

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.

TURFGRASS 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- |
| Southern Region | University of Arizona + 4- |
| 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 stimpeters, 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.

INTRODUCTORY 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 | |
| % | | |
| 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 | | |
| | | % | |
| 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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