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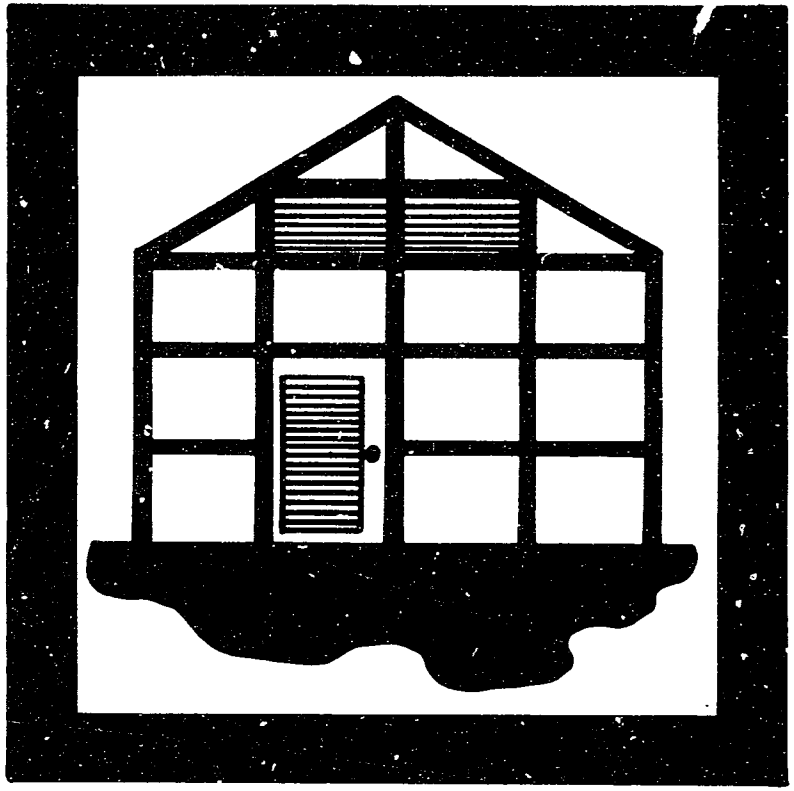
ABSTRACT

The curriculum guide (preliminary draft) is a result of the revision of the total South Carolina agricultural education curriculum; the scope of the turf and lawn management industry and its direct and indirect employment opportunities provide ample reasons for such a course offering in South Carolina high schools. The guide presents objectives, learning activities, topics, and resources related to specific units and subunits. Basic supportive units cover turfgrass and weed identification, turfgrass mechanics, pest control, soils and fertilizers, and use of a transit. Broad functional units included are the maintenance and establishment of home lawns, golf courses, athletic fields, institutional and industrial grounds, and highway roadsides. The guide is designed as a one-year course; however, it is adaptable as a two-year course by expanding units. (EA)

TURF AND LAWN MANAGEMENT



AGRICULTURAL EDUCATION

PRELIMINARY DRAFT

CURRICULUM GUIDE

Turf and Lawn Management
A Course In
Agricultural Education

A Curriculum Guide

Preliminary Draft

Prepared by:

State Department of Education
Office of Vocational Education
Agricultural Education Section
Columbia, South Carolina 29201

In Cooperation With:

Vocational Education Media Center
Clemson University
Clemson, South Carolina 29631

1973

Foreword

This curriculum guide was developed as a part of a larger project to revise the total agricultural education curriculum in South Carolina. The project was designed to implement the following changes:

- provide a more comprehensive vocational offering
- place a greater emphasis on behavioral objectives
- place a greater emphasis on learning activities
- encourage an inductive approach to teaching
- result in the re-identification of the units of instruction

Units of instruction for each course include behaviorally stated objectives, suggested learning activities a topic outline, and suggested resources.

Frank R. Stover, State Supervisor
Agricultural Education

Acknowledgements

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Mr. J. Corbett Gibson, Aiken High School, Aiken, South Carolina and Mr. Edwin C. Zahler, Horry-Georgetown Technical Education Center, Conway, S.C.

Messrs. L.J. Carter and J. Earl Frick, District Consultants of Agricultural Education, who coordinated the development of the guide.

The final copy was edited and prepared by Dr. R.J. Mercer, Vocational Instructional Materials Specialist, Vocational Education Media Center.

Illustrations were prepared by R.D. Mattox, Art Director, Vocational Education Media Center.

Contents

Rationale for the Course

A more affluent society with more leisure time, a greater concern for the esthetics of the environment and an increased interest in outdoor recreation have resulted in an almost exponential growth of the turfgrass industry in this country. Almost every individual homeowner has a lawn of some type. Almost every industry or institution has a turfgrass area. Billions of dollars are spent maintaining golf courses and athletic fields. Highway departments must establish and maintain thousands of miles of roadside grasses. According to the Turfgrass Times,[1] the national annual turfgrass maintenance expenditure for the nation was estimated to be in excess of four billion dollars (see appendix A for more complete data). These estimates do not include construction cost.

The scope of the industry and the opportunities for employment either directly or indirectly related to the industry provide ample reasons for offering a course in Turf and Lawn Management in the high schools of South Carolina.

The lack of an adequate curriculum guide adapted to the situation in South Carolina made the development of this publication necessary.

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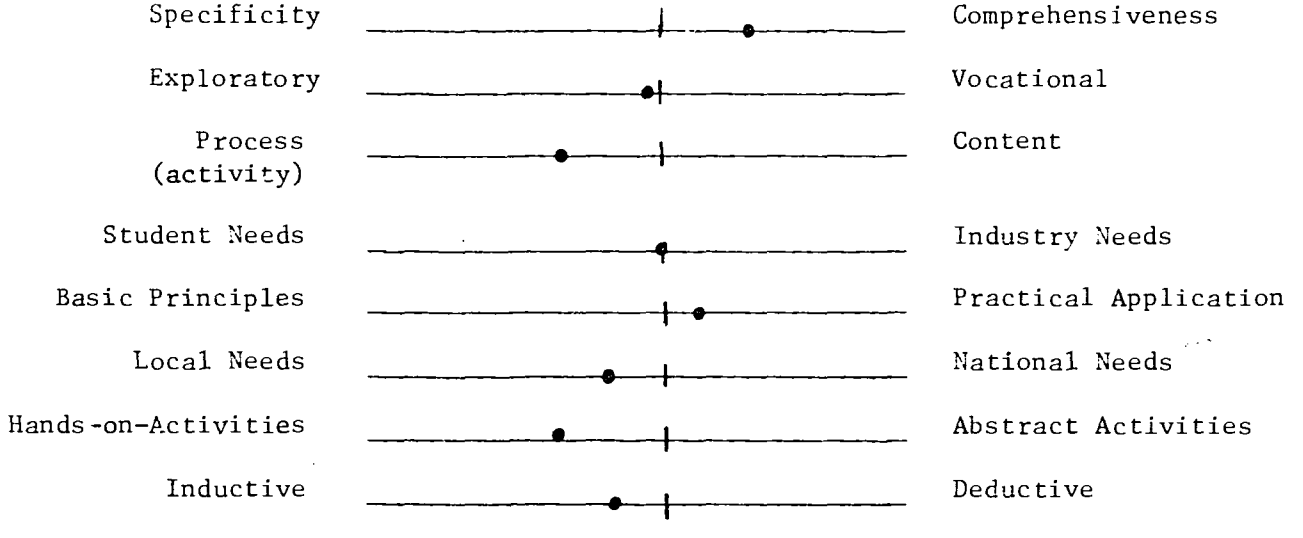
[1]"Turfgrass a Four Billion Dollar Industry," Turfgrass Times, October, 1965, p. 1. Cited by John H. Madison, Practical Turfgrass Management. New York: Van Norstrand Reinhold Company, 1971, p. 12.

Curriculum Framework

The designers of this course used the following continuums to frame their thinking as they constructed the course. The designers tried to consider both ends of these continuums. The biases of the committee are indicated below. For example, the committee felt that at the high school level they would prefer comprehensiveness to specificity. In other words, they felt that to be taking a course in turf and lawn management is specialization enough; to specialize even further by choosing only one area such as golf course turf management would represent over specialization at the high school level. Hence, as indicated by the dot on the continuum, the committee leaned toward comprehensiveness.



Curriculum Paradigm

Turf and Lawn Management

Home Lawn Maintenance and Establishment	Golf Course Maintenance and Establishment	Athletic Fields Maint. and Est.	Institutional and Industrial Grounds Maint. and Est.	Highway Roadside Maint. and Est.
	FFA, SOE, Career Exploration (1 week)			
	Turfgrass and Weed Identification (1 week)			
	Turfgrass Mechanics (4 weeks)			
	Basic Pest Control (2 weeks)			
	Basic Soils (1 week)			
	Soil Fertility and Fertilizers (2 weeks)			
	Using the Transit (1 week)			
Maintenance (5 weeks)	Maintenance (5 weeks)	Maintenance (4 weeks)	Maintenance (4 weeks)	Maintenance (2 1/2 wks.)
Career Exploration (1 week)	Career Exploration (1 week)	Career Exploration (1/2 week)	Career Exploration (1/2 week)	Career Exploration (1/2 week)
Establishment	Establishment	Establishment	Establishment	Establish-ment

Use of the Guide

This guide is not a textbook. It is, as entitled, a curriculum guide. It is not designed to provide content, but to refer to content. It is designed to ask the prior questions - what should be taught and to some degree how and with what resources. The objectives are not behavioral in the truest sense - they may be closer to goals. Hopefully they help spell out the expected outcomes of the course. It was felt that the teachers of the course can determine the "givens" of the objectives and set their own "performance standards" as needed for a particular class or individual.

The general framework of the course is problem solving. To this degree, it is a functional approach. Hopefully, most units will be taught inductively, i.e., the teacher will begin with a practical problem or project and back up to basic principles. It is also hoped that most of the learning activities will be "hands-on" type activities although the importance of vicarious learning is recognized.

This curriculum guide was designed as a one year course; however, it is felt that in some schools a two year course may be desirable. If the guide is to be used for such a course, it is recommended that each unit be expanded. The proportionate amount of time spent in each area would remain the same.

BASIC SUPPORTIVE UNITS

UNIT: Orientation to Turf and Lawn Management

OBJECTIVE(S): The student will be able to:

I. Describe in outline form the course in turf and lawn management.

II. Prepare in outline form a plan for integrating the FFA program and the course.

III. Prepare in outline form a supervised practice program which will enrich the course.

IV. Plan an occupational work experience program to complement the course in turf and lawn management.

V. Prepare a plan for exploring careers in turf and lawn management.

VI. . . . . .

UNIT: Orientation to Turf and Lawn Management

SUB-UNIT: Exploring Careers

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Describe in outline form the course in turf and lawn occupations.	I. Assign a committee to each of the major units and have them critique the unit and report their results to the class with suggestions for change.
A. List the major objective(s) of each unit.	. Observe a presentation by the instructor of the course model via overhead projection.
B. List the major learning activity(s) to be accomplished in each unit.	. . . . .
C. List the major topic(s) to be covered in each unit.	
D. List the major resources to be used in each unit.	
E.	
II. Prepare in outline form a plan for integrating the FFA program into the course in turf and lawn occupations.	II. Prepare a list of proposed turfgrass projects for the FFA.
A. List possible home or community improvement activities involving lawns or turfgrass which could become projects for the FFA.	. Enter FFA contests related to turfgrass occupations.
B. List turfgrass projects suitable for use as part of the BOAC program.	. Prepare radio or TV programs concerning turfgrass improvement projects in the local community.
C. List some of the possible radio or TV programs that could be built around turfgrass activities.	. . . . .
D. List some of the team contests that are related to the course, e.g., land identification and treatment, weed, grass or insect identification.	
E. List some of the individual contests related to the course.	
F.	

UNIT: Orientation to Turf and Lawn Management
SUB-UNIT: Exploring Careers

TOPICS	RESOURCES
I. Lawn and turfgrass occupations course. A. Objectives B. Learning activities C. Topics D. Resources, facilities, and equipment E.	I. The curriculum guide.
II. FFA as an integral part of the course. A. Committee projects relating to the environment B. Environmental projects related to the BOAC program C. Contest relating to the course . team . individual D. FFA summer camp E. TV and radio program projects F.	II. Bender, et. al. The FFA and You.

OBJECTIVES	LEARNING ACTIVITIES
III. Prepare in outline form a supervised practice program which will enrich, if not form the core of, the course. A. List at least two possible home production projects. B. List at least two possible home improvement projects related to improving the home lawn. C. List at least two supplementary farm jobs related to improvement of the home lawn. D.	III. Conduct a home production project related to turf and lawn management occupations, e.g., establishing a turfgrass area. . Perform a supplemental home or farm job related to turf and lawn occupations. . Perform a home improvement project related to lawn and turfgrass occupations, e.g., establish winter cover planting on the home grounds. . . . . .
IV. Plan an occupational work experience program to complement the course in turf and lawn occupations. A. List at least ____ work stations in your community which would provide training in occupations related to the course. B. Prepare a brief work schedule for occupational work experience at one such station. C.	IV. Make plans for and/or obtain a part-time job in a turfgrass occupation which will help prepare for a future career. . Prepare a work schedule for a chosen work station. . . . . .
V. Prepare a brief plan for exploring careers in turf and lawn management occupations. A. List at least ____ tests which can be used to analyze personal strengths and weaknesses. B. List at least ____ criteria for evaluating careers. C.	V. Ask for an interview with your guidance counselor to discuss your strengths and weaknesses. . As a class project, try to set up a list of guidelines for evaluating careers as each career area is explored during the course. . . . . .
VI.	VI. . . . .

UNIT: Orientation to Turf and Lawn Management

SUB-UNIT: Exploring Careers

TOPICS	RESOURCES
III. Integration of the supervised practice program into the course. A. Productive projects B. Home improvement projects C. Supplementary farm jobs D.	III. Miller. Supervised Practice in Vocational Agriculture. . . . . .
IV. Occupational work experience in lawn and turfgrass careers. A. Locating work experience stations B. Job schedules C.	IV. Binkley. Experience Programs for Learning Vocations in Agriculture, Chapter 31. . Fuller. Education for Agricultural Occupations. . Hoover. Handbook of Agricultural Occupations. . . . . .
V. Career explorations. A. Personal assessment . aptitudes . attitudes . skills . general competencies B. Criteria for career evaluation C.	V. Hoover. Handbook of Agricultural Occupations, Chapter 1. . . . . .
VI.	VI. . . . .

BOOKS

Bender, Ralph E.; Clark, Raymond and Taylor, Robert E. The FFA and You. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1962.

Binkley, Harold and Hammonds, Carsie. Experience Programs for Learning Vocations in Agriculture. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1970.

Byram, Harold M. Guidance in Agricultural Education. Danville, Illinois: The Interstate Printers and Publishers, Inc.

Fuller, Gerald R. Education for Agricultural Occupations. Danville, Illinois: The Interstate Printers and Publishers, Inc.

Hoover, Norman K. Handbook of Agricultural Occupations. Danville, Illinois: The Interstate Printers and Publishers, Inc., second edition, 1969.

Miller, Texton R. Supervised Practice in Vocational Agriculture. Danville, Illinois: The Interstate Printers and Publishers, Inc.

FILMS and FILM STRIPS

The Pennsylvania State University. 30 slides. Exploring Turfgrass Occupations. University Park, PA.

TRANSPARENCIES

UNIT: Turfgrass and Weed Identification

OBJECTIVE(S): The student will be able to:

I. Identify the turfgrasses more commonly used in South Carolina.

II. Identify the more common turfgrass weeds.

III. . . . . .

IT: Turfgrass and Weed Identification

3-UNIT:

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Identify the turfgrasses more commonly used in South Carolina.	I-A. As a class project, compile a list of the major grasses used as turfgrasses in South Carolina.
A. Use an identification key to identify a given grass.	. Practice drawing and/or labeling the parts of a typical grass plant.
1. Draw and/or label the parts of a typical grass plant.	. Practice drawing and labeling some of South Carolina's more commonly used turfgrasses so that variations in parts can be detected, i.e., hairy liqule vs membranous liqules, folded buds vs rolled buds, etc.
2.	. Practice using an elementary identification key.
B. Identify at least 25 of the more commonly used turfgrasses without the aid of an identification key.	B. Participate in a turfgrass identification contest.
1. Identify at least five turfgrasses commonly used on home lawns in the local community without the aid of an identification key.	. Practice identification from observing a total plot or lawn - without observing an individual plant where such identification is possible.
2. Identify at least five turfgrasses commonly used on a golf course in the local community without the aid of an identification key.	. Obtain and file a reference on turfgrass.
3. Identify without the aid of an identification key at least five grasses commonly used on athletic fields in South Carolina.	. Prepare dry mounts, pictures or slides of the more common turfgrasses.
4. Identify at least five grasses commonly used on institutional grounds in South Carolina without the aid of an identification key.	. . . . .
5. Identify without the aid of an identification key at least five grasses commonly used on highway median strips in South Carolina.	C. . . . .
6.	
C.	

UNIT: Turfgrass and Weed Identification

SUB-UNIT:

TOPICS	RESOURCES
I-A. Turfgrass . advantages . disadvantages . cultural requirements . Parts of the grass plant . stolens . rhizomes . tillers . inflorenscence . leaf . Turfgrass identification with the use of a key . Turfgrass identification without the aid of a key	I. Vengris. Lawns, pp. 5-54. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
II. Identify the more common turfgrass weeds. A. Use an identification key to identify a given grass plant. 1. Draw and/or label the parts of a typical grass plant. 2. . . . . . B. Identify at least twenty-five of the most commonly found turf weeds without the aid of an identification key. 1. Identify at least five weeds most troublesome on a local home lawn. 2. Identify at least five weeds found most troublesome on local golf courses. 3. Identify at least five weeds found most troublesome on local institutional or plant grounds. 4. Identify at least five weeds found most troublesome on local highway median strips. 5. . . . . . C. . . . . . III.	II. As a class project compile a list of the more common weeds which seriously affect turfgrasses in the state and classify them as to problem area, i.e., home lawn, golf course, etc. A. Practice drawing and/or labeling the parts of a typical weed plant. . Draw and label the parts of several of the more common weeds which cause serious damage to turfgrass in the state. . Practice using a simplified identification key to determine the identity of an unknown weed. B. Participate in a weed identification contest. . Obtain and file a reference which describes the more common turfgrass weeds. . Prepare dry mounts, pictures, or slides of the more common turfgrass weeds. C. . . . . . III. . . . .

UNIT: Turfgrass and Weed Identification

SUB-UNIT:

TOPICS	RESOURCES
II-A. Turfgrass weeds • dicotyledons . annual • perennials • monocotyledons . annual • perennials	II. Penn. State. Turfgrass Maintenance and Establishment. . Vengris. Lawns, pp. 172-198. . Clemson University. Weed of the Southern United States. . . . . .
B. The 6 most common weeds of turf. . poa annua . knot weed . crabgrass . broadleaf weeds . goosegrass . miscellaneous	
C.	
III.	III. . . . .

BOOKS

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Vengris, Jonas. Lawns. Fresno, California: Thompson Publications, 1969.

FILMS and FILM STRIPS

BULLETINS

Clemson University Extension Service, Clemson, South Carolina. Weeds of Southern United States.

TRANSPARENCIES

UNIT: Turfgrass Mechanics

SUB-UNIT: General Shop Skills

OBJECTIVE(S): The student will be able to:

I. Demonstrate the ability to perform general shop skills.

II. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Demonstrate the ability to perform general shop skills.	I. Observe demonstrations of and/or practice the safe and appropriate use of the more commonly used hand wood-working tools.
A. Select and properly use the more commonly used hand wood-working tools, e.g., the handsaw, plane, etc.	. Observe demonstrations of and/or practice the safe and appropriate use of the more commonly used metal-working or mechanics tools.
B. Select and use the more commonly used metal-working or mechanics tools, e.g., wrenches, tap and die die sets, etc.	. Observe demonstrations of and/or the selection, adjustment and safe operation of and/or practice the safe and appropriate use of the more commonly used power tools.
C. Select, adjust and operate basic power tools, e.g., power saws, electric drills, etc.	. Observe demonstrations of and practice the safe and appropriate use of electric welder for very simple welding tasks.
D. Weld an acceptable flat beed using an electric welder.	. Observe demonstrations of and practice the safe and appropriate use of the oxyacetylene welder for performing very simple cuts and welds.
E. Perform an acceptable cut and weld a flat beed using an oxyacetylene welder.	. Construct a simple wood-working project.
F.	. Construct a simple metal-working project.
II.	II. . . . .

