2019 Student Challenge Study Guide

Presented in partnership with the SAFE Foundation, Founding Partner Hunter Industries, and Ewing

SAFE
The Foundation for Safer Athletic Fields

Hunter®
The Irrigation Innovators

EWING

Table of Contents

Introduction

Thank you for your participation in the 2019 STMA Student Collegiate Challenge! The Student Challenge is presented in partnership with the SAFE Foundation, Founding Partner Hunter Industries, and supporting sponsor Ewing. Each year students from 2-year and 4-year colleges and universities across the country compete in an exam that challenges knowledge in the sports turf industry.

The 2019 STMA Student Challenge will take place on Thursday, January 24 from 2 - 4:30 pm. Please make your travel plans accordingly.

The deadline to register for the STMA Student Challenge is December 15, 2018. Any team not registered by this date will not be allowed to compete in the event. STUDENT CHALLENGE PARTICIPANTS' ARE REQUIRED TO REGISTER ONLINE. STMA will not accept any other registration method. STMA Student Challenge competitors' full conference registration fee is waived. Each student must register individually and be a current STMA member. If you are not a member, you must include your dues payment with online registration. Please contact STMA with any questions at 800-323-3875 or kalthouse@stma.org.

STMA Student Challenge Participant Code of Conduct and Eligibility Requirements

IMPORTANT - READ THIS PAGE BEFORE PROCEEDING

Code of Conduct

As a participant in the STMA Student Challenge and a guest of STMA, SAFE, and the sponsors of the event, all participating students are expected to conduct themselves in a professional, courteous, and responsible manner while at the STMA Conference and Exhibition. You are expected to be in business casual attire for the exam.

Eligibility

Graduate students are not eligible to compete in the STMA Student Challenge, take the Student Challenge exam, or enter the exam room.

Participants in the STMA Student Challenge competing on a two-year team may compete in no more than three total Student Challenge events. Participants in the STMA Student Challenge competing on a four-year team may compete in no more than five total Student Challenge events. Students who have transferred from a two-year program to a four-year program may compete in up to five total Student Challenge events.

Should a student be deemed to be in violation of any of these policies by authorized STMA staff or volunteers, the team/school that the student represents may be disqualified from current and future STMA Student Challenge competitions and will be asked to pay for the Conference registration of all team members and forfeit all awards.

Please contact STMA with any questions regarding these policies at 800-323-3875 or kalthouse@stma.org.

Rules and Guidelines for the STMA Student Challenge

1. Teams shall consist of no more than four members from two-year undergraduate, four-year undergraduate, technical school, or junior college programs

- Undergraduate individuals are allowed to compete as an individual if they choose
- Team members graduating up to three months prior to the date of the STMA Student Challenge can compete, so long as they have not begun a graduate program

2. Prior to competing, teams must declare whether they will compete in the two-year or four-year competition

- Teams with any members who are in a four-year program must compete in the four-year competition
    - Example 1: One team member from four-year program at University X, three team members from two-year program at University X. Team must compete in four-year competition.
    - Example 2: One team member from four-year program at University Y, three team members from two-year program at Junior College Z. Team must compete in four-year competition.

3. Graduate students are not eligible to compete in the STMA Student Challenge, take the Student Challenge exam, or enter the exam room

4. Individuals from different institutions can form teams to compete, but are not required to be on a team and may compete as an individual

- Awards and prizes will be divided according to the breakdown of schools represented on the team
    - Example: Two team members from University X, one team member from College Y, one team member from Junior College Z
        - 50% of prize to University X, 25% of prize to College Y, 25% of prize to Junior College Z

5. Grading Protocol:

- Multiple Choice: All multiple choice answers must be dark and recognizable. Any changed answers must be adequately erased to distinguish from the original answer.
- Identification: Only the use of the correct common name will be counted as a correct answer.

