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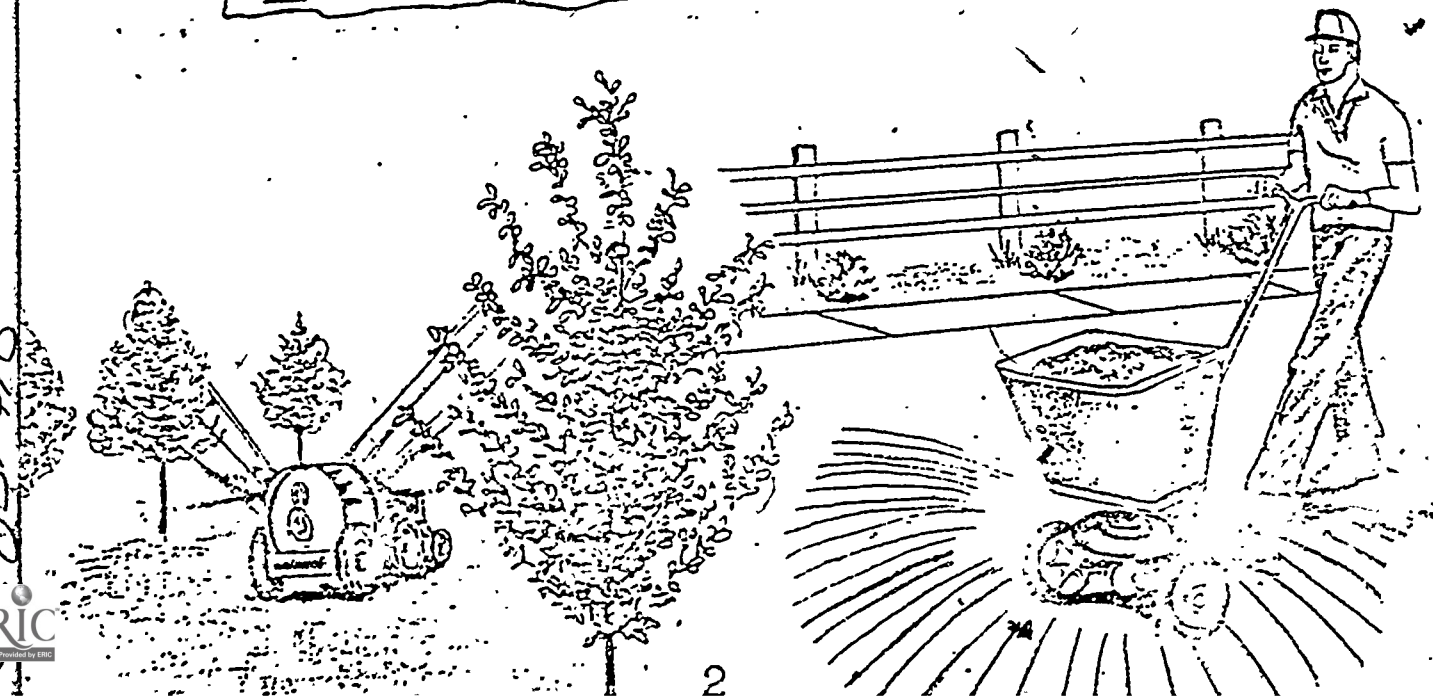
ABSTRACT

This competency-based curriculum unit on implementing the landscape plan is one of five developed for classroom use in teaching the landscape/nursery area of horticulture. The seven sections are each divided into teaching content (in a question-and-answer format) and student skills that outline steps and factors for consideration. Topics covered include laying out the landscape plan, installing drainage systems, installing irrigation systems, preparing the soil, selecting plant materials, planting flowers by seed and transplanting, and establishing the lawn by seed or sod. A list of references precedes a section containing visual aids, student skill checklist, and student activities, such as field trips, handouts, discussion activities, worksheets, crossword puzzles, hands-on experiences, tests, and quizzes. Answer keys are provided. (YLB)

Implementing The Plan

Competency Based Teaching Materials in Horticulture



Listed below are competency based curriculum units developed for classroom use in teaching horticulture. All units are indexed and include teaching content, references, student activities, a skill check list, and visual aids.