UNIT: Turfgrass Mechanics

SUB-UNIT: General Shop Skills

TOPICS	RESOURCES
I. Basic shop skills A. Hand tools . woodworking . selection . use . care . . . . metal working . selection . use . care . . . . . . B. Basic power tools . selection . adjustment and use . safety . . . . . . C. Electric welder . use . safety	I. Wakeman. The Farm Shop. . Griffin and Others. Basic Oxyacetylene Welding. . O'Brien. Farm Shop Demonstrations. . Film. ABC'S of Hand Tools. . Films, Filmstrip, Transparencies – (Stanley Tool Company offers instructional materials concerning the use of hand tools and power equipment) . . . . .
II.	II. . . . .

Resources

General Shop Skills

BOOKS

Griffin, Ivan and Roden, Edward M. Basic Oxyacetylene Welding. Albany, NY: Delmar Publishers, 1960.

O'Brien, Michael. Demonstrations for Farm Mechanics. Danville, Illinois: The Interstate Printers and Publishers.

Wakeman, T.J. and McCoy, Vernon. The Farm Shop. New York: The MacMillan Company, 1960.

FILMS and FILM STRIPS

The Stanley Works, New Britain Conn. 06050 (This company offers a variety of audio-visual aids and transparencies on both hand and power tools)

BULLETINS

TRANSPARENCIES

UNIT: Turfgrass Mechanics

SUB-UNIT: Small Gasoline Engines

OBJECTIVE(S): The student will be able to:

I. Select an appropriate engine for a given purpose.

II. Show by diagrams the principles of the small gasoline engine and its major systems.

III. Disassemble, identify worn parts, repair or replace such parts and reassemble each of the major systems of a typical small gasoline engine.

IV. Tune up a typical small gasoline engine.

V. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Select an appropriate engine for a given purpose. A. Compare and contrast small gasoline engine systems. 1. Compare and contrast horse power ratings. 2. Compare and contrast carburetor systems. 3. Compare and contrast ignition system. 4. Compare and contrast starting system. 5. . . . . . B. List the advantages and disadvantages of a given engine for a given purpose. C.	I. As a class project, prepare a classification chart comparing various types and sizes of small gasoline engines. . . . . .
II. Diagram the operational principles of the small gasoline engine and its systems. A. Diagram and/or label the strokes of a four cycle engine. B. Diagram and/or label the strokes of a two cycle engine. C. Illustrate by diagram the basic principle upon which a typical carburetor works. D. Illustrate by diagram the basic principles upon which an ignition system works. E. Illustrate by diagram the basic principles upon which the lubrication system operates.	II. Practice drawing and labeling the strokes of a 2 and 4 cycle engine. . Diagram the basic principles of a typical carburetor. . Diagram the basic principle of a typical ignition system. . Diagram the basic principle of a typical lubrication system. . Diagram the basic principle of the air cooling system. . . . . .

UNIT: Turfgrass Mechanics

SUB-UNIT: Small Gasoline Engine

TOPICS	RESOURCES
I. Engine selection. A. Combustion comparison . 2 cycle . 4 cycle . . . . . . B. Type carburetor comparison. . bowl . vacuum . . . . . . C. Type ignition comparison. . magneto . battery generator . . . . . . D.	I. AAVIM. Small Gasoline Engines, Vol. 1. . AAVIM. Small Gasoline Engines, Vol. 2. . . . . .
II. Working principles. A. 4 cycle engine B. 2 cycle engine C. Carburetor D. Ignition E. Lubrication F.	II. AAVIM. Small Gasoline Engines, Vol. 1. . AAVIM. Small Gasoline Engines, Vol. 2. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
III. Disassemble, identify worn parts, repair or replace such parts and reassemble each of the major systems of a typical small gasoline engine.	III. Observe a demonstration of and/or disassemble, identify worn parts, repair or replace such parts and reassemble each of the major systems of a typical small gasoline engine.
A. Disassemble, identify worn parts, repair or replace such parts, and reassemble the ignition system of a typical small gasoline engine.	. A. Observe a demonstration of and/or disassemble, identify worn parts, repair or replace such parts and reassemble the ignition system of a typical small gasoline engine.
B. Disassemble, identify worn parts, repair or replace such parts, and reassemble the carburetion system of a typical small gasoline engine.	B. Observe a demonstration of and/or disassemble, identify worn parts, repair or replace such parts and reassemble the carburetion system of a typical small gasoline engine.
C. Disassemble, identify worn parts, repair or replace such parts, and reassemble the block of a typical small gasoline engine.	C. Observe a demonstration of and/or disassemble, identify worn parts, repair or replace such parts, and reassemble the block of a typical small gasoline engine.
1. Remove, grind to specifications and replace intake and exhaust valve.	. Remove, grind to specifications and replace intake and exhaust valves.
2. Remove and replace rings according to specifications.	. Remove and replace rings.
3. Remove and replace a piston and rings on a typical small gasoline engine.	. Remove and replace piston and rings.
4.	. Remove and replace crankshaft, connecting rod and bearing.
D.	. . . . .

UNIT: Turfgrass Mechanics

SUB-UNIT: Small Gasoline Engine

TOPICS	RESOURCES
III. Small engine repair. . ignition system . carburetor . block . rings . piston and rings . piston, rings and bearing	III. Manufacturer's manual. . VEMC. Small Gasoline Engine - Ignition System Repair. . VEMC. Small Gasoline Engine - Bowl-type Carburetor Repair. . AAVIM. Small Engines Vol.1. . AAVIM. Small Engines Vol. II. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
IV. Tune up a typical small gasoline engine. A. Adjust a carburetor according to specifications for maximum performance. B. Adjust the timing according to specifications for maximum performance. C.	IV. Practice carburetor adjustment. . Practice point and timing adjustments. . . . . .
V.	V. . . . .

UNIT: Turfgrass Mechanics
SUB-UNIT: Small Gasoline Engine

TOPICS	RESOURCES
IV. Small engine tune up. . adjusting carburetor . adjusting timing	IV. Owner's manual. . AAVIM. Small Engines Vol. 1. . AAVIM. Small Engines Vol. II. . VEMC. Small Gasoline Engines Bowl-type Carburetor Repair. . VEMC. Small Gasoline Engines - Ignition System Repair. . . . . .
V.	V. . . . .

Resources

Small Gasoline Engine

BOOKS

American Association for Vocational Instructional Materials. Small Engines Vol. I. Athens, GA: The Association, 1971.

American Association for Vocational Instructional Materials. Small Engines Vol II. Athens, GA: The Association, 1971.

Vocational Education Media Center. Small Gasoline Engines - Bowl-type Carburetor Repair. Clemson, S.C.: The Center, 1972.

Vocational Education Media Center. Small Gasoline Engines - Ignition System Repair. Clemson, S.C.: The Center, 1972.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

UNIT: Turfgrass Mechanics

SUB-UNIT: Equipment Selection and Repair

OBJECTIVE(S): The student will be able to:

I. Select appropriate equipment for a given task.

II. Diagram the working principles of a given piece of equipment.

III. Make minor repairs on a given piece of turfgrass equipment.

IV. Disassemble, identify worn parts, repair and replace such parts, and reassemble a given piece of turfgrass equipment (exclusive of the engine)

V. Plan a daily maintenance program for a given piece of turfgrass equipment.

VI. . . . . .

OBJECTIVES

The student will be able to:

I. Select appropriate equipment for a given task.

   A. Select equipment based on effectiveness of such equipment to perform a given task.

   B. Select equipment based on the economic considerations.

      1. Compare and contrast cost of equipment based on such factors as depreciation, interest on investment, original costs, etc.

      2. Determine the anticipated yearly cost of a given piece of equipment.

      3. . . . . .

II. Diagram the working principles of a given piece of turfgrass equipment exclusive of the engine.

   A. Illustrate by drawing the working principles of a typical reel type mower.

      1. Diagram the cutting surface.

      2. Diagram the system of power transfer.

      3. . . . . .

   B. Illustrate by drawing the working principles of a typical rotary tiller.

      1. Diagram the mechanical action of the prongs.

      2. Diagram the system of power transfer.

      3. . . . . .

LEARNING ACTIVITIES

I. If feasible, visit a local golf course(s) and inventory the equipment used.

. If feasible, visit a large university(s) and inventory the equipment used for establishing and maintaining turfgrass.

. If feasible, visit a highway department district warehouse and inventory the equipment used to maintain highway median strips.

. Compile a report of types of lawn establishment and mowing equipment used or has been used by members of the class.

. Obtain catalogs or brochures from commercial concerns.

. Practice the use of a mechanic formula to determine the wisdom of purchasing a piece of equipment.

. Invite sales people to demonstrate equipment.

. . . . . .

II. Diagram the working principles of a typical reel type mower.

. Diagram the working principle of a typical rotary tiller.

. . . . . .

UNIT: Turfgrass Mechanics

SUB-UNIT: Equipment Selection and Repair

TOPICS	RESOURCES
I. Equipment selection A. Based on effectiveness B. Based on economics C.	I. Turfgrass machinery and equipment companies, e.g., Briggs and Straton. . Local equipment dealers. . Local equipment users, e.g., golf course superintendents, university groundskeepers, etc. . Hauker and Keenlyside. Horticultural Machinery. . . . . .
II. Equipment design A. Reel mower design B. Rotary tiller design C.	II. (See above references - especially Horticultural Machinery, pp. 114-132.)

OBJECTIVES	LEARNING ACTIVITIES
III. Make minor repairs on a given piece of turfgrass equipment. A. Recognize the need for minor repair. B. Sharpen or replace mower blades. C. Recognize and repair or replace easily accessable worn parts. D. Tighten or replace missing bolts, screws, etc. E.	III. Observe demonstrations of and/or replace and sharpen mower blades. . . . . .
IV. Disassemble, identify worn parts, repair or replace worn parts, and reassemble a given piece of turf equipment. (exclusive of the engine) A. Disassemble, identify worn parts, repair or replace such parts and reassemble a reel type mower. B. Disassemble, identify worn parts, repair or replace such parts and reassemble a typical fertilizer distributor. C.	IV. Observe demonstrations of and/or disassemble, identify worn parts, repair and replace such parts and reassemble a reel type mower and a fertilizer applicator. . . . . .

UNIT: Turfgrass Mechanics

SUB-UNIT: Equipment Selection and Repair

TOPICS	RESOURCES
III. Minor equipment repair A. Recognition of need B. Minor repairs . tightening or replacing bolts . sharpening blades, etc. . . . . . . C.	III. Owner's or manufacturer's manuals. . Hawker and Keenlyside. Horticultural Machinery. . . . . .
IV. Major repairs of selected equipment . disassembly . identification, repair and replacement of worn parts . reassembly	IV. Owner's or manufacturer's manuals. . Hawker and Keenlyside. Horticultural Machinery. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
V. Plan a daily maintenance program for a given piece of turf equipment. A. Identify the lubrication points. B. Select an appropriate lubricant. 1. List the functions of greases and oils. 2. Compare and contrast different types of greases and oils. 3. List at least one source of information giving lubrication recommendations. 4. List factors which affect the selection of a lubricant. 5. . . . . . C. Interpret a lubrication schedule given in an owner's manual. D. . . . . . VI.	V. Observe demonstrations of and perform the daily maintenance on the more commonly used turfgrass equipment. . Obtain and file a recommended daily maintenance program. . Obtain and file a U.S. Standards classification and recommended grades of oils. . Observe demonstrations of oil viscosity as it relates to temperature. . Obtain and file a grease specification chart. . Obtain and file a manufacturer's recommended lubrication schedule for the major turfgrass equipment. . . . . . . VI. . . . .

UNIT: Turfgrass Mechanics
SUB-UNIT: Equipment Selection and Repair

TOPICS	RESOURCES
V. Daily maintenance • locating points of lubrication • selecting lubricant . functions of greases and oils . reducing friction . sealing . cooling . cushioning . . . . SAE oil classification . heavy duty . motor severe . . . . types of greases . cup grease . . . . lubrication schedule . . . . . . VI.	V. AAVIM. Selecting and Storing Tractor Fuels and Lubricants. . . . . . . VI. . . . .

Equipment Selection and Repair

BOOKS

American Association for Vocational Instructional Materials. Selecting and Storing Tractor Fuels and Lubricants. Athens, GA: The Association, 1970.

Hawker, M.F.J. and Keenlyside. Horticultural Machinery. London: McDonald Technical and Scientific, 1971.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

UNIT: Basic Turfgrass Pest Control

OBJECTIVE(S): The student will be able to:

I. Recommend procedures for controlling the more common turfgrass insect problems.

II. Recommend procedures for controlling the more common turfgrass weed problems.

III. Recommend procedures for controlling nematodes which seriously damage turfgrasses.

IV. Recommend procedures for controlling small animals which cause damage to turfgrasses.

V. Recommend procedures for controlling diseases which attack turfgrasses.

VI. . . . . .

OBJECTIVES

The student will be able to:

I. Recommend procedures for the more common turf insect problems.

A. List the ___ insects which cause serious damage to turfgrasses.

1. Classify those insects according to types of turfs they are more prone to damage.
2. Classify these insects according to their feeding habits, i.e., chewing, sucking, etc.
3. Classify these insects according to life cycle in which the greatest damage occurs, i.e., pupa, larva, etc.
4. Site at least one reference on turfgrass insects.
5. . . . .

B. Identify the ____ insects which cause serious damage to turfgrasses.

1. Use a key to determine the identity of a given insect.
2. Draw and label the parts of a typical insect.
3. Recognize insects by the damage caused.
4. . . . . .

LEARNING ACTIVITIES

I. As a class project, compile a list of the more common turfgrass insects.

A. Classify the more common turfgrass insects according to the types of turfs they are more prone to damage, i.e., home lawns, golf courses, etc.

. Classify the more common turfgrass insects according to their feeding habits, i.e., chewing, sucking, etc.

. Classify the more common turfgrass insects according to the life cycle in which the greatest damage occurs, i.e., pupa, larva, etc.

. Obtain and file a reference on turfgrass insects.

. . . . . .

B. Draw and label the parts of the typical insect.

. Obtain and use a simplified turfgrass identification key.

. Observe actual damage or pictures of damage caused by the more common turfgrass insects.

. Participate in an insect identification contest.

. Obtain specimens of turfgrass insects.

. . . . . .

UNIT: Basic Turfgrass Pest Control

SUB-UNIT:

TOPICS	RESOURCES
I. Insects A. Turfgrass insects . chinch bugs . grubs . scales . army worms . sod web worms . ticks	I. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 87-99. . Musser. Turfgrass Management, pp. 243-260. . Hanson and Juska. Turfgrass Science, pp. 336-359. . Wise. The Lawn Book, pp. 205-224. . University of California. Turfgrass Pest, pp. 31-41. . Bulletin. Lawn Insects. . Bulletin. Better Lawns. . . . . .
B. Identification 1. Identification by key 2. Identification by damage caused 3. Labeling parts 4.	

OBJECTIVES	LEARNING ACTIVITIES
C. List the more common chemicals used for turf insect control. 1. Classify chemicals as to their danger to humans. 2. Classify these chemicals as to their usual form of application. 3. Classify these chemicals as to the types of insect controlled, i.e., chewing, sucking, etc. 4.	C. Prepare and/or obtain and file charts showing recommended insect control chemicals. . . . . .
D. Select an effective control for a given insect or insects which cause serious damage to turfs.	D. Practice using charts to determine control measures for various turfgrass insects.
E.	E. . . . .

UNIT: Basic Turfgrass Pest Control

SUB-UNIT:

TOPICS	RESOURCES
C. Controls 1. Insecticide safety 2. Form of application 3. Types of insects controlled . chewing . sucking	C. See references on preceding page.
D. Control selection	D. See references on preceding page.
E.	E. . . . .

UNIT: Basic Turfgrass Pest Control
SUB-UNIT:

OBJECTIVES	LEARNING ACTIVITIES
II. Recommend control procedures for the more common weeds which cause serious damage to turfs.	II-A. List the weeds which cause problems on the home lawn.
A. List the weeds which cause serious damage to turfgrasses.	. Visit a home lawn or other turfgrass area to observe weed problems.
1. Classify these weeds according to the type of turf in which they are most apt to be a problem.	. Prepare a collection of weeds which are a problem on local turf and dry mount them.
2. Classify these weeds according to type, i.e., annuals, perenials, grasses, legumes, broadleaves, etc.	. Make a collection of pictures of local turfgrass weeds.
3. List at least one turfgrass publication which lists the major weed problems.	. . . . .
4.	
B. Identify the ____ weeds which cause serious damage to turfgrasses.	B. See unit on Turfgrass and Weed Identification.
1. Use a key to determine the identity of a given weed.	
2. Draw and label the parts of a typical broadleaf weed.	
3. Draw and label the parts of a typical grass.	
4.	
C. List the major means of weed control, i.e., chemical, mechanical, etc.	C. Obtain and file a reference chart which gives recommended control measures for turfgrass weeds,
1. Classify the ____ weeds which cause serious damage to turfgrasses according to means of control.	. List the more common turfgrass weeds and classify according to means of control.
2.	. . . . .

UNIT: Basic Turfgrass Pest Control

SUB-UNIT:

TOPICS	RESOURCES
II. Weeds A. Classification 1. Weedy grasses . nutgrass . crowsfoot . crabgrass . barnyard grass . . . . . . 2. Broadleaf weeds . dandelion . plantain . dock . henbit . chickweed . sandspur . wild onions . garlics . . . . . . 3. Clovers B. Identification C. Controls methods 1. Chemical . pre-emerge . post-emerge . . . . . . 2. Mechanical . mowing . . . . . . 3.	II. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 55-83. . Musser. Turf Management, pp. 189-213. . Manual: Turfgrass. . Bulletin: Weeds of the Southern United States. . Bulletin: Chemical Weed Control for Turfgrass. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
D. List the more commonly used chemicals for controlling weeds which cause serious damage to turfgrasses. 1. Classify these chemicals according to danger to humans. 2. Classify these chemicals according to their usual form of application, i.e., solid, liquid, gas, etc. 3. Classify these chemicals according to their method of control, i.e., systems, etc. 4. Classify these chemicals according to the type of weed controlled, i.e., grasses, broadleaves, etc. 5.	D. Obtain and file a reference chart which gives recommended chemical controls for turfgrass weeds. • Obtain and file a reference which rates chemicals according to damage to humans. • Classify the more commonly used turfgrass weed control chemicals according to their usual form of application. • Classify the more commonly used turfgrass chemicals according to the type of weed control, i.e., grasses, broadleaf, etc. . . . . .
E. Select an effective control or controls for a given weed. F.	E. Obtain and file a reference which gives recommended controls for turfgrass weeds. . . . . . . F. . . . .

UNIT: Basic Turfgrass Pest Control

SUB-UNIT:

TOPICS	RESOURCES
D. Chemical weed controls 1. Danger to humans 2. Classification as to means of application . solids . liquids . gases . . . . . . 3. Classification as to type of weed control . selective grasses . broadleaf . . . . . . 4.	D. Wise. The Lawn Book, pp. 225-246. . Hanson and Juska. Turfgrass Science, pp. 240-282. . . . . .
E. Control selection	E. (see preceding references)
F.	F. . . . .

OBJECTIVES	LEARNING ACTIVITIES
III. Control or eliminate nematodes which seriously damage a given turf. A. Recognize damage caused by nematodes. B. Select an appropriate means of control. C. Apply a nematode treatment according to specifications given by the manufacturer. 1. List the steps in treating a plot of soil with methol bromide. 2. List the safety hazards involved in applying methol bromide. 3. . . . . . D.	III. Observe a demonstration of and/or treat a small plot of soil for nematodes and weeds using a soil sterilant such as methol bromide. . Observe actual or pictures of turfgrass damage resulting from nematodes. . Obtain and file a reference on nematode control. . . . . .
IV. Control or eliminate damage to turfgrasses cuased by small animals. A. List the small animals which often cause serious damage to turfgrasses. B. Name the animal which caused a given problem from observing the type of damage. C. Select an appropriate control measure for a given small animal. 1. List at least one method of eliminating a mole. 2. List at least one method of controlling rabbits. 3.	IV. Observe a demonstration of and/or bait a turfgrass area for moles. . . . . .

IT: Basic Turfgrass Pest Control

B-UNIT:

TOPICS	RESOURCES
III. Nematode control A. Types B. Diagnosis C. Controls	III. Hanson and Juska. Turfgrass Science, pp. 360-367. . Musser. Turf Management, pp. 257-258. . Wise. The Lawn Book, pp. 199-203. . University of California. Turfgrass Pest, pp. 38-41. . . . . .
IV. Small animal control A. Moles B. Rabbits C.	IV. (see the above references)

OBJECTIVES	LEARNING ACTIVITIES
V. Control or eliminate the more common diseases which damage turfgrasses. A. List the ____ most common diseases which attack turfgrasses. 1. Classify these diseases as to type. 2. Classify these diseases as to grasses most susceptible. 3. . . . . . B. Identify the ____ most common diseases from specimens or pictures. C. List the major methods of control. D. Select an appropriate control for a given disease. VI.	V. Collect specimens of diseased grasses. . Make a picture collection of diseased grasses. . Participate in a disease identification contest. . Obtain and file references which help identify and prescribe control measures. . . . . . . VI. . . . .