6. Should two schools have the same score, and that score qualifies for first, second, or third place, the following tiebreakers will be applied

- In the event of a tie, the team who has the higher score on two-out-of-three sections of the exam shall be declared the winner or finish higher.
- If the above procedure does not resolve the tie, the team with the higher score in the Short Answer/Case Study section shall be declared the winner or finish higher.

- If the above procedure does not resolve the tie, the team with the higher score in the Identification section shall be declared the winner or finish higher.
- If the above procedure does not resolve the tie, the team with the higher score in the Multiple Choice section shall be declared the winner or finish higher.

7. Two-year competition prizes

First Place

- A cash award, equal to that presented to the Four-Year Competition First Place Team, presented by The SAFE Foundation
- A plaque recognizing the team as STMA Student Challenge Champions, Two-Year Competition
- One medallion per team member

Second Place

- A plaque recognizing the team as STMA Student Challenge Second Place, Two-Year Competition
- One medallion per team member

Third Place

- A plaque recognizing the team as STMA Student Challenge Third Place, Two-Year Competition
- One medallion per team member

8. Four-year competition prizes

First Place

- A cash award, equal to that presented to the Two-Year Competition First Place Team, presented by The SAFE Foundation
- A plaque recognizing the team as STMA Student Challenge Champions, Four-Year Competition
- One medallion per team member

Second Place

- A plaque recognizing the team as STMA Student Challenge Second Place, Four-Year Competition
- One medallion per team member

Third Place

- A plaque recognizing the team as STMA Student Challenge Third Place, Four-Year Competition
- One medallion per team member

9. First place winners receiving prize money in the Two-Year and Four-Year competitions shall have the following obligations to STMA

- Author an article to be used in *SportsTurf* magazine, STMA Chapter Newsletter, STMA Online Newsletter, or any other STMA communication vehicle.
- Each winning team shall file a short, written progress report to the Student Challenge Sub-Committee Chairperson.
- Preferred uses of SAFE First Place Funds
    - To create an Athletic Sports Field learning lab

        - *Ex*: build home plate/mound; small-scale field project involving painting, drainage, irrigation, mowing; renovating an infield, goal areas, etc.
    - Purchase Athletic Sports Field Specific Equipment and Products
        - *Ex*: paint sprayers, transits, hand tools, mowers, irrigation equipment, tarps, stencils, paint, soil conditioners, clay, etc.
    - Other items or projects as approved by the STMA Student Challenge Chairperson or Committee

It is The SAFE Foundation's policy to not pay overhead costs at the winning team's university, college, or school. Funding is not intended for field days. Funds need to be spent or designated to be spent prior to the next year's STMA annual conference. Winning teams are encouraged to leverage the prize to generate additional funding through collaboration with campus athletics, the community, or other organizations.

Exam Overview

Check-In

- Teams may check-in 30 minutes prior to the start of the exam. Two-year and four-year teams check in separately. All team members must be present to sign-in. Teams will receive a sealed exam packet. If the packet is opened prior to the start of the exam, the team will be disqualified.

Testing Policies and Exam Room Protocol

- Students are responsible for storing personal belongings during the exam. The following is **PROHIBITED** from being at the exam table: hats, cell phones, smart watches and other devices, sunglasses, conference badges, outside calculators, notes and resources, and bags (backpacks, purses, briefcases).
- You will have 2 ½ hours to complete the exam from when the head proctor begins the test.
- CSFM Monitors will be located throughout the room to answer questions and provide guidance as students proceed through the exam.
- You will be provided with scratch paper, an answer booklet, pencils, and calculators.
- The STMA Student Challenge will consist of 100-175 questions and will be made up of several parts. The exam may be formatted to include any of the following: multiple-choice, fill-in-the-blank, matching, true/false, reading passages, short answer, oral presentation, and identification/hands-on sections.
- Some questions may require physical interaction or visual identification. Please carefully read the "Topics Covered in the STMA Student Challenge" section in this packet for guidance on what to study.
- Budget your time accordingly so that you can complete the entire exam.