LANDSCAPE/NURSERY Tree Identification Developing a Landscape Plan Implementing the Landscape Plan Maintaining the Landscape Nursery Propagation	GREENHOUSE PRODUCTION & MANAGEMENT Controlling the Greenhouse Environment Greenhouse Soils Foliage Plants Propagation Sales Cut Flower Production Bedding Plants
TURF AND LAWN SERVICES Identification of Turf Grasses Soils and Fertilizers Planting Turf Grasses Insects and Diseases	VEGETABLE PRODUCTION Identification of Cool Season Vegetables Identification of Warm Season Vegetables Vegetable Production Insects, Diseases, and Weeds
FRUIT PRODUCTION (In progress)	

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IMPLEMENTING THE LANDSCAPE PLAN

CONTENTS

Implementing The Landscape Plan

LAY OUT LANDSCAPE PLAN

Teaching content: 6 questions; 3 student skills

Question 1 Which specific design elements best compliment the landscape plan?

Alternatives	Factors for Consideration
1. Enclosures types	- Family interests
2. Planting types	- Money
3. Surface types	- Unsightly views
4. Embellishment types	- Protection

Student Skill 1

READ LANDSCAPE PRINTS, TOPOGRAPHY SUPVEYS

Steps	Factors for Consideration
1. Memorize design elements for: a. enclosures b. plantings c. surfaced areas d. garden embellishments	Examples: - fences, walls or screen plantings - shrubs, hedges, flower gardens, gardens, ground cover, trees - patio, terrace, walls, paths, sitting areas, steps - BBQ pits, seats, water features, garden furniture, portable plants, sculptures, lighting, rocks, raised beds

Question 2 Which measurement scale is best to utilize in a landscape plan?

Alternatives	Factors for Consideration
1. 1" = 1 ft.	- Common architectural scales
2. 1/4" = 1 ft.	- Amount of space found on blueprint page
3. 1/8" = 1 ft.	- 8 is a common denominator
	- Size of home lots

Question 3 What measurement scales do landscapers utilize?

- 1/8" = 1 ft.

Student Skill 2

READ LANDSCAPE PRINTS, TOPOGRAPHY SURVEYS

Steps

1. Mechanically relate 1/8" scales to 1' of property
2. Measure all physical objects (house, trees) on property
3. Measure straight out at right angle from corner of building

Factors for Consideration

1. Landscapes are drawn on graph paper using 1/8" equal to 1' scales
2. Tape measurement should be held tight
3. Features to be measured:
   a. locate setback--distance of house
   b. locate side property lines
   c. locate walk and drive locations
   d. locate other permanent features such as sewer lines, septic tank, trees, etc.

4a Wood boards should be 6" x 2"

4b Red board--enclosures
Green board--plantings
Brown board--surface areas
Yellow board--grade embellishments

Question 4 Are flat or sloping grounds assets or liabilities on landscape plans?

Alternatives

1. Flat land
2. Slopes
3. Valleys
4. Ridges

Factors for Consideration

1. Interesting design or terrace
2. Environmental factors

Question 5 What are some environmental constructs?

- Sun
- Shade patterns
- Winds
- Micro-climates

Student Skill 3

RECOGNIZE ENVIRONMENTAL FEATURES OF SITE

Steps	Factors for Consideration
1. Determine movement of sun over property	
2. Locate shade patterns	2. To be determined by sun's movement, season of year, and plant or building barriers
3. Note prevailing wind directions	
4. Locate and mark micro-climates	4. Sun areas, shade areas, wet areas, dry areas

Question 6 How does the orientation of lot and house affect the total landscape scheme?

