearly average of 45. More importantly, this course has served as a prime feeder of students to the introductory turfgrass management course as well as a source of potential *majors* in the turfgrass management program.

In terms of lecture topical content of the introductory turfgrass management course, 97% of the respondents indicated that they covered turfgrass growth characteristics, establishment, mowing, and fertilization (Table 3). However, the time spent on any one of these topics varied considerably, from as little as 25 min up to several 50-min lectures on these subjects. Coverage of turfgrass growth characteristics, averaged 50 min with a median time of 100 min or more, allotted for the three remaining topics. In addition to these topics, at least 90% covered cool-season turfgrasses, renovation, diseases, insects, weeds, thatch, irrigation, environmental stresses, and the importance of turfgrasses to humans and the environment. In the first article of this series (Karnok et al., 1993), many respondents were concerned about being able to stay current and to impress upon their students the environmental concerns surrounding turfgrass management and associated pesticide uses. Among the lecture topics covered, 78% presented information on pesticide safety and handling. Less than half covered pesticide laws and regulations. The median time allotted for turfgrass and the environment, pesticide safety and handling, and pesticide laws and regulations was 50 min each.

In recent years, an approach emphasizing concepts or

**Table 4. Questions and responses pertaining to laboratory organization and format of introductory turfgrass management courses.**

a. Does a laboratory supplement the lecture portion of the course?			
	Yes	No	
	84	16	
b. How many hours is each laboratory scheduled for?			
	1	2	3
	69		27
c. How many times does the laboratory meet each quarter or semester?			
	Mean	Range	Median
	8-30		15
d. Who teaches the laboratory?			
	Faculty	Graduate student	Other
	80	17	
e. Approximately what percentage of the total turf course grade is allocated to the laboratory?			
	Mean	Range	Median
	24	10-50	25

principles has been applied to beginning courses in agronomy at most 4-yr institutions (Karnok and Connors, 1986). This approach replaces the commodity format. This survey indicates that most instructors take a *principles* approach to turfgrass management rather than emphasizing specific turfgrass cultural systems such as golf course management, lawn care, etc. This helps clarify Peacock and Dudeck's (1991) report that most 4-yr institutions offered specific instructions in golf course management, lawn care, and parks and sports turf management. However, the present study shows that although each of these areas was covered in the introductory turfgrass management course, the median time allotted was 50 min. Some 4-yr turfgrass programs offer advanced turfgrass management courses where more detailed information probably was presented on these specialized topics, but many programs only offered the one basic turf course. Therefore, although many respondents indicated that they covered these specialized topics, most only committed about one lecture to each of them.

Overall, there was a great deal of commonality among the lecture portions of the introductory turfgrass management courses throughout the country. However, several respondents indicated that *other* lecture topics were not listed in the questionnaire. For example, some other lecture topics mentioned included: history of the turfgrass industry, troubleshooting turf problems, plant growth regulators, record keeping, integrated pest management strategies, and developing turf-landscape specifications.

### Laboratory Portion

Eighty-four percent of the respondents indicated that a laboratory was associated with the basic turf course (Table 4). Most laboratories (69%) met for 2 h each week,

**Table 5. Questions and responses pertaining to teaching methods or techniques used in the laboratory portion of introductory turfgrass management courses.**

a. Are audio-visual aids (slides, video tapes, movies, etc.) used or available for student use?		
Yes	No	
		<b>%</b>
65	35	
Are computers used in the laboratory portions of the course?		
Yes	No	
31	69	
Are guest speakers used in the lecture?		
Yes	No	
57	43	

whereas 27% met for 3 h. Since the majority (78%) of the institutions were on a 16-wk semester system and labs met once each week, the average number of laboratory meetings for each course was 15. Eighty percent indicated that the laboratory was taught by the professor responsible for the course. Seventeen percent of the laboratories were taught solely by graduate assistants. In a survey of graduate students specializing in turfgrass science in the USA, 80% indicated that they obtained teaching experience during their graduate programs. It appears that this experience was obtained primarily by giving occasional lecture presentations or assisting the professor in the lab (J. McCrimmon, 1991, personal communication). In all cases, the lab grade was included in the overall course grade. The percent of the course grade determined by the laboratory part of the course ranged from 10 to 50%. The mean and median was 25%.

The questionnaire included three questions pertaining directly to the use of various teaching methods. Sixty-five percent of the respondents indicated that they used visuals such as slides, videotapes, and movies in lab or that they were available for student use (Table 5). Respondents indicated they used computers (31%) and guest speakers (57%). Guest speakers were used by 71% of the respondents in the lecture portion of the course.

The final part of the questionnaire pertained to the topical content of the laboratory and the emphasis or time spent on various exercises (Table 6). Percent response to a given topic was used as an indication of whether the topic was covered in the laboratory. If the question was left blank, it was assumed the topic was not part of laboratory content. Exercises pertaining to the identification of cool-season turfgrasses had the greatest response (89%) of all exercises. Some institutions spend more than 3 h on this topic. Most, however, devoted at least 2 h. Weed identification and sprayer-spreader calibration each had a 74% response. These were followed by the identification of warm-season turfgrasses (70%). Peacock and Dudeck (1991) reported that less than half of the laboratory periods at 4-yr turfgrass programs in the USA were organized or conducted in a primarily hands-on fashion. In their study, they found 37% of the 4-yr programs used a demonstration approach in the laboratory

**Table 6. Response and time allotted to various topics in the laboratory portion of introductory turfgrass management courses.**

Lecture	Response	Range	Median
Turfgrass identification—cool season	89	60-360	120
Turfgrass weed identification	74	40-360	120
Sprayer-spreader calibration	74	40-540	120
Turfgrass identification—warm season	70	40-270	120
Fertilizers and fertilizer labeling	67	60-240	120
Turfgrass growth characteristics	63	40-180	120
Seed quality and identification	63	60-360	120
Turfgrass disease identification	59	60-540	120
Establishment	56	40-180	60
Root zone modification	52	120-480	120
Turfgrass and pesticide calculations	52	60-360	120
Turfgrass insect identification	52	60-270	120
Irrigation system components	48	60-360	120
Renovation	48	60-240	120
Turfgrass equipment	59	60-360	120
Mower sharpening and adjustment	44	60-240	120
Sprinkler distribution patterns	30	60-180	60
Diagnosing turf problems	26	120-240	120

segments of their programs. Additional, or *other* laboratory exercises mentioned by the respondents in our study included: use and interpretation of stimpeters, turfgrass-landscape math, and sod production practices.

## CONCLUSIONS

Results of this survey showed that the organization and goals of introductory turfgrass management courses throughout the country were quite similar. Course content for both lecture and laboratory segments varied somewhat in terms of topics covered and time allotted to specific subject areas. Course content in a basic turf course may be influenced by the availability of additional (advanced) turfgrass management or other related courses such as turf diseases, turf insects and weeds, or control of turfgrass pests. Turfgrass educators at 4-yr institutions in the USA indicated a concern regarding staying abreast of turfgrass environmental issues, including use of pesticides on turfgrass sites. However, these and other related topics received considerably less emphasis than the more traditional turf management subject areas. In addition, only 34% indicated that an advanced course in turfgrass management was offered at their institution. This may be cause for concern as to how well our students are prepared for professional practice.

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