UNIT: Basic Turfgrass Pest Control

SUB-UNIT:

TOPICS	RESOURCES
V. Turfgrass disease control	V. Hanson and Juska. Turfgrass Science, pp. 288-330.
A. Turfgrass diseases	. . . . .
. dollar spot . brown patch . fairy ring . pythium blight . powdery mildew	
B. Identification	
. symptoms . microscopic	
C. Control methods	
D. Control selection	
E.	
VI.	VI. . . . .

Basic Turfgrass Pest Control

BOOKS

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, 1969.

Musser, Burton H. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Wise, L.N. The Lawn Book. Decatur, GA: Bowen Press, Inc., 1961.

BULLETINS

Clemson University, Chemical Weed Control for Turfgrasses, Clemson University Extension Service, Clemson, S.C.

Clemson University, Weeds of the Southern United States, Clemson University Extension Service, Clemson, S.C.

Dupont. Professional Turf Manual. E.I. Dupont, DeNemours, Denemours Building, Wilmington, DE.

USDA. Better Lawns. Bulletin No. 51. U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. 20402.

USDA. Lawn Diseases. Garden Bulletin No. 61, U.S. Government Printing Office, Washington, D.C. 20402.

USDA. Lawn Insects. Garden Bulletin No. 53, U.S. Government Printing Office, Washington, D.C. 20402.

University of California. Turfgrass Pests. Manual 41. Agricultural Publications, University of California, Berkeley, California.

FILMS and FILM STRIPS

TRANSPARENCIES

UNIT: Basic Soils

OBJECTIVE(S): The student will be able to:

I. Evaluate a given soil in terms of its ability to support a turfgrass.

II. Modify a given soil to accomplish a given purpose.

III. . . . . .

IT: Basic Soils
3-UNIT:

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Evaluate a given soil in terms of its ability to support a turfgrass.	I. Observe demonstrations of and classify soils according to eight major classes of land.
A. Classify a given soil in terms of its characteristics.	A. Practice judging topsoil thickness, texture, structure, permeability and drainage.
1. Classify a given site according to the eight land classes.	. Practice determining slope.
a. Classify the topsoil as to its thickness, texture and structure on a 3 point scale.	. Participate in a land judging contest.
b. Classify the subsoil by such characteristics as thickness, texture, structure, drainage, permeability, etc.	. Prepare soil profile tubes.
c. Determine the slope of a given site.	. . . . .
d.	
2. Diagram a given soil profile.	
3.	
B. List the desirable characteristics of a given turfgrass soil.	B. Prepare a soil profile tube representing desirable soil structures for given uses, i.e., home lawn, golf course green, athletic field, etc.
1. List the characteristics of a given turfgrass soil.	. . . . .
2. List the characteristics of a desirable soil for an athletic field.	
3.	

UNIT: Basic Soils

SUB-UNIT:

TOPICS	RESOURCES
I. Soil evaluation. A. Soil identification and classification. 1. Topsoil . thickness . texture . structure . . . . . . 2. Subsoil . thickness . texture . structure . consistency . drainage . permeability 3. Slope 4. . . . . . B. Special criteria for evaluating turf soils. 1. Compaction 2. Drainage 3. Surface runoff 4.	I. Local soil conservationist. . Circular. Soil Judging and Land Treatment. . Hanson and Juska. Turfgrass Science, pp. 80-129. . Musser. Turf Management, pp. 10-33. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
II. Modify a given soil to accomplish a given purpose, e.g., improve drainage, improve aeration, improve structure, etc. A. List at least ____ methods of modifying a given soil for a given purpose. 1. List at least ____ means of modifying top-soil structure on a given soil to be used for a football field. 2. List at least ____ means of modifying a topsoil structure of a given soil to be used as a golf course green. 3. . . . . . B. Compare and contrast the use of various soil amendments used to modify soils, e.g., sawdust, peat, green-manure crops, etc. C. . . . . . III.	II. As a class project or demonstration, modify a soil plot using various amendments, i.e., sawdust humus, clay, etc. . Prepare soil profile tubes using various amendments and compare them by adding given amounts of water to observe drainage characteristics. . . . . . . III. . . . .

UNIT: Basic Soils

SUB-UNIT:

TOPICS	RESOURCES
II. Soil amendments. A. Materials available . sand . peat moss . sawdust . ground bark . clay . . . . . . B. Function of amendments . sand - drainage . clay - water holding ability	II. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 127-129. . Hanson and Juska. Turfgrass Science, pp. 151-186. . . . . .
III.	III. . . . .

Resources

Basic Soils

BOOKS

Hanson, A.A. and F.V. Juska. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, 1969.

Musser, Burton H. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

FILMS and FILM STRIPS

BULLETINS

Clemson University Extension Service. Soil Judging and Land Treatment. Circular 390. Clemson, South Carolina 29631.

TRANSPARENCIES

UNIT: Soil Fertility and Fertilizers

OBJECTIVE(S): The student will be able to:

I. Determine the nutritional needs of a given turfgrass.

II. Determine the nutrients in a given soil.

III. Compare and contrast different analysis of fertilizers.

IV. Prevent fertilizer burn on a given turfgrass.

V. . . . . .

IT: Soil Fertility and Fertilizers

B-UNIT:

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Determine the nutritional needs of a given turfgrass. A. List the essential elements of plant growth. 1. List those which are classified as trace and generally need not be added to a soil, e.g., iron. 2. List those which are sometimes needed, e.g., potassium. 3. List those which are frequently needed, e.g., nitrogen. B. List at least one reference which gives the nutritional requirements of grasses. C. Identify the more common element deficiency symptoms on a typical grass plant. D.	I. Compile a list of the elements essential for plant growth and classify them as elements usually available and those which usually must be supplied. . Obtain and file a reference which gives fertilizer recommendations for turfgrasses. . Practice the identification of element deficiency symptoms from observing actual deficient plants or color pictures of such plants. . . . . .

UNIT: Soil Fertility and Fertilizers

SUB-UNIT:

TOPICS	RESOURCES
I. Essential nutrients for turfgrasses. A. Essential nutrients for plant growth 1. Major nutrients 2. Minor (trace) nutrients 3. Topdressing 4. Liming 5. Deficiency symptoms 6.	I. Hanson and Juska. Turfgrass Science, pp. 130-149. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
II. Determine the available nutrients in a given soil. A. Take a soil sample. B. Interpret a soil sample report. C. State the effect of pH on the availability of a given element. D. State the effect of weather on the availability of a given element. E. State the effect of soil micro-organisms on the availability of a given element - especially nitrogen. F.	II. Observe a demonstration of and/or take a soil sample from a typical turfgrass plot. . Practice interpreting soil sample reports. . Observe administration of and/or perform a pH test of a soil using a soil testing kit. . . . . .
III. Compare and contrast different sources and analysis of fertilizers. A. Compare and contrast liquid vs soil forms of nitrogen for application on a given turf. B. Compare and contrast various forms of nitrogen, e.g., nitrate of soda vs ammonium nitrate, etc. C. Compare and contrast various analysis of complete fertilizers, e.g., 5-10-10 vs 3-9-9, etc. D. Compare and contrast various concentrations of fertilizers, e.g., 5-10-10 vs 10-20-20, etc. E.	III. Obtain and file a reference chart which compares different forms of nitrogen according to its usual form of application, rate of availability to grasses, rate of teaching, influence on soil pH, and cost per unit. . Obtain cost figures on low and high analysis fertilizers and compare per unit cost. . Set up fertilization experiments to compare different forms of nitrogen - rate of availability, rate of teaching - effect on pH. . . . . .

UNIT: Soil Fertility and Fertilizers

SUB-UNIT:

TOPICS	RESOURCES
II. Determining nutrient level in a soil. 1. Taking soil samples 2. Interpreting sample reports 3.	II. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 38-44. . . . . .
III. Fertilizer source comparison. 1. Inorganic vs organic 2. Solid vs liquid forms 3. Concentrate vs low analysis 4.	III. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 44-48. . Wise. The Lawn Book, pp. 107-130. . Musser. Turfgrass Management, pp. 34-49.

OBJECTIVES	LEARNING ACTIVITIES
IV. Prevent fertilizer burn on a given turfgrass. A. Describe in writing the symptoms of fertilizer burn. B. Describe in writing or show by drawing what happens when a salt such as fertilizer is placed next to a semi-permeable membrane such as a cell wall containing water. C.	IV. Observe a demonstration and/or set up a demonstration simulating fertilizer burn through the use of a salt solution and a water filled semi-permeable membrane. . Observe actual fertilizer burn on a turfgrass plot. . . . . .
V.	V. . . . .

UNIT: Soil Fertility and Fertilizers

SUB-UNIT:

TOPICS	RESOURCES
IV. Fertilizer burn. 1. Symptoms 2. Causes 3.	IV. Dupont. Professional Turf Manual, pp. 24-25. . . . . .
V.	V. . . . .

Soil Fertility and Fertilizers

BOOKS

Hanson, A.A. and F.V. Juska. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, 1969.

Musser, Burton H., Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Wise, L.N. The Lawn Book. Decatur, GA: Bowen Press, Inc., 1961.

FILMS and FILM STRIPS

BULLETINS

E.I. Dupont DeNemours Co., Professional Turf Manual. DeNemours Building, Wilmington, Deleware.

TRANSPARENCIES

UNIT: Using a Transit

OBJECTIVE(S): The student will be able to:

I. Layout a contour using a transit.

II. Determine slope using a transit.

III. Square corners using a transit.

IV. Determine evenness of a surface using a transit.

V. . . . . .

IT: Using a Transit

3-UNIT:

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Layout a contour using a transit.	I. Observe demonstrations of and/or practice laying out contours using a transit.
A. Level a transit.	. . . . .
B. Stake out a given contour line using a transit.	A. Observe demonstrations of and/or practice leveling a transit.
C.	. Observe demonstrations of and/or practice staking out a contour using a transit.
II. Determine a slope using a transit.	. Practice drawing a contour map to scale.
III. Square corners using a transit.	II. Observe a demonstration of and/or practice using a transit to determine slope.
IV. Determine evenness of a surface using a transit.	. . . . .
V.	III. Observe a demonstration of and/or practice laying out square corners using a transit.
	. . . . .
	IV. Observe a demonstration of and/or determine the evenness (levelness) of a surface using a transit.
	. . . . .
	V. . . . .

UNIT: Using a Transit

SUB-UNIT:

TOPICS	RESOURCES
I. Measurement of linear distance. a. breaking tape - (measurements of horizontal distance on slopes) b. temperature correction c. incorrect tape length correction	I. Breed. Surveying. . Brinker. Elementary Surveying. . Davis and Kelley. Surveying Theory and Practice. . Kissam. Surveying Practice.
II. Introduction to the level. a. level care b. level knobs c. leveling the level head d. reading the level rod e. setting the level fieldnotes f. small level net field project	II. See above references.
III. Introduction to transit. a. transit care b. transit knobs and adjustments c. setting up the transit d. reading the vernier e. turning deflection angles f. reading compass g. calculating bearings from deflection angles h. measurement of slope and verticle angles i. D.M.D. j. stadia	III. See above references.
IV.	IV. See above references.
V.	V. . . . .

Using a Transit

BOOKS

Breed, Charles B. Surveying. New York: J. Wiley and Sons, Inc., 1942.

Brinker, Russell C. Elementary Surveying. Scranton, PA: International Textbook Co., 1970.

Davis, Raymond E. and Kelley, Joe W. Elementary Plane Surveying. New York: McGraw-Hill, 1967.

Kissam, Phillip. Surveying Practice. New York: McGraw-Hill, 2nd ed., 1971.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

HOME LAWN MAINTENANCE AND ESTABLISHMENT

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Home Lawn Maintenance

OBJECTIVE(S): The student will be able to:

I. Plan and conduct a maintenance program for a given home lawn.

II. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Plan and conduct a maintenance program for a given home lawn.	I. Prepare an elementary plan for the maintenance of a home lawn.
A. Plan a mowing program for a given home lawn.	A. Prepare a mowing schedule for a typical year for a given typical home lawn
1. List _____ criteria for evaluating the mowing program of a given lawn.	. Obtain and file a reference which gives recommended mowing height and frequency for a given variety of turfgrass
a. Recognize the effects of improper mowing.	. ...
b. List at least one reference which gives recommended mowing procedures for a given turfgrass.	
c. ...	
2. Select an appropriate mowing height for a given lawn.	
3. State a rule-of-thumb for determining the amount of cut to take per mowing.	
4. Illustrate, by drawing, a typical mowing pattern for a given home lawn.	
a. List _____ reasons for mowing according to a set pattern.	
b. ...	
5. ...	
B. Select an appropriate lawn mower for mowing a given home lawn.	B. Observe demonstration and/or use various mower types for comparative purposes
1. Compare and contrast reel vs. blade type mowers for a given lawn condition.	. Obtain and file brochures, pictures and given information about various mowers
2. Compare and contrast self propelled vs. hand pushed models.	. Obtain and file cost information on various home mowers
3. ...	. Ask local lawn mower equipment salesmen to demonstrate their mowers
	. ...

UNIT: Home Lawn Maintenance and Establishment
SUB-UNIT: Home Lawn Maintenance

TOPICS	RESOURCES
I. Home lawn mowing	
A. When to mow	I-A. Voykin. A Perfect Lawn The Easy Way, pp. 30, 64, 78, 63, 40.
. Amount of cut per mow	. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 48-52.
. Mowing height	. Sunset. Lawns and Ground Covers, pp. 42-9.
. Mowing patterns	. Bulletin: USDA. Better Lawns.
. . . .	. . . .
B. Mower selection	B. Carleton, Milton P. Your Lawn: How to Make It and Keep It, Chapter 14.
. Reel type	. . . .
. Rotary type	
. Self propelled	
. Large wheel type	
. . . .	

OBJECTIVES	LEARNING ACTIVITIES
C. Adjust and operate a given lawn mower. 1. List the safety hazards involved in operating lawn mowers. 2. List the major adjustments on a given lawn mower. 3. ...	C. Observe demonstrations of safe and unsafe mower operation . Observe transparencies on safe lawn mower operation . Observe demonstrations of and/or adjust some of the more commonly used lawn mowers . . . .
D. Maintain a given lawn mower. 1. Prepare a maintenance checklist. 2. Use a maintenance checklist. a. Determine oil level. b. Locate parts to be lubricated. c. ... 3. Change a spark plug. 4. ...	D. Prepare a maintenance checklist . Obtain and file a manufacturer's maintenance checklist . Practice using a maintenance checklist on a home lawn mower . Observe a demonstration of and/or change oil in a home lawn mower block . Observe a demonstration of and/or change the oil in a lawn mower air cleaner . Observe a demonstration of and/or change the spark plug in a lawn mower engine . ...
E. Determine kind and amount of fertilizer needed for a given established lawn. 1. Take a soil sample. 2. Interpret soil test reports. 3. Recognize element deficiency symptoms in a typical turfgrass. 4. ...	E. Take a soil sample from an existing home lawn and fill out information sheet . Practice interpreting soil test reports . Obtain and file a reference which gives fertilization requirements for the more common home lawn turfgrasses . Observe element deficiency symptoms or slides or pictures of such deficiencies . Practice identification of element deficiency symptoms in grasses through participation in class identification contests . ...

UNIT: Home Lawn Maintenance and Establishment
SUB-UNIT: Home Lawn Maintenance

TOPICS	RESOURCES
C. Lawn mower adjustment and operation . Safety hazards . Adjustments . Engine . Carburetor . Ignition . ... . Mower . Blade height . Handles . ... . Operation . Cranking . Mowing	C. Transparencies: VEMC. Rotary Mower Safety. . Owner's manuals . AAVIM. Small Engines, Vols. I and II . ...
D. Lawn mower maintenance . Crankcase oil . Air cleaner . Cleaning	D. AAVIM. Small Engines, Vols. I and II . Owner's manual . ...
E. Lawn fertilization (established lawn) . Determining need . Taking soil samples . Interpreting a soil sample . Recognizing deficiency symptoms	E. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 38-48. . Carleton. Your Lawn: How to Make It and Keep It pp. 19-33. . Musser. Turf Management. . ...

OBJECTIVES	LEARNING ACTIVITIES
F. Select a fertilizer for applying as a top dressing. 1. Compare and contrast different forms of fertilizer, e.g., ammonium nitrate vs. nitrate of soda, etc. 2. Compare and contrast the effects of using 5-10-10 vs. 10-20-20, etc. 3. ...	F. Observe fertilizer burn on a demonstration plot . Obtain prices of various nitrogen sources for price comparison . Set up plot demonstrations to illustrate the speed of availability of various forms of nitrogen . Obtain and file at least one reference which compares nitrogen sources . ...
G. Select an appropriate time to apply topdress fertilizers. 1. Compare and contrast application during summer, fall, winter, and spring. 2. Compare and contrast application during a drought vs. following a rain, etc. 3. ...	G. Observe a demonstration using a salt concentration and water in a semi-permeable membrane to show the mechanics of fertilizer burn . Set up a demonstration to induce fertilizer burn . ...
H. Select an appropriate means of applying a topdress application of fertilizer to a given home lawn in such a manner as to obtain the rate and uniform application desired. 1. Select appropriate fertilizer distributor or applicator. 2. Calibrate an applicator or distributor. 3. ...	H. Observe a demonstration of or use a fertilizer applicator commonly used to topdress a home lawn . Observe a demonstration of or use a fertilizer applicator which attaches to a garden hose . Practice calibrating a fertilizer applicator . ...

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Home Lawn Maintenance

TOPICS	RESOURCES
F. Selecting topdress fertilizer for the home lawn. . Forms of nitrogen . Nitrate of soda . Ammonium nitrate . Liquid nitrogen . Anhydrous ammonia . ... . Complete fertilizers . Comparison of concentrated vs non-concentrated analysis (5-10-10 vs 10-20-20)	F. Musser. Turfgrass Management. . Carleton. Your Lawn: How To Make It and Keep It Chapter 4. . . . . .
G. Timing fertilizer applications . Season . Dry vs wet weather . Time of day . Relationship to growth	G. (See preceding references) . . . . .
H. Applying fertilizer to a home lawn . Method selection . Hand . Machine . Types of applicators . Garden hose attachment . Small wheel type spreader . Cyclone type spreader	H. (See preceding references) . . . . .

OBJECTIVES	LEARNING ACTIVITIES
I. Recommend a solution to the more common lawn pest problems. 1. Recognize and name a given insect by the damage caused to the home lawn turfgrass. a. When given damaged specimens or pictures of such specimens the student will be able to name the insect which caused the damage. b. When given pictures or specimens of the more common lawn insects the student will be able to correctly name them. c. When given pictures or specimens of disease or disease damage the student will be able to name the disease. d. When shown a specimen or a picture of one of the ____ most common lawn weeds the student will be able to correctly name it. e. List at least one source of lawn pest identification information. f. ... 2. When given one of the more common lawn pest problems select an appropriate treatment. a. List at least one extension service bulletin concerning lawn pest control. b. ... 3. Implement a treatment for a given lawn pest. a. Select an appropriate means of applying a given chemical. (1) List safety hazards involved in applying chemicals. (2) ... b. Operate a knapsack sprayer. c. Operate a duster. d. ...	I-1. Observe the damage caused by the more common lawn pest. . Practice pest identification by observing the insect and/or the damage it does to home lawn turfgrasses. . Make a collection of lawn grass insects . Make a collection of home lawn grass diseases or pictures of such diseases . Obtain and file a reference which lists the more common lawn grass insects . Obtain and file a reference which gives the more common lawn diseases . ... 2. Obtain and file a reference which gives the more common lawn pests and recommends controls . ... 3. Observe a demonstration of and/or treat an established lawn for an insect or disease using a chemical spray . Observe a demonstration of the safe application of a chemical spray . Observe a demonstration and/or treat an established lawn for an insect or disease using a chemical applied as a dust . Observe a demonstration of the safe use of a dust applicator . ...