Alternatives	Factors for Consideration
1. Trees	- Beauty
2. Shrubs	- Durability
3. Fences	- Protection from environment
4. Small plantings	- Cost

INSTALL DRAINAGE SYSTEMS

Teaching content: 7 questions; 2 student skills

Question 1 What are the benefits of a drainage system?

Alternatives	Factors for Consideration
1. No system	- Lack of available oxygen in soil
2. Surface or subsurface systems	- Reducation of nutrition and water by roots
	- Restricted plant growth
	- Low pH
	- Delay in cultivation and seeding

Question 2 How much should you grade in surface drainage?

Alternatives	Factors for Consideration
1. Volume of runoff	- Amount of rainfall in area
2. Not less than 1%	- Cost
3. More than 2%	- Sound grading plan

Question 3 Which subsurface system is best?

Alternatives	Factors for Consideration
1. Open 2. Closed	- Total cost - Trouble-free maintenance

Question 4 What is open drain tile subsurface drainage?

- Consists of one or more ditches that border or transect the land being drained.
- Is continuous with a disposal system that can carry this water to a natural drainageway

Question 5 Is subsurface drainage the real problem?

Alternatives	Factors for Consideration
1. Open 2. Closed 3. Aerification 4. Physical modification of soil	- Compacted surface layer - Poor soil structure - Restrictive subsurface layer - High water table - Thatch accumulation in turf

Student Skill 1

CONSTRUCT OPEN DRAIN TILE

Steps	Factors for Consideration
1. Find out about grading ordinances from your local city hall	
2. Dig 1 or more ditches that border land being drained	2a Volume of ditches depends on volume of water seepage, or 2b Deep enough for water to flow to ditch or sump
3. Ditches should be continuous with a disposal system	
4. Lay gravel over ditches	4. About 4"
5. Lay drain tiles in rows of 8' apart	5. Tile must be layed in straight lines without bends or twists
6. Cover joints with tar paper or roofing paper	6. Tightly so soil will not seep in
7. Cover all with gravel	
8. Dig ditch or sump or catch basin at low point	8. Only if there is no natural place for water to empty
9. Fill ditch or sump with rock	9. Water emptied here will filter into soil at a slow rate

Question 6 What is closed drain tile subsurface drainage?

- Consists of interconnecting tile or cemented pipes located below level of water table where they are collecting water and transporting this water to an open drainageway.

Question 7 How should drain tile be placed in the trench?

- Insert tapered end into enlarged end

Student Skill 2

CONSTRUCT A CLOSED DRAIN TILE

Steps	Factors for Consideration
1. Dig with shovel drainage trenches 18" to 4' deep	1. At subsoil level and below water table
2. Lay pipes of 2-3' long, end to end (or use plastic perforated pipe)	2a Usually they are not cemented together 2b Slope all pipe down slightly toward soakaway
3. Pack sides of pipes with small stones	3. To prevent shifting and allow water to enter joints
4. Spread on shallow layer of small stones or gravel over pipes	
5. Refill with soil	5. Slightly mount soil over pipe to settle naturally
6. Dig soakaway pit in open drainageway deep enough to reach subsoil	
7. Fill	

INSTALL IRRIGATION SYSTEMS

Teaching content: 4 questions; 1 student skill

Question 1 What are the necessary steps in laying a sprinkler system?

- Plan
- Dig trench
- Lay pipe-connect
- Install sprinkler heads
- Install dry well
- Cover with lawn

Question 2 What are the types of trenching tools?

- Rotary trenches
- Backhoe
- Trenching spade

Question 3 What are the types of pipes to be used?

- Lead pipe
- Copper pipe
- Plastic (P.V.C.) pipe

Question 4 What types of sprinkler heads are available for installation?