Post Exam

- All testing materials **MUST** be returned – this includes scratch paper, calculators, and pencils. Testing materials may **NOT** be removed from the room. Failure to comply by turning in your test constitutes academic fraud and your team and school will be banned from competing in the STMA Student Challenge for a period to be determined by the STMA Student Challenge Committee.
- Teams may be required to complete a brief survey pertaining to the Student Challenge.
- The top three teams in the 4-year and 2-year divisions will be announced at 12:30 pm Friday, January 25 at the Hunter booth located on the Trade Show floor. Winners and team scores will be posted soon thereafter near the exam room.

Topics Covered in the STMA Student Challenge

The section topics have been based upon the STMA competency outlines and are as follows.

Turfgrass Identification, Selection, and Morphology

- Identify major turfgrass species by differentiating the seeds and/or morphological characteristics. Live samples may be used.
- Identify the regional climatic zones of the U.S. and which turfgrass species are best adapted to those zones.
- Understand the basics of the selection of turfgrasses for sports field use based on the adaptability of the turfgrass species and cultivars in various agronomic and climatic conditions.
- Read and understand a seed label.
- Understand the principles of the formulations of blends and/or mixtures of turf grasses.
- Understand the different seeding techniques and be able to choose the proper one for various conditions.
- Understand vegetative turfgrass establishment via sprigs, stolons, and sod and the various techniques used in each.

Turfgrass Soils

- Identify basic soil types using the soil textural triangle.
- Identify soils based on their use in sports field management. Physical samples may be used.
- Understand soil formation, soil profiles, and soil classifications as they relate to sports field management.
- Understand soil physical properties, i.e. texture, structure, aggregation, bulk density, porosity, drainage, water relationships, and modification.
- Understand soil chemical properties, i.e. soil acidity/alkalinity, pH, cation exchange capacity, salt concentrations, phytotoxic contaminants, and nutrient availability.
- Read and understand a soil test.
- Understand the physical, chemical, and biological characteristics of soils and their influence on turf grass growth.
- Understand how to choose a proper growing medium for turfgrass rootzones.

Soil Fertility

- Understand the fertilizer label and its components.
- Understand how to develop a fertilization plan based on soil test results.
- Be able to calculate the nutrients applied on an elemental basis for a given area and rate.
- Understand turfgrass nutrition requirements and the effects of excesses, deficiencies, and nutrient imbalance on turfgrass growth.
- Know the mineral elements essential for turfgrass growth, their sources, and their relative

requirements by species (macronutrients, secondary, and micronutrients).

- Know the differences in the physical characteristics of fertilizers and how these differences can influence the uniformity of size and their dispersion tendencies. Physical samples may be used.
- Understand the differences in the release characteristics of fertilizers and when the best time is to apply the different types.
- Have a general understanding how to plan and implement an annual fertility plan.

Irrigation

- Understand the basics of irrigation system hydraulics and precipitation rates.
- Understand evapotranspiration (ET) and the factors which influence it.
- Understand the importance of proper irrigation system design to achieve efficient and uniform distribution of water.
- Understand the importance and necessity of water quality and water conservation.
- Identify irrigation system components and parts including valves, head, controllers, pipes, fittings, pumps, electrical elements and components of each of these. Identify "Smart Components" that enable water conservation in irrigation systems. Physical samples, diagrams, photographs, or descriptions may be used.
- Read an irrigation schematic/blueprint and assemble/install an irrigation system based on specifications.