UNIT: Home Lawn Maintenance and Establishment
SUB-UNIT: Home Lawn Maintenance

TOPICS	RESOURCES
I. Pest control 1. Recognition of damage . Insect damage . Disease damage . Weed damage . Small animal damage . ... 2. Lawn pest treatment . Chemical controls . Mechanical controls . ... 3. Chemical application . Selection . Means of application . Hand . Dusters . Sprayers . Garden hose attachments . Knapsack . ... Safety	I. Vengris, Jonas. Lawns. . Carleton. Your Lawn: How to Make it and Keep it, Chapters 11, 12, and 13. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 55 - 90. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
J. Plan a thatch control program for a given home lawn. 1. Recognize thatch problems. a. List the effects of thatch on the growth of a given grass. b. Measure the amount of thatch. c. ... 2. List at least _____ methods of controlling thatch buildup. 3. Operate a lawn mower with a clipping catcher. 4. Operate a thatch remover. 5. ...	J. Observe thatch problems. . Observe a demonstration of thatch measurement. . Observe a demonstration of and/or operate a mower with clippings attachment or a thatch remover. . ...
K. Aerate a given home lawn. 1. Determine the need for aeration. a. Recognize soil compaction or the symptoms of such compaction. b. ... 2. Adjust and operate a typical soil aerator. 3. ...	K. Observe symptoms of the lack of proper aeration. . Observe a demonstration of and/or operate a soil aerator. . As a class project aerate a turfgrass plot using a typical soil aerator. . ...
II. ...	II. ...

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Home Lawn Maintenance

TOPICS	RESOURCES
J. Thatch control	
1. Problem recognition . Effects . Measurement	J. Musser. Turfgrass Management. . Carleton. Your Lawn: How to Make it and Keep It, pp. 53, 61-62, 111-112. . ...
2. Methods of control . Clipping catches . Thatch remover	
K. Aeration	K. Musser. Turfgrass Management.
1. Recognition of need	. Carleton. Your Lawn: How to Make it and Keep It, pp. 78-81.
2. Aerator equipment operation	. Wise. The Lawn Book.
. ...	
II. ...	II. ...

Home Lawn Maintenance

BOOKS

American Association for Vocational Instructional Materials. Small Gasoline Engines, Vols. I and II. Athens, Ga.: American Association for Vocational Instructional Materials, 1971.

Carleton, Milton R. Your Lawn: How to Make It and Keep It. New York: Van Nostrand Reinhold Company, 1971.

Musser, H. Burton. Turf Management. New York: McGraw-Hill, 1962.

Sunset. Lawns and Ground Covers. Menlo Park, California: Lane Books, 1964.

The Pennsylvania State University. Turfgrass Maintenance and Establishment - A Student Handbook. University Park, Pa.: The Department of Agricultural Education, 1968.

Vengris, Jonas. Lawns. Fresno, California: Thompson Publications, 1969.

Voykin, Paul N. A Perfect Lawn the Easy Way. New York: Rand McNally and Company, 1969.

Wise, L. N. The Lawn Book. Decatur, Georgia: Bowen Press, Inc.

BULLETINS

U. S. Department of Agriculture. Better Lawns. Washington, D. C.: Superintendent of Documents, U. S. Government Printing Office.

FILMS and FILM STRIPS

TRANSPARENCIES

Vocational Education Media Center. Rotary Mower Safety. Clemson University, Clemson, South Carolina 29631.

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Home Lawn Establishment

OBJECTIVE(S): The student will be able to:

I. Develop a plan for the establishment of a given home lawn.

II. . . . . .

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Establishment

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Develop a plan for the establishment of a given home lawn. A. Recommend contour alteration for a given site. 1. Prepare a contour drawing of an existing site. a. Use a level to determine slope. b. . . . . . 2. Diagram a surface drainage plan for a given lawn site. a. Layout a terrace. b. . . . . . 3. Select the most appropriate means of altering surface contour for a given lawn. 4. Stake out contour lines for altering a given lawn site. 5. Remove, stock pile and replace topsoil. 6. . . . . . B. Prepare a given lawn soil for seeding or sodding. 1. List ____ criteria for evaluating a desirable seedbed. 2. Diagram the profile of a desirable seedbed. 3. Recommend soil modifications needed for a given soil site, i.e., the addition of organic matter, fertilizer, clay, topsoil, etc. a. Take a soil sample for analysis. b. . . . . . 4. Identify drainage requirements. a. Install a short run of tile. b.	I. Outline a plan for establishing a given home lawn. A. Prepare contour drawing of a given home lawn site. . Construct a small terrace. . Stake out a contour line. . As a class project, actual or demonstration, sight and remove and replace topsoil. . . . . . . B. Prepare a home lawn seedbed as a class project. . Prepare a small seedbed plot. . Prepare a soil profile tube. . Practice determining subsurface drainage by observing subsoil color, texture and feel. . Fumigate a soil.

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Establishment

TOPICS	RESOURCES
I. Site grading and drainage layout.	
A. Contour alterations.	I. A. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-146.
1. Determining slope	. Vengris. Lawns, pp. 104-116.
2. Laying out a contour	. Wise. The Lawn Book, pp. 66, 59-60, 63, 48, 44-55.
3. Drainage layout	. Carleton. Your Lawn: How to Make It and Keep It, Chapter 2.
4. Selecting means of alteration	. . . . .
5.	
B. Soil preparation.	B. Musser. Turf Management, pp. 10-33.
1. Criteria for evaluating a seedbed	. Vengris. Lawns, pp. 81-88.
2. Soil profile	. USDA. Better Lawns.
3. Modifications	. . . . .
4. Drainage	
. surface	
. subsurface	
. . . . .	

OBJECTIVES	LEARNING ACTIVITIES
5. List the more commonly used mechanical methods for preparing a seedbed.	. Fumigate a seedbed.
6. Treat a soil using a soil sterilant.	
7.	. . . . .
C. Select an appropriate variety for a given lawn.	C. Obtain and file reference which gives recommended home lawn turfgrass varieties.
1. Describe a given lawn grass in terms of its growth habit, climatic requirements, pest resistance and wear.	. Conduct a home lawn turfgrass identification contest.
2. Identify, by leaf, at least 6 or the more commonly used turfgrasses used in your community.	. Observe and make a listing of local home lawn turfgrass varieties; compare growth habits, etc.
3. List at least one reference on lawn grass varieties.	. . . . .
4.	
D. Select an appropriate seeding or sodding date.	D. Obtain and file a reference which gives seeding and sodding dates.
1. List at least one reference which gives seeding dates for lawn grasses.	. Use a reference to determine seeding dates of different turfgrasses used locally for home lawns.
2. List the requirements for seed germination.	. . . . .
3.	
E. Select an appropriate method of establishing a given lawn grass.	E. Obtain and file a reference which gives recommended establishment procedures for a given home lawn turfgrass.
1. Compare and contrast seeding vs sodding of a given variety of turfgrass.	. Observe and compare sodding.
2.	. . . . .

TOPICS	RESOURCES
5. Methods of preparation 6. Soil sterilization 7.	
C. Variety selection. 1. Variety characteristics . growth habits . climatic requirements . pest resistance . growing season . . . . . . 2. Variety identification 3. Reference for variety selection 4.	C. Vengris. Lawns, pp. 20-44. . Wise. The Lawn Book, pp. 178-179, 180-182, 227. . (for variety identification refer to the unit entitled Turfgrass and Weed Identification) . Carleton. Your Lawn: How to Make It and Keep It, Chapter 6. . Bulletin: Clemson University. Centipede Grass and Its Problems. . Bulletin: Clemson University. Cool Season Grasses. . Bulletin: Clemson University. Lawn Grasses for South Carolina.
D. Seeding or sodding dates. 1. Criteria for selecting planting dates 2. Requirements for seed germination 3.	D. Vengris. Lawns, pp. 104-124.
E. Method of establishment. 1. Seeding 2. Sodding 3. Sprigging 4. Plugging 5.	E. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-144.

OBJECTIVES	LEARNING ACTIVITIES
F. Seed a given lawn.	F. Seed a home lawn as a class project.
1. Compare and contrast different methods of seeding, e.g., hand sowing, drilling, cyclone seeder, impregnated mats, etc.	. Seed small plots using different seeding procedures, i.e., hand sowing, impregnated mats, etc.
2. Calibrate a seed drill or cyclone seeder.	. Practice calibrating a cyclone seeder.
3. Select an appropriate quantity of seed for seeding a given area with a given turfgrass variety.	. Obtain and file a reference which gives seeding rates for a given home lawn turfgrass variety.
4.	. Practice calculation of appropriate seed quantity for a given area.
G. Sprig or sod a given lawn site.	G. Sprig a home lawn as a class project.
1. Sprig a given site.	. Sprig a sample plot.
a. Compare and contrast different methods of sprigging.	. Layout rows for sprigging.
b. List rooting requirements of a given variety to be sprigged.	. Obtain and file a reference which gives sprigging rates or spacing.
c. Recommend spacing for a given turfgrass variety.	. Solve problems to determine the quantity of sprigs needed to plant a given area.
d. Determine supply needed to plant a given area.	
e.	
2. Sod (plug) a given lawn site.	. Sod a home lawn as a class project.
a. Compare and contrast different methods of sodding.	. Sod (plug) a sample plot
b. List rooting requirement of a variety to be sodded.	. Obtain and file a reference which gives plugging rates or spacing.
c. Recommend a spacing for plugging a given turfgrass variety.	. . . . .
d.	
II.	II. . . . .

TOPICS	RESOURCES
F. Seeding 1. Methods . hand sowing . drilling . cyclone seeder . impregnated mats . . . . . . 2. Seeder calibration 3. Determining quantity required 4.	. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-144. . . . . .
G. Sprigging or sodding 1. Sprigging a. Methods b. Spacing c. Holding requirements d. . . . . . 2. Sodding a. Methods b. Spacing c.	G. Masser. Turf Management, pp. 118-153. . Wise. The Lawn Book, pp. 94-97. . . . . .
II.	II. . . . .

Resources

Home Lawn Establishment

BOOKS

Carleton, Milton R. Your Lawn: How to Make It and Keep It. New York: Van Nostrand Reinhold Company, 1971.

Musser, H. Burton. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment - A Student Handbook. University Park, PA: Department of Agricultural Education, 1968.

Vengris, Jona. Lawns. Fresno, California: Thompson Publications, 1969.

Wise, L.N. The Lawn Book. Decatur GA: Bowen Press, Inc.

FILMS and FILM STRIPS

BULLETINS

Clemson University. Cool Season Grasses. Clemson University Extension Service, Clemson, S.C. 29631.

Clemson University. Centipede Grass and Its Problems. Clemson University Extension Service, Clemson, S.C. 29631.

Clemson University. Lawn Grasses for South Carolina. Circular 495. Agricultural Extension Service, Clemson, S.C. 29631.

USDA. Better Lawns. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

TRANSPARENCIES

UNIT: Home Lawn Maintenance and Establishment

SUB-UNIT: Exploring Career Opportunities

OBJECTIVE(S): The student will be able to:

I. Explore career opportunities related to residential lawn maintenance and establishment.

: Home Lawn Maintenance and Establishment

UNIT: Exploring Career Opportunities

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Explore career opportunities related to residential lawn maintenance and establishment. A. List occupational titles of the people who establish or maintain home lawns for a living. B. List people who are not employed full-time in this field but who are employed for special tasks and who therefore require competencies in this field. C. List some of the major tasks performed, e.g., seedbed preparation, variety selection, seeding, sprigging, mowing, watering, etc. D. List some of the competencies needed, e.g., equipment operation, knowledge of soils, grasses, physical skill, etc. E. List the educational requirements for a given job in this field and sources of such education. F. List the average wage paid for a given occupational title held in this field. G. Describe in writing how a career in this area would complement or fail to complement life goals. II.	I. Interview a person who maintains or establishes lawns as a career (this may be a local nurseryman, garden center operator, or contractor). . Seek part-time work experience maintaining or establishing home lawns. . Prepare a job description of a person(s) employed in maintaining and establishing home lawns. . Determine the equipment, training and skill required to start a business maintaining or establishing home lawns. . Prepare a paper describing how an employment in this area of work would complement or fail to complement your life goals. II. . . . .

UNIT: Home Lawn Maintenance and Establishment
SUB-UNIT: Exploring Career Opportunities

TOPICS	RESOURCES
I. Career exploration. A. Occupational titles 1. Major occupation . landscape contractor . . . . . . 2. Related occupation (competencies needed) . landscape gardner . garden center operator . nurserymen . . . . . . 3. . . . . . B. Major task performed 1. shaping or grading 2. soil preparation 3. seeding or sprigging 4. . . . . . C. Competencies needed D. Educational requirements E. Wages F. Life goals G. . . . . . II.	I. Local landscape contractors, landscape gardners, etc. . Hoover. Handbook of Agricultural Occupations, pp. 243-263. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 1-15. . Slides: Exploring Occupations in Turfgrass, 30 slides. . . . . . . II. . . . .

Exploring Career Opportunities

BOOKS

Hoover, Norman K. Handbook of Agricultural Occupations. Danville, Illinois: The Interstate Printers and Publishers, Inc., 2nd ed., 1969.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

FILMS and FILM STRIPS

Slides: Exploring Turfgrass Occupations. 30 slides - $5.50. Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania.

BULLETINS

TRANSPARENCIES

GOLF COURSE MAINTENANCE AND ESTABLISHMENT

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Maintenance

OBJECTIVE(S): The student will be able to:

I. Plan a turfgrass maintenance program for a given course.

II. . . . . .

UNIT: Golf Course Maintenance

OBJECTIVES

The student will be able to:

I. Plan a maintenance program for a given course.

A. Plan a mowing program for a given green, tee, or fairway.

1. List ___ criteria for evaluating the mowing program for a given green, tee, or fairway.

a. Recognize the effects of improper mowing.
b. ....

2. Select an appropriate mowing height for a given green, tee or fairway.

3. List the major factors to be considered in selecting amount and frequency of cut.

4. State a rule-of-thumb for determining the amount of cut to take for a given mow.

5. Construct a mowing schedule for a given green, tee, or fairway.

6. Illustrate, by drawing a typical mowing pattern for a green, tee, or fairway.

a. List ___ reasons for mowing according to a set pattern.
b. ....

7. Demonstrate the ability to mow a given component of a course.

a. Select, adjust and operate a mower for cutting a given turfgrass area.
b. Compare and contrast reel and blade type mowers.
c. ....

LEARNING ACTIVITIES

I. Prepare an elementary plan for maintaining a golf course turfgrass

A. Prepare an elementary plan for mowing greens, tees, and fairways

- Observe the effects of improper mowing on a local golf couse if possible
- Observe a demonstration of proper and improper mowing procedures on greens, tees, and fairways
- Draw a typical mowing pattern of a green
- List at least one reference which gives recommended mowing heights for golf course turfs
- Visit a local course to observe mowing
- Survey local course superintendents to determine their mowing schedule or how they determine when to mow
- Observe demonstrations of and/or adjust and operate the more commonly used mowers on golf course fairways
- Obtain and file brochures or other information on golf course mowers
- Observe demonstrations designed to show the effect of cutting a turfgrass with reel type vs rotary mowers
- ...

UNIT: Golf Course Maintenance and Establishment
SUB-UNIT: Golf Course Maintenance

TOPICS	RESOURCES
I. Golf course maintenance A. Mowing - Fairways - Greens - Tees . Criteria for evaluating mowing - fairways, greens, tees . Effects of improper mowing - fairways, greens, tees . Mowing heights - fairways, greens, tees . Amount of cut per mowing - fairways, greens, tees . Mowing schedules . Mowing patterns . Mowing equipment . Selection . Types . Reel . Rotary . ... . Operation and adjustment . Mower safety	I. Musser. Turf Management, pp. 175-188. . Vengris. Lawns, pp. 137-141. . Pennsylvania State. Turfgrass Maintenance and Establishment, pp. 48-51, 106-108. . Transparencies: VLMC. Rotary Mower Safety. . ....

OBJECTIVES	LEARNING ACTIVITIES
B. Plan a fertilization program for a given golf course.	B. 1. Take a soil sample from a typical green, tee and fairway and complete information
1. Determine the pH fertility level of a given green, tee, or fairway truf.	. Practice interpreting soil test reports
a. Take soil samples.	. Practice identifying element deficiencies from symptoms through the use of picture contest .
b. Interpret soil test reports.	. ...
c. Recognize fertilization deficiency symptoms in a given turf.	
d.	
2. Select an appropriate form for an analysis of fertilizer.	2. Obtain and file a reference which compares the sources of nitrogen for use on grasses
a. Compare and contrast different forms of fertilizer, e.g., ammonium nitrate vs nitrate of soda, etc.	. ...
b. Compare and contrast different forms of lime.	
c. Compare and contrast the effects of a 5-10-10 analysis with that of a 10-20-20, etc.	
d.	
3. Set up a fertilization schedule of a given course.	3. Prepare a fertilization schedule for a typical green and fairway
a. List the factors which affect frequency and quantity fertilization requirements.	. ...
b.	

TOPICS	RESOURCES
B. Golf course fertilization 1. Need determination . Soil test . Deficiency symptoms	B. Vengris. Lawns, pp. 89-103. . Musser, Turf Management, pp. 34-49. . Penn. State. Turfgrass Maintenance and Establishment, pp. 104-105. . . . . .
2. Analysis selection . Forms of nitrogen . Forms of topdress . low analysis . high analysis . . . . Forms of lime	
3. Fertilization schedule . Seasons . Weather . Time of day	

OBJECTIVES	LEARNING ACTIVITIES
4. Demonstrate the ability to apply fertilizers. a. Select appropriate means of application. (1) Compare and contrast solid vs liquid application. (2).	4. Observe demonstrations of fertilizer application equipment. . Practice adjusting and operating fertilizer application equipment commonly used on greens and fairways.
b. Select and adjust and operate appropriate application equipment for a given green, tee or fairway. (1) Calibrate a given type of applicator. (2).	. Calibrate fertilizer application equipment used for applying fertilizers on greens, tees, and fairways.
c. Recognize the effects of improper fertilizer application.	. Observe the actual effects or pictures of the effects of improper fertilizer application on greens, tees and fairways.
	. . . . .
C. Plan a watering program for a given green, tee or fairway.	C.1. Observe a demonstration of determining the water content of soil by squeezing.
1. Determine the need for watering. a. List ____ symptoms of a droughty soil.	. Diagram the working principle of a soil probe.
b. Use a soil probe to determine water content.	. Observe a demonstration of the use of a soil probe.
c. Diagram the working principle of a soil probe.	
d.	
2. Set up a water schedule for a given green, tee or fairway.	2. Prepare a tentative watering schedule for a green or fairway.
a. List at least ____ factors which affect the moisture content of a typical soil.	. Obtain the watering schedules of some of the local golf courses if one is used.
b. List at least ____ factors which affect the moisture requirements of a typical grass plant.	. Prepare soil profiles and compare their ability to hold water by pouring a given quantity of water in the top of the tube and measuring the amount of water collected at the bottom over a given period of time.

TOPICS	RESOURCES
4. Fertilizer application . methods . equipment . operation and adjustment . callibration . . . . improper application . unequal distribution . burn	
C. Water 1. Need determination . probe . feel and sight . condition of grass . . . . . . 2. Water schedules - tee- greens - fairways . factors which affect soil moisture . soil characteristics . slope . soil cover . weather	C. Penn. State. Turfgrass Maintenance and Establishment, pp. 52, 110. . Musser. Turf Management, pp. 64-65, 73-83. . Vengris. Lawns, pp. 132-136. . Musser. Turf Mangement, pp. 64, 82-83.

OBJECTIVES	LEARNING ACTIVITIES
c. Select an appropriate amount, time and frequency of water application needed on a given green, tee, or fairway. (1) Determine the water holding capacity of a given soil. (2) Determine the capacity of a given soil to absorb water without runoff. (3) Compare and contrast different time periods for applying water, i.e., night vs day - morning vs evening, etc. (4) Recognize the effects of overwatering and underwatering. d. Select an appropriate means of applying water to a given green, tee or fairway. (1) Compare and contrast typical means used to water greens and tees vs that used for fairways. (2) Estimate the effect of nozzle size and pressure on size, drift and rate of application. (3).	. Demonstrate, with models, the effects of cover and slope. . Observe and compare watering systems used by golf courses in the community as to effectiveness, labor required, cost, etc. . Practice measuring the adequacy of distribution of a given nozzle or overhead sprinkler on a fairway. . Practice measuring the output of water from a given sprinkler when the pump capacity pressure and nozzle size is varied. . Observe the effects of nozzle size and pressure on drift. . Observe a demonstration of and/or water a green. . Obtain and file a reference which gives recommended watering rates and frequencies. . . . . .

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Maintenance

TOPICS	RESOURCES
. Factors which affect moisture requirements of grass . weather . wind . temperature . relative humidity	. Musser. Turf Management, pp. 77-78, pp. 78-81.
. soil	
. application . time . frequency . amount per application . water holding capacity of soils . slope . drainage	. Musser. Turf Management, pp. 73-78, pp. 82-83.
. means of application . greens . fairways . subsurface irrigation . surface irrigation . tees	. Toro. Toro Design Information for Large Turf Irrigation Systems.