Alternatives	Factors for Consideration
1. Wave sprinkler for far throwing	- Land area to cover
2. Moving stream of water	- Cost
3. Fixed fan-jet	- Installation and maintenance

Student Skill 1

IMPLANT A SPRINKLER SYSTEM

Steps	Factors for Consideration
1. Graph map of grounds for sprinkler layout	
2. Drive marker stakes at locations	
3. Lay out plastic hose, or pipe along path that will be followed	3. Keep curves as gentle as possible
4. Cut a V-shaped slit for pipe with flat bladed spade	
5. Dig trench 8"-9" below grade	
6. Lay pipe, attach to main outdoor faucet line and inside clock box	
7. Attach piping to sprinkler heads	7. Sliding a clamp onto pipe, push pipe into a head fitting from both sides
8. Tighten clamps with wrench or screwdriver	
9. Cover all with coarse gravel and lawn	
10. Dig a dry well at sprinkler heads fitted with drains	
11. Fill wells with coarse gravel	

PREPARE SOIL

Teaching content: 13 questions; 7 student skills

Question 1 What are the fertilizing mineral nutrients plants need for good growth and development?

- Nitrogen, phosphorus, potassium, calcium, sulphur, magnesium, manganese, iron, copper, zinc, boron and molybdenum

Student Skill 1

TEST SOIL FOR FERTILITY

Steps	Factors for Consideration
1. Get a soil test	1. Send a soil sample to county cooperative extension office
2. Purchase commercial soil testing kit	2. Really easy to follow and inexpensive
3. Read soil kit's directions	
4. Carry out each individual test on fresh soil sample from the same plot of soil	4. Note: soil tests do not measure fertility in absolute terms; they only provide an index of fertility
5. Color changes in each test indicate absence, presence or overabundance of some nutrients over others in that soil	5. Soil fertility is ability of soil to supply nutrients required for maximum plant growth
6. Addition of commercial fertilizers in organic or inorganic forms can add nutrients to soil	
7. Adjusting pH of soil sometimes releases essential nutrients	

Question 2 What does soil pH say about your soil?

- Soil pH can tell how acid, alkaline or neutral your soil is. Good pH is desirable to keep the soil in physical balance.

Question 3 Which test produces the best pH soil results?

Alternatives	Factors for Consideration
1. Indicator solutions	- Age of product
2. Test strips	- Cost
3. pH meter	- Time
	- Degree of accuracy

Student Skill 2

TEST SOIL pH

Steps	Factors for Consideration
1. Gather a quantity of same sample soil to be tested	
2. Dilute soil with water	2. Make a semi-fluid paste
3. Maintain similar moisture conditions from sample to sample	
4. Use indicator solutions, test strip pH paper or a pH meter to test samples	
5. pH of 7 indicates neutralness (as for distilled water). pH below 7 is acid and above 7 is alkaline.	5. pH is important to plant nutrition, growth and to maintain soil in desirable physical state
6. Adjust soil pH by adding inorganic or organic amendments	6. Add hydrated lime or limestone to make soil more alkaline. Add aluminum sulfate, sulfur, or gypsum to make a soil more acid

Question 4 How are tillage operations implemented?

- Tillage operations are carried out by a roto-tiller on soil (dry). This machine mixes fertilizer and chemicals into your soil up to 6' deep while crumbling the soil and leaving it in a smooth well-granulated condition.

Question 5 Are some tillage operations more harmful than others?

Alternatives	Factors for Consideration
1. Roto-tiller-power driven	- Quality of land
2. Shovel--manual driven	- Increases susceptability to erosion
	- To prepare beds for planting
	- To control weeds quickly

Student Skill 3

TILL AND GRADE SOIL

Steps	Factors for Consideration
1. Till soil with a Renovator Power Rake or roto-tiller to a depth of 6"	1. Do not work soil when it is wet as soil structure is destroyed and results in hard impervious surface that will not support a good lawn
2. Add fertilizer, acid producing chemical or lime and rake in	3. Spring rains help dilute soluble nutrients down through soil
3. Adjust soils during early to mid-spring	

Question 6 What are the 3 kinds of soils?

- Sandy
- Loam
- Clay

Question 7 Which soil structure is best for plantings?