Drainage

- Understand the various types of drainage – internal, surface, and subsurface installed systems – and the benefits/disadvantages of each for use on sports fields.
- Understand how the dispersion test can help a turf manager evaluate the stability of a soil.
- Understand the forces that influence surface tension of water and how these forces influence water intake, movement, and retention in soils.
- Understand the forces that are required to pull water through the soil; e.g. suction or matric potential.
- Recognize the differences between saturation, field capacity, wilting point, and permanent wilting point.
- Have a working knowledge of the reasons for a field experiencing net infiltration, ponding, or runoff.
- Understand the reasons for localized dry spots (LDS) and how to manage those areas.
- Understand the concept of perched and temporary water tables and how they affect sports fields.
- Understand the design criteria for a subsurface drainage system which includes: drainage patterns, pipe size, slope, and collector drains.
- Assemble/install a subsurface drainage system based on a schematic/blueprint.
- Be able to identify the different types of drainage pipe and system components including

pipes, fittings, and backfill materials. This may include physical samples, diagrams, photographs, or descriptions.

Turfgrass Mathematics

- Perform area calculations for geometric configurations used in sports fields.
- Calculate conversions between metric and English measurement systems given the formulas.
- Calculate application rates for a given area.
- Calculate application rates in pounds or ounces of active ingredient (a.i.) or of product per unit area.
- Perform volume calculations for topdressing materials, seed, skinned area clay mixes, or other products used in sports field management.
- Calculate "pure live seed" amounts from a seed label.
- Calibrate liquid and dry material application equipment. Physical samples may be used.
- Calculate precipitation rates and water related problems.

Pest Management

- Understand climatic conditions and management practices, which may influence various pest infestations.
- Have a basic understanding of pesticide activity, i.e. contact versus systemic, preventative versus curative.
- Identify the various pesticide physical formulations such as emulsifiable concentrate, flowable, water-soluble packet, granular, etc.
- Read and understand a pesticide label.
- Knowledge of pesticide safety such as safe handling, storage and disposal, and REI.
- Knowledge of distribution equipment including sprayer setup, pressures, nozzles, and pumps; broadcast and drop spreaders. Physical samples, diagrams, photographs, or descriptions may be used.
- Knowledge of integrated pest management techniques in the overall sports field management plan.
- Knowledge of environmental concerns such as drift, runoff, leaching, and persistence.
- Identify weeds (grasses, sedges, and broadleaves) and understand their growth cycles in both cool season and warm season grasses. Physical samples, diagrams, photographs, or descriptions may be used.
- Identify major turfgrass insect pests, understand their life cycles, and diagnose resulting turfgrass damage of both warm season and cool season turfgrasses. Physical samples, diagrams, photographs, or descriptions may be used.
- Identify the major turfgrass diseases, understand their life cycles, and diagnose resulting turf grass damage of warm season and cool season turfgrasses. Physical samples,

diagrams, photographs, or descriptions may be used.

· Knowledge of how to troubleshoot turfgrass problems and create a corrective plan of action.

Sports Field Management – Turf Areas

· Understand general concepts dealing with safety, i.e. smoothness, consistency, Gmax, uniformity, on and off field hazards (may include safety checklist knowledge).

· Understand basic concepts of playability – traction, surface stability, species selection, irrigation management, appropriate crown specifications.

· Identify equipment, uses, depreciation, and equipment parts including mowers, aerifiers, sprayers, spreaders. Could include physical samples, diagrams, photographs, or descriptions.

· Understand field marking and logo painting. This can include field layout and lining, stencils, painting technique, paint mixing, etc.

· Understand the effects weather has on sports field management including weather fronts; atmospheric moisture, relative humidity, and dewpoint; heat index; and severe weather safety

· Comprehend basic cultural practices

- Knowledge of appropriate heights of cut and directional mowing, reel vs. rotary mower
- Identify and adjust a reel mower's height of cut and evaluate reel to bedknife clearance
- Understand soil compaction causes, effects on the physical properties of soils and effects on turfgrass growth.
- Understand how thatch develops and how to manage thatch
- Know the different methods and techniques of cultivation, including the types of equipment and techniques used and the advantages and disadvantages of each.

Sports Field Management – Non Turf Areas

· Identification of the different types of soil conditioners and mound or home plate fortification materials (both natural and synthetic). Physical samples may be used.