OBJECTIVES	LEARNING ACTIVITIES
e. Recommend a nozzle size and type for a given irrigation system on course location. f. Uniformly syringe a given green or tee. (1) List ____ reasons for syringing a green. (2). . . . . . g.	
D. Select auxiliary practices at appropriate times for best turf care. 1. Determine when to verticut. 2. Determine when to hole punch. 3. Determine when to top dress. 4. Determine when to sub-air.	D. Observe a demonstration of/and or: . verticutting . hole punching . top dressing . sub-airing . Prepare an appropriate top dressing mixture.
II.	II. . . . .

TOPICS	RESOURCES
. irrigation systems . pump capacity . pipe size . nozzle type . nozzle size	. AAVIM. Planning for an Irrigation System.
. green syringing	. Slides: AAVIM. Planning for an Irrigation System. . . . .
D. Auxiliary practices.	. Musser. Turf Management, pp. 157-158.
1. Verticutting a. aeration b. compaction c. thatch removal	
2. Hole punching a. aeration b. compaction	. Musser. Turf Management, pp. 4, 7, 13-14, 83, 169-172.
3. Top dressing a. rejunivation b. changing soil mixture c. compaction	. Musser. Turf Management, pp. 163-168, 174-175, 185, 196-197, 204, 258. . . . . .
4. Sub-airing a. compaction b. drainage c. hardpans	
II.	II. . . . .

Golf Course Maintenance

BOOKS

American Association for Vocational Instructional Materials. Planning for an Irrigation System. Athens, GA: The Association, 1971.

Musser, H. Burton. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Vengris, Jonas. Lawns. Fresno, California: Thomson Publications, 1969.

Toro. Toro Design for Large Irrigation Systems. Riverside, California: The Toro Company.

FILMS and FILM STRIPS

American Association of Vocational Instructional Materials. Athens, GA: Slides, Planning for an Irrigation System (204 slides).

BULLETINS

TRANSPARENCIES

Vocational Education Media Center. Clemson University, Clemson, S.C. 29631. Rotary Mower Safety.

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

OBJECTIVE(S): The student will be able to:

I. Prepare an elementary plan for establishing a typical golf course.
II. Prepare an elementary plan for establishing a typical hole.
III. Prepare an elementary plan for establishing a typical green.
IV. Prepare an elementary plan for establishing a typical fairway.
V. Prepare an elementary plan for establishing a typical tee.
VI. Prepare an elementary plan for establishing a typical bunker and trap.
VII. Prepare an elementary plan for establishing a typical rough.
VIII. . . . . .

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Develop an elementary plan for course design. A. List the components of a golf course. B. List some of the criteria used in evaluating a course. C. Diagram a total course for a given terrain. D. List the more commonly used specifications for a given course. E.	I. Outline an elementary plan of a golf course. . Construct a model of a golf course. . Visit a local golf course to observe and list components. . Make a drawing of a golf course. . Observe pictures of golf courses. . Play a game(s) of golf to learn rules of game and components of the course. . Invite a person familiar with the local course to visit the class. . . . . .

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
I. Components of the golf course. . components . green . tee . fairway . rough . traps . . . . criteria for evaluating a course . game challenge . beauty . quality of turf . . . . course specifications . course drawing	I. Hanson and Juska. Turfgrass Science, pp. 502-564.

UNIT: Golf Course Establishment

OBJECTIVES	LEARNING ACTIVITIES
II. Develop an elementary plan for the construction of a given hole. A. Make a scale drawing of a typical hole showing the location of each component. 1. List the major components of a hole. 2. Label the major components of a hole. 3. List the game specification for a hole. 4. . . . . . B. List at least ____ criteria for evaluating a hole. 1. List at least ____ criteria for evaluating a given tee. 2. List at least ____ criteria for evaluating a given green. 3. List at least ____ criteria of evaluating a given fairway. 4. . . . . . C.	II. Outline a plan for constructing a given hole. . Make a scale drawing of a hole on a local golf course. . Construct a small model of a typical hole. . Invite a local golf pro to visit the class and discuss "What makes a good golf course hole?" . Visit a local course and have a local pro or course superintendent explain "What makes a good golf course hole?" . . . . .

TOPICS	RESOURCES
II. Golf course hole construction 1. Scale drawing . components . green . fairway . tee . specifications 2. Hole evaluation . greens . size . smoothness . challenge . slope . . . . . fairway . design . slopes . . . . tees . design . smoothness . . . . . . 3. Irrigation . type	II. Hanson and Juska. Turfgrass Science, pp. 504-574. . Vengris. Lawns, pp. 104-115. . Local golf course superintendent. . Local golf pro. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
III. Plan the establishment of a given green.	III. Outline a plan for establishing a typical green
A. Make a scale drawing of a given green.	A. Make a drawing of a typical golf green
1. List and label on a drawing the major components of a typical green.	. Make a cross sectional diagram of a typical green
2. Make a cross sectional diagram of a typical green.	. Practice making a contour drawing of a typical green using a transit
3. Make a contour drawing of a typical green. a. Level a transit b. Use a transit to layout a contour c. ...	. ...
4. ...	
B. Plan for appropriate surface and underground drainage.	B. Practice determining degree of slope of a site
1. State sloper requirements for a given green.	. Prepare a cross sectional and top view drawing of a typical green drainage system
2. Select appropriate tile size, depth and spacing for a given green soil condition.	. Obtain and file a reference which gives recommended tile size, depth and spacing for a given soil
3. Prepare a cross sectional and top view drawing of the green drainage system.	. . . . .
4. ...	
C. Prepare soil profile for a typical green.	C. Prepare a soil profile for a typical green
1. Recommend type and size materials needed at each level of the soil profile.	. Diagram a soil profile for a typical green
2. Diagram an appropriate soil profile for a given green.	. ...
3. ...	

UNIT: Golf Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
III. Green Establishment A. Grading or shaping . Contour plan . Design . Profile . ... B. Drainage . Surface . Subsurface . ... C. Soil . Top soil . Sub soil	III. Fergerson. Building Golf Holes for Good Turf Management, pp. 11-20. . Vengris. Lawns, pp. 104-115. . ....

OBJECTIVES	LEARNING ACTIVITIES
D. Prepare a seeding or rooting medium for a typical green. 1. List, in sequence, the steps in preparing a ready to seed or sprig seedbed. 2. List ___ criteria for evaluating a ready to plant seedbed. 3. Select, adjust and operate equipment for preparing a seed or rooting medium. 4. Determine the analysis and amount of fertilizer needed prior to planting. 5. Perform a pH test on a given soil. 6. Calculate lime requirement for a given soil based on pH level and type of lime. 7. Sterilize or fumigate a given soil using a soil fumigant such as methel bromide.	D. As a class project prepare a seeding or rooting medium for a typical green. . Observe the preparation of a seeding or rooting medium for a green being constructed in the local community and list the steps followed. . Prepare a small seed or rooting bed plot. . Practice the use of equipment and tools used in seed or rooting mediums. . Observe demonstrations of equipment used for the preparation of seed or rooting mediums. . Practice taking soil test. . Practice solving problems to determine the amount of lime needed to change pH a given amount. . Fumigate a seedbed. . ....
E. Select an appropriate variety of turfgrass for a given green. 1. List the characteristics of a desirable turfgrass for a green. 2. List at least ___ varieties of turfgrass suitable for use on a given green. 3. List at least ___ source(s) of turfgrass variety information. 4.	E. Obtain and file a reference which gives recommended turfgrass varieties for golf course greens. . Observe and compare the characteristics of various varieties of turfgrasses used on local greens. . ...
F. Select an appropriate seeding date(s).	F. Obtain and file a reference which gives recommended seeding date for a given turfgrass variety.

UNIT: Golf Course Maintenance and Establishment
SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
D. Seedbed Preparation 1. Steps in preparation . Mechanical preparation . Soil pulverization . Smoothing . ... . Chemical treatment . Fertilization . Sterilization or fumigation . Liming . ... 2. Seedbed evaluation 3. ...	D. Vengris. Lawns, pp. 81-88. . Musser. Turf Management, pp. 10-33. . ....
E. Variety(s) selection . Criteria for selection . Climate . Wear . Beauty . Smoothness . ... . Sources of Variety information	E. Vengris. Lawns, pp. 20-55. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 17-36.
F. Seeding date or time Selection . Critical factor . Sources of information	F. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-146.

OBJECTIVES	LEARNING ACTIVITIES
G. Select an appropriate establishment method. 1. Compare and contrast seeding vs sprigging. 2. List at least ___ means of seeding and ___ means of sprigging. 3. .... H. Seed or sprig a given golf green I.	G&H. If possible observe the seeding and/or sprigging of a local green . Sprig or seed a sample plot using a turfgrass variety(s) typically used on a golf course green . ... I. . . . .
IV. Develop an elementary plan for the construction and planting of a typical fairway. A. Prepare a very elementary and hypothetical design for a given fairway. 1. Sketch a typical topographic map of a fairway and hole. 2. Sketch a cross-sectional view of a typical fairway. 3. .... B. Given a topographic map of an existing area and a topographic map of a planned fairway, stake out the planned fairway. 1. Layout contours to obtain a given shape. 2. ... C. Diagram a surface and/or underground drainage system for a given fairway. 1. State the drainage slope requirements for a typical fairway.	IV. Outline an elementary plan for constructing and planting a given fairway A. Draw a contour map of an existing fairway . Sketch a cross sectional view of a typical fairway . ... B. Practice laying out contours to obtain a given shape . Invite a local soil conservationist to demonstrate laying out a contour. . .... C. Practice using a topographic map to determine surface drainage . Observe surface drainage on a local fairway during or shortly after a rain . Determine the degree of slope at various points on a local fairway

UNIT: Golf Course Maintenance and Establishment
SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
G. Selection of Establishment method . Seeding vs sprigging . Means of seeding . Hand sowing . Drill . ... . Means of sprigging . Hand sprigging . Mechanical sprigging	G. Musser. Turf Management, pp. 118-153.
H. Seeding and sprigging	H. . . . .
I.	I. . . . .
IV. Fairway Construction	IV. Hanson & Juska. Turfgrass Science, pp. 584-601.
A. Fairway design . Topographic mapping of existing terrain . Topographic mapping of desired terrain	. Fergerson. Building Golf Holes for Good Turf Management, pp. 23-29. . Musser. Turf Management, pp. 50-83. . Local Soil Conservationist . ...
B. Contour layout	
C. Drainage Layout . Surface . Swales . Slopes . Ditches	

OBJECTIVES	LEARNING ACTIVITIES
2. Select appropriate tile type and size and give the appropriate locations, depth and spacing for a given soil condition. a. List the steps involved in the installation on tile. b. Diagram a cross sectional view of a tile drainage system. c.	. If possible, observe a tile drainage map of a local fairway . Diagram a cross sectional view of a subsurface drainage system of a typical fairway . ...
D. Plan an elementary irrigation system for a typical fairway. 1. Prepare a drawing showing the location, depth and spacing of irrigation pipes and nozzles. 2. Recommend appropriate types and size of pipes and nozzles needed to irrigate a given fairway. 3.	D. Prepare an elementary plan for irrigating a typical fairway . Diagram the major waterlines of an existing fairway . Observe demonstrations of water application rate determination and variation using varying nozzle size and types and pressures . Obtain and file a reference which gives information concerning nozzle size, pressure and rate of application . ...

TOPICS	RESOURCES
. Sub-Surface . Size . Patterns . Spacing . ... . Drainage line slope . Tile or pipe types . Plastic . Terracota . Concrete . ... . Steps in installation	
D. Fairway irrigation . Types . Size . System construction . Soil water holding characteristics . Water sources . Pump type and capacity . Pipe sizes . Nozzle type	D. AAVIM. Planning for an Irrigation System. . Toro. Toro Design Information for Large Turf Irrigation Systems. . Local irrigation dealers. . ....

OBJECTIVES	LEARNING ACTIVITIES
E. Prepare an appropriate seedbed for seeding or sprigging a fairway. 1. Select an appropriate method of shaping or grading, e.g., bulldozer, graders, etc. 2. Select appropriate mechanical soil treatment, i.e., discing, plowing, etc. 3. Select appropriate equipment for leveling (smoothing). 4. List the sequence of steps to follow in preparing a given soil for planting. 5. List ___ criteria for evaluating a seedbed. 6. Determine the analysis and amount of fertilizer needed prior to planting. 7.	E. If possible observe the preparation of a golf course fairway . As a class project, prepare a small plot of soil as you would for a full sized fairway seedbed . Prepare a soil profile representing the desired profile of a real fairway seedbed . Practice taking soil samples . If feasible practice using the equipment normally used for preparing a fairway seeding or sprigging medium . Observe demonstrations of operation and adjustment of equipment used in preparing a seeding or sprigging medium for a fairway seedbed . ....
F. Select an appropriate variety of turfgrass for a given fairway. 1. List the characteristics of a desirable turfgrass for a given fairway. 2. List at least ___ varieties of turfgrass suitable for a given fairway. 3. List at least ___ sources of turfgrass variety information. 4.	F. Obtain and file a reference which compares recommended turfgrass for fairways . ...

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
E. Fairway Seedbed preparation . Shaping and grading . Mechanical treatment . Discing . Plowing . Raking . Smoothing . ... . Chemical treatmer . Fertilization . Liming . Sterilization or fumigation	E. Musser. Turf Management, pp. 10-50. . Vengris. Lawns, pp. 116-131. . ....
F. Variety Selection . Criteria for selection . Climate . Wear . Beauty . Smoothness . ... . Sources of Variety information	F. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-146. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
G. Select an appropriate seeding/sprigging date.	G&H. If possible observe and compare seeding, sprigging and plugging and/or observe the subsequent progress of such establishment methods on a fairway
H. For a given fairway, select an appropriate method of seeding or sprigging.	. Seed, sprig and sod small plots and observe the rate of cover, weed problems encountered, etc.
1. Compare and contrast seeding vs sprigging.	. Practice seeder calibration
2. List at least ___ means of seeding and ___ means of sprigging.	. Operate and adjust sprigging and/or plugging equipment used in the planting of fairways
3. Select and operate seeding or sodding equipment.	. Observe demonstrations of the use of sprigging and/or plugging equipment used in the planting of fairways
a. Calibrate a seeder.	I. . . . .
b.	
I.	
V. Prepare an elementary plan for the establishment of a typical tee.	V. While on field trips to local courses, observe tee construction.
. List the criteria for evaluating a typical tee	. Prepare a scale drawing of a typical tee.
. Diagram or prepare an ideal soil profile for a typical tee	. Prepare a soil tube depicting an ideal tee profile.
. Diagram and give the dimensions of a typical tee	. If possible, observe the establishment of a typical tee.
. List the means in which the establishment of a typical tee differs from the establishment of a typical green.	. As a class project establish a tee.
. . . . .	. . . . .

UNIT: Golf Couse Maintenance and Establishment
SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
G. Seeding date selection	G. . . . .
H. Methods of establishing	H. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 115-146.
. Seeding vs sprigging or stolonizing	. Hanson & Juska. Turfgrass Science, pp. 656-679.
. Methods	. ....
. Seeding . Hand sowing . Drilling	
. Sprigging or stolonizing	
. ...	
I.	I. . . . .
V. Tee construction	V. Fergerson. Building Golf Holes for Good Turf Management, pp. 20-23.
. Criteria for evaluating a tee	. Local golf course superintendents.
. Dimensions of a typical tee	. ....
. Soil profile	
. Special problems	
. ...	

OBJECTIVES	LEARNING ACTIVITIES
VI. Prepare plan for constructing a bunker and trap. A. List the criteria for evaluating a bunker and trap. B. List size specifications for typical bunkers and traps. C.	VI. While on field trips to local courses, observe bunker and trap construction. . As a class project, construct a small bunker and trap. . ....
VII. Prepare a plan for constructing a typical rough. A. List the criteria used for evaluating a rough. B. Prepare a sketch showing the usual location and dimensions of a rough. C.	VII. While on field trips to local courses, observe rough designs. . Sketch a rough to show location and typical dimensions. . . . . .
VIII.	VIII. . . . .

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Golf Course Establishment

TOPICS	RESOURCES
VI. Bunker and trap construction. . criteria for evaluating . construction design . design dimensions	VI. Fergerson. Building Golf Holes for Good Turf Management, pp. 30-34. . Local golf course superintendents. . . . . .
VII. Rough construction. . criteria for evaluating . construction design . design dimensions	VII. Vengris. Lawns, pp. 104-115. . Local golf course superintendents. . . . . .
VIII.	VIII. . . . .

Golf Course Establishment

BOOKS

American Association for Vocational Instructional Materials. Planning for an Irrigation System. Athens, GA: The Association, 1971.

Fergerson. Building Golf Holes for Good Turf Management. New York: Golf House.

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, Inc., 1969.

Musser, H. Burton. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Toro. Toro Design for Large Irrigation Systems. Riverside, California: The Toro Company.

Vengris, Jonas. Lawns. Fresno, California: Thompson Publications, 1969.

FILMS and FILM STRIPS

Clemson University Extension Service, Clemson University, Clemson, S.C. 29631. Golf Green Construction.

TRANSPARENCIES

UNIT: Golf Course Maintenance and Establishment

SUB-UNIT: Exploring Career Opportunities

OBJECTIVE(S): The student will be able to:

I. Explore career opportunities related to golf course maintenance and establishment.

II. . . . . .

UNIT: Golf Course Maintenance and Establishment
SUB-UNIT: Exploring Career Opportunities

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Explore career opportunities related to golf course establishment and maintenance. A. List the occupational title of the people involved in the establishment and maintenance of golf courses, e.g., greens keeper. B. List the major competencies needed by people involved in the establishment and maintenance of golf courses. C. List the major task performed by people employed in the establishment and maintenance of golf courses. D. List people who are not employed full-time in this field but who are employed for special tasks and who therefore require competencies in this area, e.g., landscape designers, design consultants, irrigation consultants, etc. E. List the educational requirement for a given occupational title and sources of such education. F. State the usual experience requirements for a given occupational title held in this field of work. G. List the average wage paid for a given occupational title held in this field of work. H. Describe in writing how a career in this area would complement or fail to complement life goals. . . . . . . II.	I. Interview people employed in the maintenance and establishment of golf courses. . Spend a day with a golf course superintendent. . Seek part-time work experience at a local golf course. . Prepare a job description of a person(s) employed on maintenance or establishment of a golf course. . Prepare a resume' of requirements for a given job involving the maintenance or establishment of a golf course. . Prepare a paper describing how a particular job involving the establishment or maintenance of a golf course complements or fails to complement life goals. . . . . . . II. . . . .

UNIT: Golf Course Maintenance and Establishment
SUB-UNIT: Exploring Career Opportunities

TOPICS	RESOURCES
I. Career opportunities . occupational titles . competencies needed . tasks performed . related occupations . educational requirements . experience requirements . job satisfactions	I. Local golf course employees. . Hanson and Juska. Turfgrass Science, pp. 9-28. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 1-15. . Vengris. Lawns, pp. 1-4. . Slides: The Pennsylvania State University. Exploring Occupations in Turfgrass. 30 color slides. . . . . .
II.	II. . . . .

Exploring Career Opportunities

BOOKS

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, Inc., 1969.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

Vengris, Jonas. Lawns. Fresno, California: Thompson Publications, 1969.

FILMS and FILM STRIPS

The Pennsylvania State University. Exploring Turfgrass Occupations. 30 slides. University Park, PA: Department of Agricultural Education.

BULLETINS

TRANSPARENCIES

ATHLETIC FIELD MAINTENANCE AND ESTABLISHMENT

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Maintenance

OBJECTIVE(S): The student will be able to:

I. Plan an athletic field maintenance program.

II. . . . . .

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Maintenance

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Plan an athletic field maintenance program.	I. As a class project, prepare an elementary plan for maintaining a typical athletic field(s).
A. Plan an athletic field turfgrass mowing program.	A. Outline an elementary plan for mowing an athletic field(s).
1. Determine when a given athletic field turfgrass should be mowed.	1. Observe the effects of improper mowing . Observe the effects of taking a very large cut at one mowing . Observe the effects of mowing grass when it is wet . ....
a. List ___ factors which affect the rate of growth of a given athletic field turfgrass. b. List ___ effects of mowing on a typical grass plant. c. Write a rule-of-thumb for determining the amount of cut per mow. d. Compare and contrast the effects of morning vs afternoon mowing of a typical turfgrass. e. Compare and contrast the effects of mowing when grass is dry and when wet. f.	
2. Prepare a mowing schedule for a given turfgrass variety used on an athletic field for a typical month.	2. Obtain and compare mowing schedules from groundskeepers.
3. List the characteristics of a desirable turf for a given athletic field.	3. Interview coaches, groundskeepers, and players to determine what they prefer in an athletic field turf.
4. Select appropriate equipment for mowing a given athletic field. a. Compare and contrast reel vs rotary type mowers. b. Compare and contrast self-propelled vs tractor drawn mowers. c.	4. Determine what types of equipment are used for mowing the local high school athletic fields and other athletic fields in the community. . Observe demonstrations of mowers used on athletic fields . Obtain and file brochures from commercial concerns on mowers and mowing. . ....