Alternatives	Factors for Consideration
1. Sand	- Nutrient content
2. Loam	- Soil moisture and drainage
3. Clay	- Aeration ability
4. Types of loams	- Amendments addition
	- Cost
	- Maintenance

Student Skill 4

ADD ORGANIC SOIL AMENDMENTS TO IMPROVE SOIL STRUCTURE

Steps	Factors for Consideration
1. Add sand amendments to soils	1. Clay soils have high nutrient and water holding abilities. Sand improves drainage and aeration
2. Add humus, peat moss, sphagnum moss amendments to sandy soils	2. Sandy soils have a low nutrient holding capacity and need amendments to replace nutrients lost by large movement of water through soil
3. Adding to loam soils depends on which amounts of sand, silt, or clay dominate	

Question 8 What soil amendments can hold additional soil moisture?

- Perlite
- Sand
- Vermiculite

Student Skill 5

ADD SOIL AMENDMENTS TO IMPROVE SOIL MOISTURE

Steps	Factors for Consideration
1. Improve moisture and aeration in soils by adding perlite, sand or vermiculite	1a Perlite and vermiculite are both very lightweight amendments 1b Sand is excellent for improvement of aeration and drainage 1c Vermiculite improves water retention 1d Perlite promotes water movement

Question 9 Which amendment best increases the soil moisture of a soil type?

Alternatives	Factors for Consideration
1. Vermiculite	- Water retention
2. Perlite	- Water movement
3. Sand	- Drainage of water

Question 10 How does the addition of soil amendments affect the nutrient content of a soil?

- Depends on what the pH of that soil is. If the soil is nutrient-poor, addition of particular amendments can add to the quality of that soil and still keep the pH in check.

Question 11 Which amendment should be used to raise or lower the pH in a soil?

Alternatives	Factors for Consideration
1. Gypsum	- To make a soil more acid
2. Peat	- To make a soil more alkaline
3. Lime	- To neutralize a soil

Student Skill 6

- ADD SOIL AMENDMENTS TO IMPROVE NUTRIENT CONTENT OF SOIL

Steps	Factors for Consideration
1. Addition of organic or inorganic amendments can make a soil more acid and/or improve the nutrient content	1a Some organic amendments are: peat moss, sawdust, humus, and compost 1b Some inorganic amendments are: aluminum sulfate, sulfur or gypsum. These, when added, increase acidity
2. Addition of organic or inorganic amendments can make a soil more basic (alkaline) and/or improve the nutrient content	2a Some inorganic amendments that increase alkalinity are: hydrated lime or limestone 2b Some inorganic commercial fertilizers that improve nutrient content are: High analysis 12-24-12 or low analysis 6-12-6 (N.P.K.)

Question 12 What amendments are organic or inorganic in nature?

- Peat, compost, sawdust and sphagnum moss are organic
- Perlite, vermiculite and gypsite are inorganic

Question 13 What is the difference between organic and inorganic soils?

- Organic soils have 20% or more of organic matter
- Inorganic soils have less than 10%

Student Skill 7

ADD SOIL AMENDMENTS TO IMPROVE ORGANIC OR INORGANIC QUALITY OF SOIL

Steps	Factors for Consideration
1. Add organic or inorganic amendments to correct problems with native soils	1a Organic soils are 20% or more high in organic matter 1b Inorganic soils generally have less than 10% organic matter
2. Adding organic amendments improves water retention, has aeration and is rich in nutrients	2. Examples: peat, sawdust, compost
3. Adding inorganic amendments improves drainage, aeration and decreases weight of soil	3. Examples: Perlite, vermiculite, sand, and gypsite
4. Read labels on packages of amendments to determine which amounts to add	

SELECT PLANT MATERIALS

Teaching content: 13 questions; 11 student skills

Question 1 What factors affect planting scheme:

- Points of accent
- Color effects
- Textural composition
- Shadow and light interplay
- Balance

Question 2 How should plants be arranged according to color?