· Understand the various used of soil conditioners on sports fields.

· Understand and outline pitcher's mound construction and maintenance.

· Surveyor's transit use: Measure heights using a transit and determine correct height of pitcher's mound and its slope.

· Understand and outline skinned area construction and maintenance including lip prevention and maintenance

· Understand grading and installation techniques associated with new construction projects and field reconstruction.

· Knowledge of general synthetic turf maintenance.
· Identification of synthetic turf maintenance equipment. Could include physical samples, diagrams, photographs, or descriptions.
· Understand planning, preparation, and renovation/recovery associated with special events.

Sports Field Management - Administration

· Understand proper communication techniques including verbal and non-verbal methods.
· Knowledge of basic supervisory skills including time management, leadership techniques, team development, positive performance management, conflict management, etc.
· Knowledge of the budgeting process and the fiscal responsibilities inherent in turf management.
· Knowledge of administrative principles of turf management safety management systems.

The History of STMA

· Identify STMA's Founders
· Understand STMA's growth and establishment
· Knowledge of professional programs offered by STMA
· Knowledge of STMA's Mission and Vision

Weed List for STMA Collegiate Student Challenge

Annual Bluegrass
Annual Sedge

Barnyardgrass
Bedstraw/Catchweed
Bermudagrass
Black Medic
Broadleaf Dock
Broadleaf Plantain
Buckhorn Plantain
Bull Thistle

Canada Thistle
Carpetweed
Chicory
Cinquefoil
Common Chickweed
Common Mallow
Common Mullien
Crabgrass (Smooth)
Creeping Bentgrass
Creeping Speedwell
Creeping Woodsorrel
Curly Dock

Dallisgrass
Dandelion
Downy Brome

English Daisy

Fall Panicum
Field Bindweed

Geranium
Goosegrass
Green Foxtail
Ground Ivy

Hawkweed
Healall
Henbit

Kikuyugrass
Kochia

Lambsquarter

Moss
Mouse Ear Chickweed
Musk Thistle

Nimblewill

Orchardgrass
Oxeye Daisy

Pennywort/Dollarweed
Peppergrass/Virginia Pepperweed
Pineapple Weed
Prickly Lettuce
Prostrate Knotweed
Prostrate Spurge
Puncture Vine
Purslane

Quackgrass

Ragweed
Red Sorrel

Sandbur
Shepard's Purse
Spotted Spurge
Star of Bethlehem

Thymeleaf Speedwell

Venice Mallow
Violet
Virginia Buttonweed

Western Salsify
White Clover
Wild Carrot
Wild Garlic
Wild Onion
Wild Strawberry

Yarrow
Yellow Foxtail
Yellow Nutsedge
Yellow Rocket
Yellow Woodsorrel/Oxalis

Accepted Names - Grasses

Common Name	Latin Name
Creeping Bentgrass	*Agrostis palustris (A. stolonifera)*
Colonial Bentgrass	*Agrostis capillaris*
Tall Fescue	*Festuca arundinacea (Lolium arundinaceum)*
Creeping Red Fescue	*Festuca rubra*
Hard Fescue	*Festuca trachyphylla (Festuca brevipila)*
Kentucky Bluegrass	*Poa pratensis*
Supina Bluegrass	*Poa supina*
Annual Bluegrass	*Poa annua*
Rough Bluegrass	*Poa trivialis*
Italian Ryegrass/ Annual Ryegrass	*Lolium multiflorum*
Perennial Ryegrass	*Lolium perenne*
Smooth Brome	*Bromus inermis*
Buffalograss	*Buchloe dactyloides*
Bermudagrass	*Cynodon dactylon var. dactylon*
Hybrid bermudagrass	*Cynodon dactylon x C. tranvaalensis*
Bahiagrass	*Paspalum notatum*
Kikuyugrass	*Pennisetum clandestinum*
St. Augustine grass	*Stenotaphrum secundatum*
Japanese Lawngrass (Zoysiagrass)	*Zoysia japonica*
Seashore Paspalum	*Paspalum vaginatum*
Carpetgrass	*Axonopus affinis*
Centipedegrass	*Eremochloa ophiuroides*