TOPICS	RESOURCES
I. Athletic field maintenance A. Mowing athletic fields 1. Determination of need for mowing . Effects of mowing time . Determination of amount of cut per mowing . Effects of weather on mowing . .... 2. Mowing schedules 3. Characteristics of desirable turf . Football fields . Soccer fields . Baseball fields . .... 4. Equipment selection . Reel . Rotary . Self-propelled . Tractor drawn	Hanson & Juska. Turfgrass Science, pp. 542-559. Penn. State. Turfgrass Maintenance and Establishment. pp. 95-102.

OBJECTIVES	LEARNING ACTIVITIES
5. Adjust and safely operate a given mower ordinarily used to mow athletic fields. a. List the major safety hazards involved in operating mowers used on athletic fields. b. List the major adjustments possible on mower ordinarily used on athletic fields. c.	5. Observe demonstrations of and/or adjust and operate mowers ordinarily used to mow athletic fields. . Observe demonstrations of safe and unsafe use of athletic field mowers. . ....
6. Perform daily maintenance of mowing equipment used on athletic fields.	6. Observe demonstrations of and/or perform daily maintenance on mowers recommended for use on athletic fields.
7.	. ....
B. Plan a watering program for a given athletic field.	B. As a class project, prepare an elementary plan for watering an athletic field(s).
1. Determine the need for watering. a. Install and interpret readings from a soil Moisture probe. b. Recognize the effects of drought on a given athletic field trufgrass. c. Roughly determine the moisture content of soil through feel or by checking the cohesiveness of a handful of soil. d.	1. Observe demonstrations of and/or determine moisture content of soils using a moisture probe. . Observe demonstrations of and/or determine roughly the water content of a soil by squeezing a handful of soil and observing its cohesiveness. . Observe drought symptoms by observing pictures of grass suffering from drought. . ....
2. Determine the amount of water to be added at a given watering. a. Determine the water holding capacity of a soil. b. Determine the amount of runoff expected on a given athletic field. c. Determine the water content of a given soil. d.	2. Observe demonstrations of soil water holding capacity using various soil profile tubes. . Observe demonstrations of water runoff using various slopes and covers over a soil profile. . ....

TOPICS	RESOURCES
5. Mower adjustment and operation . Adjustments . Operation . Safety	. Transparencies: VEMC. Rotary Mower Safety.
6. Daily maintenance . Crankcase oil . Air cleaner	
7.	
B. Watering athletic fields	B. The Pennsylvania State University. Turfgrass Maintenance and Establishment, p. 110.
1. Determination of need . Moisture probe . Recognition of condition of grass . Feeling soil . Observing soil	. AAVIM. Planning For An Irrigation System. . ....
2. Determination of amount to add per watering . Soil water holding capacity . Soil slope . Soil cover . Relative humidity	

OBJECTIVES	LEARNING ACTIVITIES
3. Compare and contrast alternative means of application, e.g., overhead sprinklers, hand hosing, etc.	3. Visit athletic fields. Observe and compare irrigation systems used.
4. Calculate the rate of application of a given sprinkler when the pump capacity, pressure and nozzle size is known.	4. Practice solving rate of application problems when given pump capacity, pressure and nozzle size.
5. Compare and contrast nozzle size and pressure setting on drift.	5. Observe a demonstration of the effects of pressure, nozzle size and type on drift.
6. Determine the evenness of application of a given sprinkler.	6. Use a pan test to determine rate of application and evenness of distribution.
7. Site at least one reference which gives recommended irrigation equipment for a given use.	7. Obtain and file a reference which gives recommended equipment capacities, types, sizes, etc.
8.	8. ....
C. Plan a pest control program for a given athletic field turfgrass.	C. Prepare an elementary pest control program for a given athletic field(s).
1. Recognize pest damage and the pest which caused the damage. a. Identify the insect which would cause serious damage to athletic fields. b. Identify the major turfgrass diseases which cause serious damage to athletic fields. c. Identify the major turfgrass weeds which ordinarily cause serious damage on athletic fields.	1. Observe pictures of or actual damage caused by the more serious pests. . Practice insect, disease, and weed identification. . Practice the use of an elementary weed identification key.

TOPICS	RESOURCES
3. Means of application . Overhead sprinklers . Hand hosing . Subsurface sprinkler system . .... 4. Rate of application determination . Based on mathematical calculations . Based on measurement . Effect of variables . Pump capacity . Pipe size and length . Nozzle type and size . ... . Relationship of variable to drift	
C. Pest control 1. Identification of pest damage . Insect damage . Disease damage . Weed damage . Small animal damage . Identification of pest . Insects . Diseases . Weeds . Small animals	Musser. Turf Management, pp. 189-260.

OBJECTIVES	LEARNING ACTIVITIES
d. Site at least one publication which lists and pictures the insects which cause serious damage to turfgrasses frequently used on athletic fields. e. Site at least one publication which shows the major diseases which seriously damage athletic field turfgrasses. f. Site at least on publication which shows the major weeds which seriously damage athletic field turfgrasses. g.	. Obtain and file at least one publication helpful in the identification of the major insects diseases and weeds which damage athletic field turfgrasses. . . . . .
2. Recommend appropriate control measures for a given pest frequently found on athletic fields. a. Site at least one publication which gives recommended procedures for controlling turfgrass insects. b. Site at least one publication which gives recommended procedures for controlling turfgrass diseases. c. Site at least one publication which gives recommended procedures for controlling turfgrass weeds. d.	2. Obtain and file a reference which gives recommended control procedures for the major turfgrass insects which seriously damage athletic field turfgrasses. . Obtain and file a reference which gives recommended control procedures for the major turfgrass diseases which seriously damage athletic field turfgrasses. . Obtain and file a reference which gives recommended control procedures for the major turfgrass weeds which seriously damage athletic field turfgrasses. . ....
3. Apply chemical pest controls to a given athletic field. a. Select an appropriate application for a given treatment. b. Compare and contrast sprayers vs dusters.	3. Observe demonstrations of and/or apply chemical pest control using sprayers or other equipment recommended for this purpose. . Practice sprayer calibration . Observe demonstrations of the effect of pressure and nozzle size on a spray drift.

TOPICS	RESOURCES
2. Control measures . Insects . Diseases . Weeds . Mechanical . Chemical . Small animals	
3. Pest control application . Equipment selection . Equipment comparison	

OBJECTIVES	LEARNING ACTIVITIES
c. Calibrate sprayer. d. Select an appropriate pressure and nozzle size for spraying a given chemical. e. Adjust and operate a typical sprayer used to apply chemical treatments to athletic fields. f.	. Observe demonstrations of safe and unsafe usage of spray equipment . Practice adjusting and operating a tractor mounted sprayer . ...
D. Prepare a fertilization plan for a given athletic field. 1. Determine the need for fertilization. a. Recognize deficiency symptoms. b. Take soil sample. c. Interpret soil samples. d. .... 2. Select an appropriate quantity and form of topdress. a. Compare and contrast different forms of nitrogen. b. Interpret soil test reports. c. .... 3. Select an appropriate means of application. a. Compare and contrast liquid vs solid application. b. .... 4. .... E.	D. Observe a demonstration of and/or take a soil sample from an athletic field. . Observe pictures of or actual symptoms of element deficiency in a turfgrass. . Obtain and file a publication which compares forms of nitrogen. . Observe demonstrations of and/or operate fertilizer application equipment . ....
II. ...	II. ...

TOPICS	RESOURCES
. Equipment calibration . Sprayers . Dusters . Spreaders . Garden hose attachments . ... . Equipment operation . Adjustments . Safety	
D. Athletic field fertilization	Musser. Turf Management, pp. 34-50.
1. Determination of need . Recognition of deficiency symptoms . Soil test	
2. Fertilizer selection . Nitrogen . Nitrate of soda . Ammonium nitrate . Liquid nitrogen . Complete fertilizers . High analysis . Low analysis	
3. Means of application . Solid . Liquid	
4. ...	
E. ...	
II. ...	II. ...

Athletic Field Maintenance

BOOKS

American Association for Vocational Instructional Materials. Planning for an Irrigation System. Athens, GA: The Association, 1971.

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, Inc., 1969.

Musser, H. Burton. Turf Management. New York: McGraw-Hill, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment, University Park, PA: Department of Agricultural Education, 1968.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

Vocational Education Media Center, Clemson University, Clemson, S.C. Rotary Mower Safety.

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Establishment

OBJECTIVE(S): The student will be able to:

I. Prepare an elementary plan for the design, construction and establishment of an athletic field.

II. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
I. Prepare an elementary plan for the layout, construction and establishment of an athletic field.	I. Outline an elementary plan for the construction and establishment of an athletic field.
A. Sketch or draw to scale a given athletic field.	A. Practice sketching and drawing to scale a football field.
1. Sketch or draw to scale a typical football field.	. Practice sketching and drawing to scale a baseball field.
a. Label the parts.	. Obtain and file a reference which gives the dimensions of athletic fields.
b. List field specifications.	. . . . .
c.	
2. Sketch or draw to scale a typical baseball field.	
a. Label the parts.	
b. List the field specification.	
c. ...	
B. Stake out (for grading) a given athletic field on a given terrain.	B. Diagram the end view of a football field
1. Layout a given contour using a plane table, level, or transit.	. Make a contour drawing of a baseball field.
2. List the typical contour requirement for a given athletic field.	. ....
3.	

TOPICS	RESOURCES
I. Athletic Field design, construction, and establishment.	
A. Athletic field Design	I. A. Bulletin: Athletic Fields
1. Types of fields	. The Pennsylvania State University, Turfgrass Maintenance and Establishment. pp. 95-100.
. Football . baseball . soccer	. ....
2. Field specifications	
3. ...	
B. Grading and leveling	B. Hanson & Juska. Turfgrass Science, pp. 542.
1. Contour establishment	. ....
2. Lining-out	
3. ...	

OBJECTIVES	LEARNING ACTIVITIES
C. Prepare drainage plan for a given athletic field. 1. Prepare a drainage map of a given athletic field. 2. Given the soil characteristics and slope, select appropriate tile or pipe spacing and size. 3. Diagram the location of drainage tile or pipes. 4. Install a short section of tile and/or pipe.	C. Make a surface and subsurface drainage map of a football field. . Install a short section of drainage tile or pipe. . Obtain and file a reference which gives recommended tile size, type spacing and depth for differing soil conditions. . Diagram a side and end view of tile properly installed. . If possible observe installation of tile - preferably on an athletic field. . ....
D. Prepare plan for shaping (grading) a given athletic field. 1. Select appropriate equipment. 2. List the steps involved in grading. 3. Determine proper contour using a transit. 4.	D. Outline plan for grading a site . Practice using the transit to determine level . Visit a site which is being reshaped by various means and in which a transit is being used to determine the desired shape . ...

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Establishment

TOPICS	RESOURCES
C. Drainage . Surface . Swales . Ditches . ... . Sub-surface . Tile . Size . Type . Depth . Spacing . Slope . ... . Pipe . Installation	C. Hanson & Juska. Turfgrass Science, pp. 542-544. . ....
D. Grading . Contouring . Layout	D. Hanson & Juska. Turfgrass Science, pp. 542-44. . ....

OBJECTIVES	LEARNING ACTIVITIES
E. Prepare plan for establishing an irrigation system for a given athletic field. 1. Select appropriate system, i.e., sub-surface, overhead, permanent, portable, etc., for a given athletic field. 2. Select appropriate type and size equipment for a given athletic field. 3. Calculate gph output of water for a given pump capacity, given pressure, and given nozzle size and type	E. Outline plan for establishing an irrigation system on an athletic field . Visit or interview a university grounds superintendent to determine the system of irrigation used . Practice calculating the gph output of water when using a given capacity pump at a given pressure with a given nozzle type and size. . Obtain and file a reference which gives recommended pumps, pressures, nozzle sizes and type. . ....
F. Prepare a seedbed for seeding or sprigging a given athletic field. 1. Diagram and or prepare a soil profile for a given athletic field. a. List the characteristics of a desirable soil profile. b. Compare and contrast a given soil profile in terms of its drainage, nutrient holding, and compaction characteristics. c. .... 2. Blend an appropriate topsoil mixture. a. Select appropriate materials to construct a given topsoil structure. b. Select the appropriate percentage of each material used in a mixture. c. Select an appropriate method of blending. d.	F.1-2. Prepare a small amount of topsoil for an athletic field. . Observe the mixing of topsoil ingredients, preferably on an athletic field. . Observe the amending of an existing soil, preferably on an athletic field. . Prepare - an ideal soil profile tube for a given athletic field.

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Establishment

TOPICS	RESOURCES
E. Irrigation System 1. Types . Surface . Sub-surface . ... 2. Pipe . Type . Size . ... 3. Nozzles . Type . Size . ... 4. Out-put calculations 5. ...	E. AAVIM. Planning For An Irrigation System. . Bulletin: Athletic Fields. . Musser. Turf Management, pp. 50-83. . ....
F. Seedbed Preparation 1. Soil Structure needed 2. Mechanical preparation	F. Hanson & Juska. Turfgrass Science, pp. 542-45. . ...

OBJECTIVES	LEARNING ACTIVITIES
3. Amend or modify an existing soil. a. Select appropriate materials needed for amending a given soil. b. Select the appropriate amount of each material to be added. c. Select an appropriate method of incorporating additives into a given soil. d.	3. Prepare several soil mixtures using different amendments and test the rate of water movement, etc. . ....
4. Treat a given soil mixture for pest prior to planting. a. Select an appropriate pesticide. b. Determine appropriate quantity of a given chemical for a given area to be treated. c. Select an appropriate means of application on incorporation. d. Treat a given soil using a nematode - weed control chemical such as methol-bromide. 1. List steps in application. 2. List requirements for effective treatment. 3. List safety hazards. 4.	4. Obtain and file a reference which recommends soil pesticide treatments. . Treat a small plot of soil for nemotodes using methol bromide . (See Unit on Turfgrass Pest Control). . ....

TOPICS	RESOURCES
3. Amendments . Sawdust . Peat . Bark	. Hanson & Juska. Turfgrass Science, pp. 542-45. . Musser. Turf Management, pp. 10-33. . ....
4. Soil treatment . Soil sterilant selection . Soil sterilant application . Methods . Safety	

UNIT: Athletic Field Maintenance and Establishment
SUB-UNIT: Athletic Field Establishment

OBJECTIVES	LEARNING ACTIVITIES
G. Select an appropriate turfgrass variety for a given athletic field. 1. List at least ___ acceptable varieties for a given athletic field. 2. List at least ___ references on turfgrass varieties. 3. List at least ___ criteria to use for the selection of a turfgrass for a typical athletic field. 4. Compare and contrast athletic field turfgrass requirements with the requirements of home lawns, golf green, etc. 5.	G. Obtain and file a reference which lists and compares turfgrass varieties for athletic fields . Survey athletic fields in your community and compile a list of the grass varieties use. . Gather any comparative data you can on the turfgrass varieties used on athletic fields in the local community. . ....
H. Sprig or seed an athletic field. 1. Select the most appropriate method of establishment for a given variety, i.e., seeding or sprigging. 2. Select the most appropriate means of establishing a given athletic field. 3. Select and operate the simpler equipment used for seeding or sprigging. a. Calibrate a given seeder. b. List application rates for a given variety. c. Determine spacing and planting depth for a given turfgrass. d.	H. If possible, observe the sprigging or seeding or plugging of an athletic field . As a class project seed, sprig or plug a small plot . If possible, compare the various methods of establishing turfgrass areas (this would not necessarily have to be an athletic field) . Obtain and file a reference which recommends establishment methods . Practice calibrating a seeder. . Diagram a seed application pattern for use when hand seeding or using a cyclone type seeder . Make a marker for achieving even distribution of plugs . ....

TOPICS	RESOURCES
G. Variety(s) Selection 1. Criteria for selection 2. Characteristics of varieties 3. Sources of variety information 4. ...	G. Wise. The Lawn Book, p. 12. . Hanson & Juska. Turfgrass Science, p. 549. . ....
H. Establishment . Seeding . Methods . Seed . Hand sowing . cyclone seeder . Drill . ... . Sprigging or Stoloning . Equipment . ... . Seeder Calibration . Sprig spacing	H. Vengris. Lawns, pp. 104-124. . Bulletin: Athletic Fields. . ....

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Athletic Field Establishment

OBJECTIVES	LEARNING ACTIVITIES
I. Mulch a given athletic field. 1. Select an appropriate mulch material. 2. Select an appropriate means of application. 3. State appropriate amount of application for a given mulch, e.g., wheat straw, apply 2" of cover, etc. 4. .... J. .... II.	I. If possible observe mulches used during turfgrass establishment in the local area or when traveling preferably on athletic fields but others as well. . Mulch a small plot established as a class project. . Observe demonstrations of different methods of anchoring a mulch. . Observe different methods of application. . .... J. .... II. ....

UNIT: Athletic Field Maintenance and Establishment
SUB-UNIT: Athletic Field Establishment

TOPICS	RESOURCES
I. Mulching	I. Musser. Turf Management, pp. 118-153.
. Types	. ....
. Purposes	J. ...
. ...	II. ...
J. ...	
II.	

Athletic Field Establishment

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Hanson, A. A. and F. V. Juska. Turfgrass Science. Madison, Wisconsin: The American Society of Agronomy, 1969.

Musser, H. Burton. Turf Management, New York: McGraw-Hill Book Company, 1962.

The Pennsylvania State University. Turfgrass Maintenance and Establishment, University Park, Pa: Department of Agricultural Education, 1968.

Vengris, Jomas. Lawns, Fresno, CA: Thomson Publications, 1969.

Wise, L. N. The Lawn Book, Decatur, Ga.: Bowen Press Inc., 1961.

Bulletins

The Pennsylvania State Univeristy. Agricultural and Home Economics Extension Service, University Park, Pennsylvania. Athletic Fields.

FILMS and FILM STRIPS

TRANSPARENCIES

UNIT: Athletic Field Maintenance and Establishment

SUB-UNIT: Exploring Career Opportunities

OBJECTIVE(S): The student will be able to:

I. Explore career opportunities related to athletic field maintenance and establishment.

II. . . . . .

IT: Athletic Field Maintenance and Establishment

3-UNIT: Exploring Career Opportunities

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Explore career opportunities related to athletic field maintenance or establishment. A. List the occupational titles of people involved in the maintenance or establishment of athletic fields. B. List the major competencies needed by people involved in the maintenance or establishment of athletic fields. C. List the major tasks performed by people employed in the maintenance or establishment of athletic fields. D. List people who are not employed full-time in the maintenance or establishment of athletic fields but who are employed for short periods of time for special tasks and who therefore require competencies in this field. E. List the educational requirements for a given occupational title in this area and list also sources of such education. II.	I. Interview a person(s) employed in maintaining athletic fields. . Interview a person(s) employed in establishing athletic fields. . Seek part-time work experiance maintaining or establishing athletic fields. . Prepare a resume' of job requirements for a job(s) in this area. . Prepare a job description of a person(s) involved in the maintenance or establishment of athletic fields. . Prepare a paper describing how a particular job in this field complements or fails to complement life goals. . . . . . . II. . . . .

T: Athletic Field Maintenance and Establishment

UNIT: Exploring Career Opportunities

TOPICS	RESOURCES
I. Career Exploration. . Occupational titles . agronomist . athletic field superintendent . landscape contractor . . . . Other occupations requiring competencies in this area . institutional grounds supervisors . turf supplies salesmen . some athletic coaches . grounds keepers . . . . Competencies needed . science . plant . soil . . . . mechanical . cultural practices . . . . Educational requirements and opportunities	I. Hoover. Handbook of Agricultural Occupations, pp. 243-263. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 1-15. . Slides: Exploring Occupations in Turfgrass. . . . . .
II.	II. . . . .

Exploring Career Opportunities

BOOKS

Hoover, Norman K. Handbook of Agricultural Occupations. Danville, Illinois: The Interstate Printers and Publishers, 2nd ed., 1969.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

FILMS and FIIM STRIPS

The Pennsylvania State University. Department of Agricultural Education. University Park, PA. 30 slides: Exploring Turfgrass Occupations.