- Plant for seasonal variation
- Plant according to taste of client

Question 3 What qualities should the final product have?

- Balanced look--stability of plan and composition
- Enframement and unity of house and grounds

Question 4 Which plant type is best?

Alternatives	Factors for Consideration
1. Tree	- Native plant
2. Shrub	- Vistas-view seen through a long passage, as between rows of trees
3. Evergreen	- Climate
	- Environment

Question 5 Which tree (root) type is best to plant?

Alternatives	Factors for Consideration
1. Balled and burlapped	- Cost
2. Bare root stock	- Customer preference
3. Container stock	- Maintenance
	- Quality of planting

Question 6 What type of material may cover the ball?

Alternatives	Factors for Consideration
1. Burlap	- Best covering--decomposes easily
2. Plastic bag or buckets	- Good for quick transplant; not readily decomposable
3. Fiber buckets	- Should be removed

Question 7 What is the proper depth for planting trees?

- Twice the width and 4" deeper than required by plant roots.

Student Skill 1

PREPARE PROPER HOLE DEPTH FOR PLANT TYPE

Steps	Factors for Consideration
1. Dig hole prior to purchase of plant or delivery 2. Prepare hole twice the width and 4" deeper than required by plant roots	1. Get plant in ground as soon as it arrives or dampen soil within the balled and burlapped plant and cover with soil or sawdust to reduce drying

Question 8 What soil amendments should be added before tree is planted?

- Good topsoil rich in organic matter, nitrogen, phosphorus and potash

Student Skill 2

ADD SOIL AMENDMENTS TO OPEN HOLE

Steps	Factors for Consideration
1. Mix 2" of super phosphate and manure. Put into hole. 2. Add grass clippings and dampen 3. Add peat with 2" of soil mixture 4. Press all down and water	1. Super phosphate stimulates growth. Manure is a source of humic acid and minerals 4. Never let roots of plant come in contact with fertilizers

Question 9 When and how much should a balled and burlapped tree be pruned?

- Before planting tree
- Keep natural shape of plant in mind and take off about 1/4 to 1/3 of the top balancing it with as much of the root system.

Student Skill 3

PRUNE PLANT BEFORE IT IS SET INTO HOLE

Steps	Factors for Consideration
1. Prune before setting. Usually equal amounts of roots to equal amounts of branches.	1. Generally prune 1/3 of top growth to compensate for root-shock and loss. An overbalance of leaves over roots will draw more water than roots can supply and the plant will wilt and die.

Student Skill 4

SPREAD ROOTS PROPERLY

Steps	Factors for Consideration
1. Plant B&B plants with burlap still around plant	
2. Loosen burlap around top, remove rope and plastic.	2. Burlap rots quickly and causes no problems
3. Deciduous material should be planted at their original depth or slightly lower	3. Use the prepared soil mixture from bottom of hole to set plant at correct height
4. Evergreens should not be buried any deeper than depth at which they originally grew, although they may be planted slightly higher	

Student Skill 5

PLACE SOIL PROPERLY

Steps	Factors for Consideration
1. Fill in with soil around roots to prevent air pockets	1. Use soil originally dug out of hole
2. Tramp this fill with a shovel handle or your foot	
3. When roots are 1/2 covered, soak with water	
4. Finish filling hole and saucer top covering	

Question 10 How much should a newly planted tree/shrub be watered?

- When tree is 1/2 planted, water thoroughly
- When tree is fully planted, soak
- Water thoroughly twice a week for first month or two

Student Skill 6

WATER SITE

Steps	Factors for Consideration
1. Water 1/2 way through planting	
2. Water thoroughly when planting is completed	2. Don't erode soil
3. Soak thoroughly twice a week for 1st month or two.	

Question 11 What materials are used to wrap or stake a stem?