Insect List for the STMA Student Collegiate Challenge

****Both immature and mature specimens may be used for identification.**

Annual Bluegrass Weevil (*Listronotus maculicollis* Dietz)
Ants - Red Imported Fire Ants (*Solenopsis invicta*)
Armyworm (*Pseudaletia unipuncta*)
Asiatic Garden Beetle (*Maladera castanea*)

Bermudagrass Scale (*Odonaspis ruthae*)
Billbugs
- Bluegrass Billbug (*Sphenophorus parvulus*)
- Hunting Billbug (*Sphenophorus venatus vestitus*)
- Denver Billbug (*Sphenophorus cicatristriatus*)
- Phoenician Billbug (*Sphenophorus phoeniciensis*)

Black Turfgrass Ataenius (*Ataenius spretulus*)

Chinch Bugs
- Hairy Chinch Bug (*Blissus leucopterus hirtus*)
- Southern Chinch Bug (*Blissus insularis*)
- Common Chinch Bug (*Blissus leucopterus leucopterus*)

Crane Fly (*Tipula paludosa*)
Cutworms
- Black Cutworm (*Agrotis ipsilon*)
- Bronzed Cutworm (*Nephelodes minians*)
- Variegated Cutworm (*Peridroma saucia*)

European Chafer (*Rhizotrogus (Amphimallon) majalis*)

Fall Armyworm (*Spodoptera frugiperda*)
Fiery Skipper (*Hylephila phyleus*)
Frit Fly (*Oscinella frit*)

Greenbug / Aphid (*Schizaphis graminum*)
Green June Beetles (*Cotinis nitida*)
Ground Pearls (*Margarodes meridionalis and Eumargarodes laingi*)

Japanese Beetle (*Popillia japonica*)

Leafhoppers (*Draeculacephala minerva and Deltacephalus sonorus*)
May and June Beetles (*Phyllophaga species*)
Masked Chafer
- Northern Masked Chafer (*Cyclocephala borealis*)
- Southern Masked Chafer (*Cyclocephala lurida*)

Mealybug
- Rhodesgrass Mealybug (*Antonina graminis*)
- Buffalograss Mealybug (*Tridiscus sporoboli*)

Mites

Eriophyid Mites

Bermudagrass Mite (*Eriophyes cynodoniensis*)
Zoysiagrass Mite (*Eriophyes zoysiae*)
Buffalograss Mite (*Eriophyes slykhuisi*)
Grain Rust Mite (*Abacarus hystrix and Aculodes mckenziei*)

Noneriophyid Mites

Clover Mite (*Bryobia praetiosa*)
Banks Grass Mite / Timothy Mite / Date Mite (*Oligonychus pratensis*)
Brown Wheat Mite (*Petrobia latens*)
Winter Grain Mite / Blue Oat Mite / Pea Mite (*Pentheleus major*)

Mole Crickets

Southern Mole Cricket (*Scapteriscus borellii*)
Tawny Mole Cricket (*Scapteriscus vicinus*)
Short-winged Mole Cricket (*Scapteriscus abbreviatus*)
Northern Mole Cricket (*Neocurtilla hexadactyla*)

Oriental Beetle (*Exomala orientalis*)

Sod Webworms (*Crambus spp*.)