BULLETINS

TRANSPARENCIES

INSTITUTIONAL AND INDUSTRIAL GROUNDS MAINTENANCE AND ESTABLISHMENT

UNIT: Institutional and Industrial Grounds Maintenance and Establishment

SUB-UNIT: Institutional and Industrial Grounds Maintenance

OBJECTIVE(S): The student will be able to:

I. Plan a turfgrass maintenance program for a given institutional or industrial plant grounds.

II. . . . . .

UNIT: Institutional and Industrial Plant Grounds Establishment and Maintenance

SUB-UNIT: Institutional and Industrial Grounds Maintenance

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Plan a turfgrass maintenance program for a given institutional or industrial plant grounds.	I. Prepare an elementary plan for maintaining institutional or industrial plant grounds.
A. Plan a mowing program for a given site.	A. 1. Observe the effects of improper mowing - waiting too long to mow - mowing too frequently.
1. Determine when to mow.	. . . . .
a. List the factors which affect the frequency of mowing.	2. Observe demonstrations and compare the effectiveness and efficiency of the more commonly used mowing equipment used on institutional or industrial plant grounds.
b. Select an appropriate mowing height for a given turfgrass.	3. Observe demonstrations of and/or operate the mower commonly used to mow institutional and plant grounds.
c.	. Observe demonstrations of and/or adjust the mower commonly used to mow institutional or plant grounds.
2. Select the most appropriate equipment for mowing a given turfgrass area.	. Observe demonstrations of the safe and unsafe operations of such mowers.
a. Compare and contrast blade and reel type mowers.	. . . . .
b. Compare and contrast tractor mowers, self propelled mowers, gang mowers, etc.	4. Observe a demonstration of and/or change the oil in the crankcase of mower engines.
c.	. Observe a demonstration of and/or change the oil in the mower engine air cleaner.
3. Adjust and operate a given type mower.	. Performing the daily maintenance tasks recommended in the owners manual.
a. List the safety hazards involved in operating a given type of mower.	. . . . .
b.	
4. Perform daily maintenance task on a given type of mower.	
5.	

UNIT: Institutional and Industrial Plant Grounds Establishment and Maintenance

SUB-UNIT: Institutional and Industrial Grounds Maintenance

TOPICS	RESOURCES
I. Institutional and industrial plant grounds maintenance	
A. Mowing institutional and industrial plant grounds.	
1. When to mow	I-A. Bulletin: Turfgrass Guide for Lawns, Recreational Areas, and Roadsides.
. factors which affect mowing frequency . mowing height . amount of cut per mowing	. Hanson: Turfgrass Science, Chapter 25. . . . . .
2. Equipment selection	2. Hanson: Turfgrass Science, Chapter 28.
. reel type . rotary type . self-propelled . tractor drawn . gang mowers . wheel type	. Manufacturers' manual . Local equipment salesmen . Local highway supervisor . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 37-93.
3. Mower operation and adjustment	. . . . .
. adjustments . safety	
4. Mower daily maintenance	
. crankcase oil . air cleaner	
5.	

UNIT: Institutional and Industrial Grounds Maintenance

OBJECTIVES	LEARNING ACTIVITIES
B. Plan a fertilization program for a given institutional or industrial plant grounds.	
1. Determine when fertilization is needed for a given turfgrass.	1. Practice taking soil samples for existing institutional or industrial plant grounds.
a. Take a soil sample.	. Practice interpreting the results of such tests.
b. Interpret a soil sample report.	. Practice the identification of element deficiency symptoms of turfgrasses.
c. Recognize element deficiency symptoms in grasses.	. . . . .
2. Determine the analysis and quantity of fertilizer needed for a given turfgrass.	2. Obtain and file a reference which gives fertilizer recommendations for grasses commonly used on institutional and industrial plant grounds.
3. Select an appropriate time of application.	. . . . .
a. List the major factors to consider when selecting the time of application.	3. Demonstrate the results of applying fertilizers to wet vs dry soils.
b. Compare and contrast the various seasons.	. Observe demonstrations of fertilizer burn.
c. Compare and contrast application during dry and wet conditions.	. . . . .
d. Recognize the symptoms of fertilizer burn.	
e.	
4. Select the most appropriate equipment for applying fertilizer to a given turfgrass area.	4. Observe and compare demonstrations of the more commonly used fertilizer application equipment.
a. Compare and contrast dry spreaders vs liquid applicators for fertilizing a given turfgrass.	. Obtain and file brochures describing the more commonly used fertilizer application equipment for applying fertilizer to institutional and industrial plant grounds.
b. Compare the economics of using alternative equipment.	. . . . .
c.	

UNIT: Institutional and Industrial Plant Grounds Establishment and Maintenance

SUB-UNIT: Institutional and Industrial Grounds Maintenance

TOPICS	RESOURCES
B. Fertilization of institutional and industrial plant grounds.	B. Hanson. Turfgrass Science, Chapter 5.
1. Need determination a. Soil test b. Deficiency symptoms c.	. Bulletin: Selecting Fertilizers for Lawns and Gardens. . Musser. Turf Management, pp. 34-44.
2. Analysis selection	
3. Time of application . Factors which affect time of application . season . moisture . rainfall . climate	
4. Equipment selection . spreaders . sprayers	4. Hanson. Turfgrass Science, Chapter 28. . Local equipment dealers. . Local institutional grounds superintendents. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
5. Adjust and operate a given applicator in such a manner as to achieve a uniform application of fertilizer.	5. Observe demonstrations of and/or adjust and operate fertilizer application equipment commonly used for applying top dress fertilizer to institutional and industrial plant grounds.
6. Calibrate a fertilizer applicator (sprayer or distributor)	6. Practice calibrating the more commonly used fertilizer applicators.
7.	7. . . . .
C. Plan a pest control program for a given institutional or industrial plant grounds.	C. As a class project plan an elementary pest control program for an institution or industrial plant grounds.
1. Recognize pest damage.	. Observe pest or pictures of damage caused by the more common turfgrass pests.
2. Determine pest which caused damage.	. Practice (perhaps through contest) the identification of the more common insects, diseases, and weeds.
a. Identify ____ of the more common turfgrass pests.	. Obtain and file a reference which suggests control measures for turfgrass pests.
b. List at least one extension service bulletin concerning turfgrass pests and their control.	. Observe demonstrations of and/or operate chemical applicator.
c.	. Calibrate a typical sprayer used to apply chemical, disease, weed or insect control chemicals.
3. Select a method of controlling a given pest.	. . . . .
a. List at least one extension service bulletin which provides information on turfgrass pest control.	
b.	
4. Select an appropriate means of applying a pest control.	
5. Calibrate, adjust and operate pest control equipment for treating a given turfgrass for a given pest.	
6.	

TOPICS	RESOURCES
5. Application operation. 6. Applicator calibration. 7.	5. Local equipment dealers. . Owner's manuals. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, p. 48. . . . . .
C. Pest control	C. See unit on Basic Pest Control.
1. Damage recognition . insect damage . disease damage . weed damage . small animal damage	. Musser. Turf Management, pp. 189-260.
2. Pest identification . insects . weeds . diseases . small animals	
3. Methods of control . insects . diseases . weeds . chemical . mechanical . small animals	
4. Methods of applying chemicals . spreaders . sprayers	
5. Equipment . operation . adjustment . calibration	
6.	

OBJECTIVES	LEARNING ACTIVITIES
D. Plan a watering program for a given institutional or industrial plant grounds.	D. Prepare an elementary watering program for an institutional or industrial plant grounds.
1. Determine the need for water.	. Observe a demonstration of determing the water content of soil by observing a handful of soil.
a. Use and interpret soil probe.	. Practice determining the need for watering by observing the turfgrass.
b. Determine the approximate water content of soil by feel and sight.	. Observe a demonstration of determining the water content of a soil using a moisture probe.
c.	. Visit local institutions and industrial plants to observe the water systems used.
2. Select an appropriate means of watering a given turfgrass area.	. Observe demonstration of the water holding capacity of different soil profile tubes.
a. Compare and contrast the economics of a given type of irrigation.	. Obtain and file a reference which recommends application rates for a given type of soil.
b.	. . . . .
3. Select an appropriate rate of application for a given turfgrass location and soil condition.	
4.	
E. Determine the need for aerating a given institutional or industrial plant turfgrass.	E. Observe actual compaction damage or observe slides or photos of such damage.
	. Observe demonstrations of and/or practice operating a soil aerator.
F. Determine the need for thatch removal for a given industrial or plant turfgrass.	. . . . .
	F. Observe actual effects of thatch damage or observe slides or photos of such damage.
	. Observe demonstrations of and/or use thatch removal equipment.
G.	G. . . . .
II.	II. . . . .

UNIT: Institutional and Industrial Plant Grounds Establishment and Maintenance

SUB-UNIT: Institutional and Industrial Grounds Maintenance

TOPICS	RESOURCES
D. Watering	D. Hanson. Turfgrass Science, Chapter 6.
1. Need determination . soil moisture probe . feel and sight of soil . observeation of grass	. AAVIM. Planning for an Irrigation System. . Musser. Turf Management, pp. 50-84.
2. Means of watering . overhead irrigation . subsurface irrigation	
3. Rate of application . effects of soil type . effects of soil slope . effects of soil cover . effect of water holding capacity of soil	
4.	
E. Aeration 1. Need determination	E. Hanson. Turfgrass Science, pp. 553, 577, 598, and 696.
2. Means	. Musser. Turf Management, pp. 261-274.
3.	
F. Thatch 1. Amount needed 2. Means of remaining excess 3.	F. Hanson. Turfgrass Science, pp. 500-502, 520, 533-535.
	. . . . .
G.	G. . . . .
II.	II. . . . .

Institutional and Industrial Grounds Maintenance

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Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: The American Society of Agronomy, 1969.

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The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

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Agricultural and Home Economics Extension Service, Turfgrass Guide for Lawns, Recreational Areas and Roadsides, The Pennsylvania State University, University Park, PA.

U.S. Department of Agriculture. Selecting Fertilizers for Lawns and Gardens, Bulletin No. 89, Washington, D.C.

TRANSPARENCIES

UNIT: Institutional and Industrial Grounds Turfgrass Maintenance and Establishment

SUB-UNIT: Institutional and Industrial Grounds Establishment

OBJECTIVE(S): The student will be able to:

I. Prepare a plan for the establishment of a given institutional or industrial plant grounds turfgrass.

II. . . . . .

UNIT: Institutional and Industrial Grounds Establishment

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Prepare a plan for the establishment of a given institutional or industrial plant grounds.	I. Outline an elementary plan for establishing an institutional or industrial plant grounds.
A. Shape or modify the shape of an existing terrain for drainage, erosion, control and esthetics.	A. Practice staking out a site for grading.
1. Stake out contours and/or terraces.	. Practice staking out a contour.
a. Operate a level b. Determine slope c.	. Observe the construction of a short terrace. . Observe the grading of a site. . Obtain and file a reference which gives information on slope requirements for surface drainage.
2. Construct a contour and/or terrace.	. . . . .
a. Diagram a contour. b. Select and operate equipment necessary to construct a contour or terrace. c.	
3.	
B. Prepare land for seeding or sprigging.	B. Prepare a desirable turfgrass soil profile tube.
1. Select the mechanical treatment needed for preparing a given soil.	1. Practice classifying an existing soil.
a. Diagram the structure of a given soil in terms of top and subsoil texture, consistency, structure, etc. b. List at least ____ criteria for evaluating a desirable seedbed. c. List some of the mechanical or other means of attaining a desirable structure. d.	. If possible observe the preparation of seedbed 2. As a class project prepare a seedbed plot. . Observe demonstrations of and/or operate soil preparation equipment.
2. Select, adjust, and operate equipment necessary for preparing a seedbed.	

UNIT: Institutional and Industrial Grounds Turfgrass Maintenance and Establishment

SUB-UNIT: Institutional and Industrial Grounds Establishment

TOPICS	RESOURCES
I. Institutional and industrial grounds establishment.	
A. Shaping and grading.	I-A. Beard. Turfgrass Science and Culture, Chapter 16.
1. Contouring and terracing	. Local grounds superintendents or contractors.
. use of transit	. . . . .
. staking out	
. . . . .	
2. Mechanical means	
3.	
B. Soil preparation	B. Beard. Turfgrass Science and Culture, Chapter 16.
1. Mechanical treatment	
. topsoil removal and storage	
. subsoil treatment	
. . . . .	
2. Equipment adjustment and operation.	

OBJECTIVES	LEARNING ACTIVITIES
3. Determine the fertilization needs of a given soil for a given turfgrass prior to planting. a. Take a soil sample. 1. List the steps in taking a soil sample. 2. State the depth at which a soil sample for turf establishment should be taken. 3. . . . . . b. Interpret a soil test report. c. List at least one reference for determining the nutrient requirements of turfgrasses. d. Determine the pH level from a soil test report. e. . . . . . 4. Apply a given chemical soil treatment. a. Select appropriate equipment for application of a given chemical. b. Calibrate a given machine so as to apply a given amount of a given chemical per acre. c. Operate application equipment. d. . . . . . 5. Determine the need for pre-plant pest control. a. Identify existing pest. 1. List the six more common turfgrass pest.	3. Practice taking soil samples of an area to be used as for institutional or industrial plant grounds. . Obtain and file a reference which gives the nutrient requirement of turfgrasses. 4. Practice calibrating and/or observe demonstration of the calibration of a fertilizer application. . Observe demonstrations of and/or operate fertilizer application equipment. 5. Obtain and file pictures of the more common soil insects which are hazardous to turfgrasses. . Obtain and file a reference which shows pictures and gives recommended control measures for turfgrass pests. . Observe a demonstration of or treat a small plot of soil for soil pests. . Observe a demonstration of the application of method bromide for nematode and weed control. . . . . .

TOPICS	RESOURCES
3. Fertilization . soil sampling . soil sample report interpretation	3. The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 38-48.
4. Fertilizer application . methods . solids . drills . spreader . . . . liquids . sprayers . . . . calibration	4. Hanson. Turfgrass Science, pp. 687-688, also pp. 225-227.
5. Pre-plant pest control . solids . gases	5. Hanson. Turfgrass Science, pp. 358-367.

OBJECTIVES	LEARNING ACTIVITIES
2. Site at least one reference for use in pest identification. 3.	
b. Select an appropriate pre-plant control methods for a given pest. 1. Site at least one reference helpful in selecting pest control methods. 2.	
6.	
C. Select an appropriate turfgrass variety for a given set of specifications, i.e., cost (est. & maint.) requirements, esthetic requirements, use requirements, etc. 1. List the major variables involved (factors and to be considered) in the selection of a turfgrass variety. 2. List at least one reference which compares and contrasts turfgrass varieties. 3.	C. Obtain and file a reference which compares and contrasts turfgrass varieties suitable for institutional or plant grounds. . Interview groundkeepers or superintendents at institutions or plants in the local community to obtain their appraisal of various turfgrasses they are using. . Practice identifying grasses commonly used on industrial plant and institutional grounds. . . . . .
D. Select an appropriate method and time of seeding/sprigging a given turfgrass variety. 1. List the essential requirements of seed germination. 2. Site at least one reference which gives recommended seeding/sprigging dates for a given turfgrass variety.	D. Obtain and file a reference which gives recommended methods and times of establishing turfgrasses. . Observe a demonstration of and/or seed or sprig or plug an area as it would be done when establishing industrial plant or institutional grounds. . Calibrate a seeder.

TOPICS	RESOURCES
C. Variety(s) selection 1. Criteria for selection . climatic adaptations . beauty . maintenance cost . . . . . . 2. References 3.	C. Hanson. Turfgrass Science, Chapters 19, 20 and 21.
D. Seeding/sprigging method 1. Methods . seeding . sprigging . sodding . . . . . . 2. Planting dates	. Hanson. Turfgrass Science, Chapter 18.

UNIT: Institutional and Industrial Grounds Turfgrass Maintenance and Establishment

SUB-UNIT: Institutional and Industrial Grounds Establishment

OBJECTIVES	LEARNING ACTIVITIES
3. Compare and contrast seeding vs sprigging where the alternative exist. 4. List at least ____ means of seeding and ____ means of sprigging. 5. Select, calibrate and operate seeding/sprigging equipment. 6.	
E. Select and apply an appropriate mulch for a given establishment condition. 1. List the more commonly used mulches. 2. Compare and contrast the more commonly used mulches. 3. Select an appropriate amount of mulch for a given establishment condition. a. List the factors to consider in determining the amount of mulch to apply. b.	E. Observe a demonstration of and/or mulch a small area of newly planted grass. • Observe the kinds of mulches if any used in the local area for establishing turfgrasses. • Observe demonstrations of different methods of application. • Observe demonstrations of different methods of anchoring. . . . . .
II.	II. . . . .

TOPICS	RESOURCES
3. Seeding vs sprigging. 4. Seeder calibration. 5.	
E. Mulching . selection of materials . wheatstraw . . . . amount of mulch needed	E. Hanson. Turfgrass Science, Chapter 18.

Institutional and Industrial Grounds Establishment

BOOKS

Beard, James B. Turfgrass Science and Culture. Englewood Cliffs, NJ: Prentice Hall Inc., 1973.

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Association of Agronomy, Inc., 1969.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

UNIT: Institutional and Industrial Plant Grounds Maintenance and Establishment

SUB-UNIT: Exploring Career Opportunities

OBJECTIVE(S): The student will be able to:

I. Explore career opportunities related to the maintenance and establishment of institutional and industrial plant grounds.

II. . . . . .

: Institutional and Industrial Plant Grounds Establishment and Maintenance

UNIT: Exploring Career Opportunities

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to:	
I. Explore career opportunities in institutional and industrial plant grounds establishment and maintenance. A. List the occupational titles of the people involved in this area. B. List the major competencies needed by people employed in this area. C. List the major task performed by people involved in this area. D. List people who are not employed full-time in this field but who are employed for special tasks and who therefore require competencies in this field. E. List the educational requirements and sources of such education for the holder of a given job title. F. State the usual experience requirement for a given occupational title. G. List the average wage paid for a given occupational title. H. Describe in writing how a career in this area would complement or fail to complement life goals. I.	I. Interview people employed or people who contact the maintenance and/or establishment of institutional or plant grounds. . Spend a day with a person employed in this area of work. . Seek part-time work experience involving the maintenance or establishment of institutional or plant grounds. . Prepare a job description of a person employed in the maintenance or establishment of institutional or plant grounds. . Prepare a resume' of requirements for a given job in the maintenance or establishment of institutional or plant grounds. . Prepare a paper describing how a particular job in the maintenance or establishment of institutional or plant grounds would complement or fail to complement life goals. . . . . .
II.	II. . . . .

UNIT: Institutional and Industrial Plant Grounds Establishment and Maintenance

SUB-UNIT: Exploring Career Opportunities

TOPICS	RESOURCES
I. Career Exploration . Occupational titles . agronomist . grounds superintendent . grounds keeper . . . . Related occupations . turfgrass supplies salesman . landscape designers . . . . Competencies needed . Major tasks performed . Experience requirements . Wages . Life goals	I. Hoover. Handbook of Agricultural Occupations, pp. 243-263. . The Pennsylvania State University. Turfgrass Maintenance and Establishment, pp. 1-15. . Slides: Exploring Occupations in Turfgrass. . . . . .
II.	II. . . . .

Exploring Career Opportunities

BOOKS	FILMS and FILM STRIPS
Hoover, Norman K. Handbook of Agricultural Occupations. Danville, Illinois: The Interstate Printers and Publishers, 2nd ed., 1969. The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.	Department of Agricultural Education. Exploring Turfgrass Occupations. 30 slides. The Pennsylvania State University, University Park, PA.
BULLETINS	TRANSPARENCIES

HIGHWAY ROADSIDE MAINTENANCE AND ESTABLISHMENT

UNIT: Highway Roadside Maintenance and Establishment

SUB-UNIT: Highway Roadside Establishment

OBJECTIVE(S): The student will be able to:

I. Plan the establishment of a given highway roadside.

II. . . . . .

UNIT: Highway Roadside Maintenance and Establishment
SUB-UNIT: Highway Roadside Establishment

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Plan the establishment of a given highway median strip. A. List the special turf establishment problems associated with a given highway median strip, e.g., working with existing soils, critical time factors, slope problems, etc. B. Prepare a given highway median strip for seeding or sprigging. 1. Select the mechanical treatment needed for preparing a given site. a. Diagram the structure of desirable seedbed showing top and subsoils thickness, texture, consistency, etc. b. List at least ___ criteria for evaluating a desirable seedbed. c. . . . . . 2. Select, adjust and operate tractors and equipment typically used in preparing a seedbed for a given median strip. a. Select, adjust and operate a farm type tractor. b. Select, adjust and use a set of plows or disc for a given median strip establishment condition. c.	I. Prepare an elementary plan for establishing a highway median strip. A. Interview a highway engineer to determine special turfgrass establishment problems involved in establishing a highway median strip. . Make a contour drawing of a section of median strip to show slope and surface drainage problems. . . . . . . B. Practice analyzing and classifying median strip soils to determine treatments needed if any for growing turfgrasses. 1. Observe the preparation of a median strip or shoulder for seeding (site preparation for planting a fescue pasture might be similar) 2. Observe demonstrations of the operation of or operate equipment used for preparing median strip seedbeds. . . . . As a class project prepare a seedbed for planting an area similiar to a highway median strip . . . . . .