- Two wood stakes, wire loops with plastic tubing, sisal kraft paper for wraps

Student Skill 7

WRAP OR STAKE PLANT

Steps	Factors for Consideration
1. Stake with 2 x 2" or 2 x 4" stakes	1. For about 2 years.
2. Stake in 2 directions	
3. Drive stakes below excavated area	3. So they do not move
4. Fasten tree to stake with wires	
5. Loop wire around once in 3 places	
6. Use plastic tubing or rubber hose	6. For 2 growing seasons
7. Wrap stem with sisal kraft paper	
8. Spread paper from ground level to first branches	
9. Secure paper with twine wound around full length of trunk	

Student Skill 11

PLANTING BAREROOT STOCK

Steps	Factors for Consideration
1. Trim off any broken or twisted roots	1. Determine original soil line--look for soil or change of color on trunk
2. Set plant in hole so soil line is above the surrounding soil	2. Spread roots evenly, radiating outward from root crown
3. Work backfill soil between and around the roots	
4. Firm soil gently with a tamper or your foot as you fill the hole	4. Make sure roots and soil are in firm contact with each other
5. Run water slowly over root area	5. Eliminates air pockets and settles soil
6. Build basin at outer edge of root area to hold water	

Question 13 What is the proper method in planting container grown stock?

- Follow steps used in planting B&B stock with the exception of removing container (if metal or wood) from stock plant. Be sure to root prune in order to prevent growth of girdling roots.

PLANTING FLOWERS BY SEED AND TRANSPLANT

Teaching content: 8 questions; 1 student skill

Question 1 What are the requirements for good seed germination?

- Viable seeds
- Moisture
- Nutrition
- Oxygen
- Optimum temperature

Question 2 What types of alternative seeds are there?

Alternatives	Factors for Consideration
1. Annuals--flowering plants	- Customer preference
2. Perennials	- Location and placement
3. Ferns/mosses	- Maintenance

Student Skill 1

PLANT THE SEED OR YOUNG PLANT

Steps	Factors for Consideration
1. Prepare soil in flower beds, water thoroughly	
2. Start planting with vigorous plants or seeds. Read seed packets--they give viable information for planting, spacing, depth, time, location	2a Best method is to buy started plants 2b Next best method is to sow fresh seeds where plants are to grow 2c Least satisfactory plan is to start your own plants indoors
3. Set plants or sow seeds at recommended times	
4. Thin seedlings providing recommended distances between plants and set plants, before planting	
5. Potted plants are removed from pots by placing hand over soil, with fingers on each side of stem invert pot.	

Question 3 What should be considered when planting flowers?

- Arrange plants so that something is blooming throughout the growing season
- Amount of care plants will require

Question 4 Which type of mulch should be used for flowers?

- Manure
- Tree bark
- Shells of nuts
- Peat moss

Question 5 How much mulch should be applied to the flower bed surface?

- one to two inches

Question 6 How should the mulch be applied?

- Lay on surface
- Work into soil

Question 7 What will each element provide a plant?

- Nitrogen provides better leaf growth
- Phosphorus and potassium provide better root growth and encourage more flowering and fruit production

Question 8 What is a good fertilizer ratio for flowers?

- 5-10-10

ESTABLISHING THE LAWN BY SEED OR SOD

Teaching content: 16 questions; 7 student skills

Question 1 What factors determine seed selection?

- Quality of seed
- Environmental condition of soil
- Maintenance
- Personal preference

Question 2 What are the alternative lawn types?

Alternatives	Factors for Consideration
1. Basic	- Cost
2. Nurse	- Maintenance
3. Special purpose	- Preference
	- Quality

Question 3 Why is a seed mixture advantageous over one variety?

- Maintain a green lawn throughout the season
- Adaptation to various uses
- Adaptation to various soil conditions

Student Skill 1

SELECT SEEDS FOR YOUR ENVIRONMENT

Steps	Factors for Consideration
1. Select grass	1. Purchase quality seeds
2. Talk to a garden or lawn specialist about your environmental conditions or read at local library	2. Know the environmental conditions of the seeds that will be sown in.
3. Decide how much care you are willing to provide to your lawn after it is established	3. Some lawns need more maintenance than others

Question 4 What does the rate of seeding depend on?