Two-lined Spittlebugs (*Prosapia bicincta*)

White Grubs - may include Japanese Beetle (*Popillia japonica*), May and June Beetles (*Phyllophaga species*), Northern Masked Chafer (*Cyclocephala borealis*), Southern Masked Chafer (*Cyclocephala lurida*), Green June Beetles (*Cotinis nitida*), European Chafer (*Rhizotrogus (Amphimallon) majalis*), Asiatic Garden Beetle (*Maladera castanea*), Oriental Beetle (*Exomala orientalis*), Black Turfgrass Ataenius (*Ataenius spretulus*)

Malady List for the STMA Student Collegiate Challenge

Biotic

Algae
Anthracnose Foliar Blight / Basal Rot
Black-Layer
Brown Blight
Brown Patch / Large Patch / Rhizoctonia Blight

Copper Spot

Damping Off / Seed Rot
Dollar Spot

Fairy Ring

Gray Leaf Spot / Blast
Gray Snow Mold

Leaf Blotch
Leaf Spot / Melting Out

Necrotic Ring Spot
Net Blotch
Nematode damage

Pink Patch
Pink Snow Mold / Microdochium Patch / Fusarium Patch
Powdery Mildew
Pythium Blight / Pythium Root Rot

Red Thread
Rhizoctonia Large Patch
Rust

Sclerotium Blight / Southern Blight
Slime Mold
Spring Dead Spot
Stripe Smut
Summer Patch

Take-All Patch
Take-All Root Rot / Bermudagrass Decline
White Patch / White Blight

Yellow Patch
Yellow Tuft / Downy Mildew

Abiotic

Abrasive injury
Animal damage - chemical
Animal damage – physical

Chemical spills
Cold weather damage

Drought stress

Equipment injury

Fertilizer misapplication

Hazardous material

Irrigation issues

Lightning Damage

Mixed stand of turfgrass

Pesticide misapplication

Shade
Soil compaction

Thatch
Traffic stress

Wilt
Wet wilt

Study Resources

Students have a wide variety of resources available to them. The following textbooks, along with STMA's monthly publication, *SportsTurf* are recommended as study resources. The textbooks may be available through your school library, local bookstore, or may be purchased online from various book outlets. Speak with your instructors, peers, and/or other industry professionals regarding topics in the general study guide. Start networking now! The STMA directory is available online to all student members and is full of quality industry professionals. Also be sure to check out the Knowledge Center on the STMA website (www.stma.org) to access various technical bulletins on sports field management.

Compendium of Turfgrass Diseases (*3rd Edition*) – Richard W. Smiley, Peter H. Dernoeden, and Bruce B. Clarke

Controlling Turfgrass Pests (*3rd Edition*) – Thomas W. Fermanian, Malcom C. Shurtleff, Roscoe Randell, Henry T. Wilkinson and Philip L. Nixon

Destructive Turfgrass Insects – Daniel A. Potter

Establishing and Maintaining the Natural Turf Athletic Field—Stephen T. Cockerham, Victor A. Gibeault, and Deborah B. Silva

Fundamentals of Turfgrass Management *(Fifth Edition)* – Nick Christians, Aaron Patton, Quincy Law

Handbook of Turfgrass Insects – Rick L. Brandenburg, Michael G. Villani

History of STMA – Session recording from 2014 Conference: https://www.intelliquestmedia.com/library/STMAHistory)

Human Resource Management for Golf Course Superintendents – Robert A. Milligan, Thomas R. Maloney

Managing Turfgrass Pests – Thomas L. Watschke, Peter H. Dernoden and David J. Shetlar

Mathematics for the Green Industry: Essential Calculations for Horticulture and Landscape Professionals – Michael L. Agnew, Nancy H. Agnew, Nick Christians, Ann Marie VanDerZanden

Practical Drainage for Golf, Sportsturf, and Horticulture – Keith McIntyre and Bent Jakobsen.

Irrigation Design and Technical Guides – Hunter Industries - https://www.hunterindustries.com/resource_guide/tech-and-education-guides

Sports Fields: Design, Construction and Maintenance, Second Edition - Jim Puhalla, Jeff Krans, and Mike Goatley

Turfgrass Management (*Ninth Edition*) – A.J. Turgeon

Turfgrass Soil Fertility and Chemical Problems – R.N. Carrow, D.V. Waddington, and Rieke