UNIT: Highway Roadside Maintenance and Establishment

SUB-UNIT: Highway Roadside Establishment

TOPICS	RESOURCES
I. Highway roadside establishment.	I. Hanson and Juska. Turfgrass Science, pp. 613-627.
A. Special problems . working with existing soils . critical time requirements . slope problems . drainage problems	. Local highway engineer or highway supervisor.
B. Seedbed preparation . mechanical treatment needed . seedbed requirements . equipment . selection . operation	. Hanson and Juska. Turfgrass Science, Chapter 28. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
3. Determine the fertility requirements for a given highway median strip for establishing a given grass. a. Take a soil sample. (1) List at least ____ recommended steps involved in taking a soil sample for turfgrass establishment. (2) State the depth to which a soil sample should be taken for the establishment of a turfgrass. (3). . . . . b. Interpret a soil test report. c. List at least one reference for determining nutrient requirements of turfgrasses. d. Calculate the amount of a given form of lime to raise the soil pH to a given level. e.	3. Practice taking soil samples and completing the information sheets. . Practice interpreting soil reports. . Obtain and file at least one reference which gives recommended fertilization of turfgrasses. . Practice calculating lime requirements from soil test reports.
4. Apply a given soil treatment. a. Select appropriate equipment for the application of a given soil treatment. b. Calibrate a given application equipment to apply a given amount of treatment per acre. c. Adjust and operate a given applicator. d.	4. Practice calibrating fertilizer applicators used in highway median strip seedbed preparation. . Observe demonstrations of and/or operate a fertilizer spreader used to apply starter fertilizer on a highway median strip. . . . . .

TOPICS	RESOURCES
3. Fertilizer requirements . taking soil samples . interpreting soil samples . nutrient requirements of turfgrasses . liming	3. Penn. State. Turfgrass Maintenance and Establishment, pp. 38-44.
4. Soil treatments . equipment . calibration . adjustment . maintenance	4. Penn. State. Turfgrass Maintenance and Establishment, pp. 46-48. . University of California. Turfgrass Pest, pp. 4-9.

UNIT: Highway Roadside Establishment

OBJECTIVES	LEARNING ACTIVITIES
5. Determine the need for preplant pest control. a. List the more common turfgrass pests which might cause serious problems on highway median strip turfs. b. (1) Identify existing pests on a given establishment site which would require preplant treatment. (2) List at least one reference for use in pest identification. (3). . . . . b. Select an appropriate preplant control method for a given pest. 1. Site at least one reference helpful in selecting pest control methods. 2. Apply a given preplant control chemical. 3.	5. Obtain and file a reference on turfgrass soil pests and their control. . . . . .
6.	
C. Select an appropriate turfgrass variety for a given highway median strip condition. 1. List the major variables to be considered in the selection of a turfgrass variety for a given highway median strip. 2. List at least one reference which compares and contrasts turfgrass varieties.	C. Obtain and file a reference which compares turfgrass varieties or mixtures suitable for highway median strips. . Observe and compile a list of the major turfgrass varieties found on highway median strips in the local community. . Practice identifying major grasses used on median strips. . . . . .

TOPICS	RESOURCES
5. Soil sterilization . insect pest . weed pest . pre-emerge herbicides . post-emerge herbicides . . . . disease pest	
C. Variety(s) selection . variables to be considered . varieties . mixture . natural grasses	C. Hanson and Juska. Turfgrass Science, pp. 608-618.

OBJECTIVES	LEARNING ACTIVITIES
3. Select a turfgrass variety for temporary cover on a highway median strip. 4.	
D. Seed a given highway median strip. 1. List the essential requirement of germination for a given turfgrass seed. 2. Select an appropriate method of obtaining uniform seed distribution on a given site. 3. Calibrate a given type of seeder, e.g., grain drill type, cyclone type, blower type, etc. 4. Select an appropriate means of seed coverage and compaction. 5. Adjust and operate seeding equipment. 6. Site at least one reference which gives recommended seeding dates for a given turfgrass variety. 7.	D. If possible, observe the seeding of highway median strip. . Calibrate seeder frequently used to seed highway median strips, e.g., cyclone seeders, blows, chills, etc. . Observe a demonstration of seeding and/or seed a small plot using equipment normally used for seeding highway median strips. . Obtain and file a reference which gives seeding dates and rates for turfgrasses used on highway median strips. . . . . .
E. Sprig or sod a given area of a highway median strip. 1. List the requirements for root establishment. 2. Select an appropriate method of obtaining uniform distribution of sprigs, plugs, sod on a given site. 3. Select an appropriate means of coverage and/or compaction. 4. Adjust and use sprigging, plugging, sodding equipment or tools. 5. ...	E. If possible, observe the sprigging or sodding of a highway median strip - especially sodding steep banks. . Observe a demonstration of and/or use sprigging, plugging, sodding equipment and tools. . . . . .

TOPICS	RESOURCES
D. Establishment . seeding methods . hydroseeding . dry seeding . drill . cyclone . . . . seeder calibration	. Local highway supervisor.
E. Sprigging or sodding . requirements for root establishment . equipment	. Hanson and Juska. Turfgrass Science, pp. 619-627. . Local highway supervisor.

UNIT: Highway Roadside Establishment

OBJECTIVES	LEARNING ACTIVITIES
F. Select and apply an appropriate mulch for a given highway median establishment site.	F. Observe the application of mulches on highway median strips - especially steep banks.
1. Compare and contrast the mulches typically used on highway median strips.	. Observe the anchoring of mulches on steep banks.
2. Select an appropriate amount of mulch coverage for a given establishment condition.	. As a class project, and with the permission and aid of the highway department, establish a turf-grass on a steep bank.
a. List the major factors to be considered in determining the amount of mulch to apply.	. . . . .
b.	
3. Select an appropriate means of applying mulch on a given site.	
4. Select an appropriate means of anchoring the mulch on a given site.	
5.	
G.	G. . . . .
II.	II. . . . .

TOPICS	RESOURCES
F. Mulching	F. Hanson and Juska. Turfgrass Science, pp. 623-626.
. types	
. wheat straw	
. . . . .	. . . . .
. amount needed	
. means of application	
. means of anchoring	
. . . . .	
G.	G. . . . .
II.	II. . . . .

Resources

Highway Roadside Maintenance

BOOKS

Hanson, A.A. and Juska, F.V. Turfgrass Science, Madison, Wisconsin: American Society of Agronomy, Inc., 1969.

The Pennsylvania State University. Turfgrass Maintenance and Establishment. University Park, PA: Department of Agricultural Education, 1968.

FILMS and FILM STRIPS

BULLETINS

University of California. Turfgrass Pest. Manual 41. Agricultural Publications, Berkeley, California.

TRANSPARENCIES

UNIT: Highway Roadside Maintenance and Establishment

SUB-UNIT: Highway Roadside Maintenance

OBJECTIVE(S): The student will be able to:

I. Plan a highway roadside maintenance program.

II. . . . . .

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Plan a highway median strip turfgrass maintenance program. A. Plan a highway median strip turfgrass mowing program. 1. Determine the need for mowing highway median strips. a. List ____ factors which affect the rate of growth of a given median strip turf. b. List ____ reasons for mowing a given median strip turfgrass. c. Select an appropriate height of mow for a given highway turfgrass. d. . . . . . 2. List the approximate frequency of mowing required for a given median strip turfgrass during a given typical month. 3. Select appropriate equipment for mowing a given highway turfgrass area. a. Compare and contrast the operational effectiveness of different types and sizes of mowers generally used for mowing highway turfs. b. Compare and contrast the economics of highway turfgrass mowers. c.	I. Prepare an elementary plan for maintaining highway median strip turfgrasses. A. Prepare a mowing schedule for a typical year and month for a typical highway median strip in the local community. . Visit a highway maintenance warehouse and survey the equipment used to mow highway median strips in a highway district. . Make a list of equipment required for mowing in a local district. . Classify these mowers according to major use, e.g., steep banks, etc. . Classify these mowers as to type, e.g., rotary, reel, etc. . Classify these mowers as to method of propulsion, i.e., self-propelled, tractor pulled, etc. . Classify the tractors used for mowing as to type, i.e., low wheel-high wheel, tricycle, shortdog, garden tractor, etc. . Observe demonstrations of safe and unsafe use of mowing equipment. . Observe demonstrations of safe and unsafe tractor operation - especially safety on slopes and near ditches. . Observe demonstrations of and/or adjust and operate tractors and mowers. . . . . . .

TOPICS	RESOURCES
I. Highway median strip maintenance. A. Mowing 1. Need determination . Effect of cutting . Reasons for cutting . Height of cut . . . . . . 2. Frequency of cut . Effects of weather . Effects of variety . Effects of fertilization . . . . . . 3. Equipment selection . Types of mowers . reel . rotary . tractor drawn . knuckle-boom type . . . . Economic comparison of mowers	I-A. Hanson and Juska. Turfgrass Science, pp. 631-634.

OBJECTIVES	LEARNING ACTIVITIES
4. Adjust and safely operate a given highway turfgrass mower. a. List the major safety hazards involved in operating a highway turfgrass mower. b. List the adjustment provided on a given highway turfgrass mower. c.	
5.	
B. Plan highway median strip weed control program. 1. List the major weed and brush control problems. a. Identify some of the major weeds which cause problems. b. List at least one reference concerned with turfgrass weed identification. c.	B-1. Practice the recognition of weeds which cause problems on highway median strips through the observance of weed specimens, pictures, or actual plants. . Practice using a weed key to determine the identity of unknown weeds. . Obtain and file a reference which gives pictures of weed which cause serious problems on highway median strips. . . . . .
2. Select an appropriate means of controlling a given weed on a given highway median strip. a. List at least one publication which can be used or a source of information on weed control for specific weeds. b. Compare and contrast mechanical (mowing) vs chemical means of controlling weeds on a given median strip. c.	2. Obtain and file a reference which gives weed control recommendations. . . . . .
3.	

TOPICS	RESOURCES
4. Mower operation . Adjustments . Safety . . . . . . 5.	4. AAVIM. Tractor Operation. Section on Safety. . Packet: O.P.E.I. Mr. Lawnmowers Safety. . . . . .
B. Weed control on highway median strips 1. Weed identification . broadleaf . narrow leaf . . . . . . 2. Weed control methods . mechanical . chemical . . . . . . 3.	. Hanson and Juska. Turfgrass Science, pp. 629-631.

OBJECTIVES	LEARNING ACTIVITIES
C. Plan a fertilization program for a given highway median strip. 1. Determine the need for fertilizing a given median strip turf. 2. Determine the analysis and quantity of fertilizer needed on a given median strip turf. a. Take a soil test. b. Interpret a soil test results. c. . . . . . 3. Compare and contrast various forms of fertilizers, e.g., liquid, solid, high concentrate, low concentrate, etc., for use on a given median strip. 4. Select an appropriate means of applying fertilizer or lime to a given median strip turf. a. Compare and contrast effectiveness of sprayers vs spreader for applying fertilizers on a given median strip turf. b. Compare the cost of sprayers vs spreader for applying fertilizers on a given median strip turf. c. . . . . . 5. Adjust and safely operate a given fertilizer applicator. a. List the safety hazards involved in operating a given applicator.	C. As a class project, outline a typical fertilization program for a typical highway median strip. 1. Observe a demonstration of and/or take a soil sample for a section of a highway median strip . . . . . . 2. Obtain and file a reference which gives recommended fertilization for the grasses ordinarily used on highway median strips. . . . . . . 3. Practice calculating the cost per unit of high analysis sources of nitrogen vs low analysis forms. • Obtain and file a reference which compares various forms of nitrogen fertilizer. • Observe a demonstration or pictures of fertilizer burn. • Illustrate fertilizer burn through the use of a salt solution and a water filled semi-permeable membrane. 4. Observe demonstrations of and/or operate a sprayer type fertilizer applicator frequently used to fertilize highway median strip turfs. • Observe demonstrations of and/or operate a spreader type fertilizer distributor frequently used to fertilize highway median strip turfs. • Visit a highway maintenance warehouse and observe the types of fertilizer applicators used. . . . . . .

TOPICS	RESOURCES
C. Fertilization	
1. Need determination	C-1. Hanson and Juska. Turfgrass Science, pp. 627-629, 619, 616.
. Soil test . Deficiency symptoms	. . . . .
2 & 3. Fertilizer selection	2 & 3. Hanson and Juska. Turfgrass Science, Chapter 5.
. complete . . high analysis . . low analysis	. . . . .
. nitrogen . . nitrate of soda . . ammonium nitrate . . liquid fertilizers	
. lime . . agricultural . . Ca So4	
. . . . .	
4. Means of application	4. Hanson and Juska. Turfgrass Science, pp. 687-688.
. sprayers . spreaders	. Local district highway department supervisor.
5. Equipment operation	. . . . .
. adjustments . safety	

OBJECTIVES	LEARNING ACTIVITIES
b. List the adjustments available on a given applicator. c.	
6. Compare and contrast the effects of various application times, e.g., fall, winter, spring, under wet conditions, under dry conditions, etc. 7. Recognize the effects of fertilizer burn. 8.	
II.	II. . . . .

TOPICS	RESOURCES
6. Time of application . season . wet or dry conditions	6 & 7. Hanson and Juska. Turfgrass Science, pp. 522-524.
7. Fertilizer burn	
D.	D. . . . .
II.	II. . . . .

Highway Roadside Maintenance

BOOKS

American Association for Vocational Instructional Materials. Tractor Operation. Athens, GA: The Association, 1970.

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: American Society of Agronomy, Inc., 1969.

FILMS and FILM STRIPS

BULLETINS

TRANSPARENCIES

Packet. Mr. Lawnmower Safety. Mr. Harold K. Howe, Exec. Sec. O.P.E.I., 734 15th St., NW, Washington, D.C. 20005.

UNIT: Highway Roadside Maintenance and Establishment

SUB-UNIT: Exploring Career Opportunities

OBJECTIVE(S): The student will be able to:

I. Explore opportunities related to highway roadside establishment and maintenance.

II. . . . . .

UNIT: Highway Grass Establishment and Maintenance

SUB-UNIT: Exploring Career Opportunities

OBJECTIVES	LEARNING ACTIVITIES
The student will be able to: I. Explore career opportunities related to highway grass establishment and maintenance. A. List the occupational titles of people involved in the establishment and maintenance of highway grasses. B. List the major competencies needed by people involved in the establishment and maintenance of highway grasses. C. List the major task performed by people employed in the establishment and maintenance of highway grasses. D. List people who are not employed full-time in the establishment and maintenance of highway grasses but who are employed for short periods of time for special tasks and who therefore require competencies in this field. E. List the educational requirements for a given occupational title and the sources of such education. F. State the usual experience requirements for a given occupational title held in this field. G. List the average wage paid for a given occupational title held in this field. H. Describe in writing how a career in this area would complement or fail to complement life goals. I.	I. Interview people employed to maintain or establish highway median strips. . Seek part-time work experience doing maintenance or establishment work in this area. . Spend a day with a highway supervisor. . Prepare a resume' of requirements for a typical job in the maintenance or establishment of highway median strips. . Prepare a paper describing how a certain job in the maintenance or establishment of highway median strips would complement or fail to complement life goals. . . . . .
II.	II. . . . .

UNIT: Highway Grass Establishment and Maintenance

SUB-UNIT: Exploring Career Opportunities

TOPICS	RESOURCES
I. Career exploration. . Occupational titles . state highway department agronomist . district highway maintenance supervisors . private or commercial contractor for highway roadside establishment and/or maintenance . highway roadside crew member . . . . Related occupations - some competencies required. . highway engineers . landscape architects . . . . Competencies needed. . Major tasks performed. . Educational requirements. . Occupational benefits. . Life goals.	I. Local highway department supervisors. . Local highway engineer. . Slides: Careers in Turf Management. . Hanson and Juska. Turfgrass Science, pp. 9-28. . . . . .
II.	II. . . . .

Exploring Career Opportunities

BOOKS

Hanson, A.A. and Juska, F.V. Turfgrass Science. Madison, Wisconsin: The American Society of Agronomy, Inc., 1969.

FILMS and FILM STRIPS

The Pennsylvania State University. Department of Agricultural Education, University Park, PA. Slides: Exploring Turfgrass Occupations.

BULLETINS

TRANSPARENCIES

APPENDIX

Appendix A

Scope of the Industry [1]

Table 1.1. National Annual Turfgrass Maintenance Expenditures by Selected Facility[a]

Facility	Annual National Expenditure ($)	Percent of Total
Airports	34,606,352	0.8
Cemeteries	363,366,704	8.4
Churches	25,954,764	0.6
Colleges and universities	17,303,176	0.4
Golf courses	237,918,674	5.5
Highways	471,511,556	10.9
Lawns, Residential	3,002,101,097	69.4
Lawns, commercial	25,954,764	0.6
Parks, minicipal	60,561,117	1.4
Schools, public	38,932,147	0.9
Miscellaneous[b]	47,583,735	1.1
Total	4,325,974,086	100.0

[a]From Turf-grass Times, Oct, 1965.

[b]"Turfgrass a Four Billion Dollar Industry," Turfgrass Times, October, 1965, p. 1. Cited by John H. Madison, Practical Turfgrass Management. New York: Van Norstrand Reinhold Company, 1971, p. 13.

[1] To include sod and seed production; municipal, state, and Federal government building lawns; state and Federal parks; private school facilities; professional athletic facilities; and others. Very conservatively estimated. For example, Florida alone grows approximately $10,000,000 worth of commerical sod yearly.

APPENDIX B

Facilities, Tools and Equipment

Facilities

Classroom

Land laboratory (area for construction putting green, turf plots,etc.)

Equipment storage shed (for large machinery - tractor, mowers, etc.)

Storage shed for chemicals (fertilizers, pesticides, etc.)

Access to the agricultural education shop

Adequate transportation for field trips

Access to audio-visual aids equipment

...

Tools and Equipment

General equipment list for all units

Tractor and tractor equipment
Land preparation equipment

- Disk harrow
- Blade
- Scoop
- Roto-tiller
- Soil shredder
- Drag mat
- ...

Mowing Equipment

- Bushhog
- Flail mower

Irrigation Equipment

- Irrigation demonstration bit or access to demonstration equipment trailer
- Jet type sprinkler
- Impact type sprinkler
- Gear driven sprinkler (valve-in-head)
- ...

Drawing Equipment

- 5 Drawing boards 18"x24"
- 5 T-squares 24"
- 5 Triangles 10" - 30^{o} x 60^{o}
- 5 Triangles 8" - 45^{o}
- ...

Turfgrass and Weed Identification

- 10 Hand lenses
- ...

Turfgrass Mechanics

- 2 small engines tool kits
- Access to the agricultural education shop tools, and equipment
- ...

Basic Pest Control

- Gasoline-powered spray unit
- Gas mask
- Pair rubber gloves
- Rubber apron
- Insect collecting net
- Insect killing jar
- Insect mounting board
- ...

Basic soils

- Display tube
- Soil auger
- Soil sample tube
- Soil testing kit
- 6 shovels
- 6 spades
- 6 rakes
- 1 set of soil seives
- 1 capillary movement tube
- ...

Soil Fertility and Fertilizers

- 1 Cyclone type spreader
- 1 Scot type spreader
- ...

Home Lawn Maintenance and Establishment

- 1 Rotory type lawn mower
- 1 Verticutter
- 1 Hole puncher
- 6 Pluggers
- 1 Garden hose (3/4") (300')
- 2 Wheel barrows
- ...

Golf Course Maintenance and Establishment

- 1 Top dresser
- 1 Greens mower (reel type)
- 1 Cup changer
- 6 Cups
- 6 Flag poles and flags
- 1 whipping pole
- 1 Lapping machine
- 1 sod cutter
- 2 Sand trap rakes
- 1 Edger
- 2 Divot fixers
- 2 Chippers
- 2 Putters
- ...

Athletic Field Maintenance and Establishment

(No special equipment which has not been listed previously)

Institutional and Industrial Grounds Maintenance and Establishment

(Size and cost of most such equipment precludes purchase; however, demonstrations of such equipment might be arranged with a grounds superintendent)

Highway Grass Maintenance and Establishment

(Size and cost of most such equipment precludes purchase; however, demonstrations of such equipment might be arranged with district highway maintenance supervisor)

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Cool Season Grasses.
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Lawn Grasses for South Carolina, Circular 495.
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The Pennsylvania State University. Agricultural and Home Economics Extension Service, University Park, Pennsylvania.
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