- Culture loss
- Quality of seed
- Soil fertility
- Variety

Question 5 What types of spreader techniques are employed to sow seeds?

- Spreader--lays seeds straight onto soil
- Cyclone spreader--throws seeds in a circular pattern; may be combined with fertilizer

Question 6 What factors affect the spreading of seed?

- Direction of wind
- Speed of wind

Student Skill 2

SPREAD SEEDS

Steps	Factors for Consideration
1. Grade area	
2. Remove all stones	
3. Slope 2-3% directed away from house	3. Enhances surface drainage
4. Seed your area at the recommended rate of your grass seeding	4. Usually 1-2 lbs/1000 sq.ft.
5. Apply 1/2 of seeds with spreader	
6. Then apply rest at right angle to original direction with spreader	

Student Skill 3

FERTILIZE SEEDS SOWN AND ROLL

Steps	Factors for Consideration
1. A 'starter' fertilizer should be applied with seeds or separately.	1. 'Starter' is a nitrogen source
2. If fertilizer and seeds are sown together, use a cyclone spreader.	2. A cyclone seeder throws seeds in a circular pattern as operator walks back and forth
	3. Racking and rolling gives seeds a more intimate contact with soil

Question 7 Which mulch is best for starting grass?

- Cheesecloth
- Straw
- Mushroom compost

Question 8 How should the mulch be used?

- Rake into soil
- Cover top of soil

Question 9 What is a good fertilizer ratio for grass?

- 20-5-5 for established lawns
- 5-10-10 for new lawns

Question 10 How is lawn fertilizer applied?

- Broadcast method with hand
- Drop spreader
- Rotary spreader

Question 11 Is it better to fertilize heavy once or light many times?

- Fertilize light many times

Question 12 When should lawn be fertilized?

- 2 times a year--early spring and fall
- 3 times a year--early spring, late spring and fall
- 4 times a year--early spring, late spring, late summer and fall

Question 13 How much water does a newly seeded lawn need?

- 24" depth

Student Skill 4

WATER SEEDLINGS

Steps	Factors for Consideration
1. Water area well and keep moist until seedling stands	
2. Give several light applications of water per day	2. 24" in depth of water
3. When seedlings are 1-2" tall, a light application of nitrogen is added	

Question 14 How much of the blade should be removed during each cutting?

- Only 1/3 of blade should be removed at a cutting

Student Skill 5

MOW NEWLY ESTABLISHED LAWN

Steps	Factors for Consideration
1. Spring seedlings must be established before mowing 2. When grasses are 4-5" tall, cut 2" at first cutting 3. Rake up clippings 4. Second and third mowings, cut only 1 1/2"	1. Good rule for mowing: Cut no more than 1/3 of foliage at any one time

Question 15 Why is sod layed staggered at ends?

- To avoid a continuous line of attachment during drying.

Student Skill 6

LAY SOD

Steps	Factors for Consideration
1. Prepare sod bed in same manner as for seedlings 2. Order sod from local nursery 3. Moisten sod before planting 4. Place strips of sod snugly together 5. Stagger ends of sod to avoid continuous lines of attachment during drying 6. Roll	

Question 16 Which lawn to lay--sod or seed?

Alternatives	Factors for Consideration
1. Sod 2. Seed 3. Groundcover	- Cost - Maintenance - Preference - Aesthetics

Student Skill 7

CARE FOR SOD

Steps	Factors for Consideration
1. Water thoroughly	1. Water to 6" depth
2. Do not step on wet grass	
3. Fertilize 4 times a year	3. 5 lbs. nitrogen/1000 sq.ft. divided during April, June, Aug., Sept.
4. Mow after established	4. Only 1/3 of blade at one cutting

IMPLEMENTING THE LANDSCAPE PLAN

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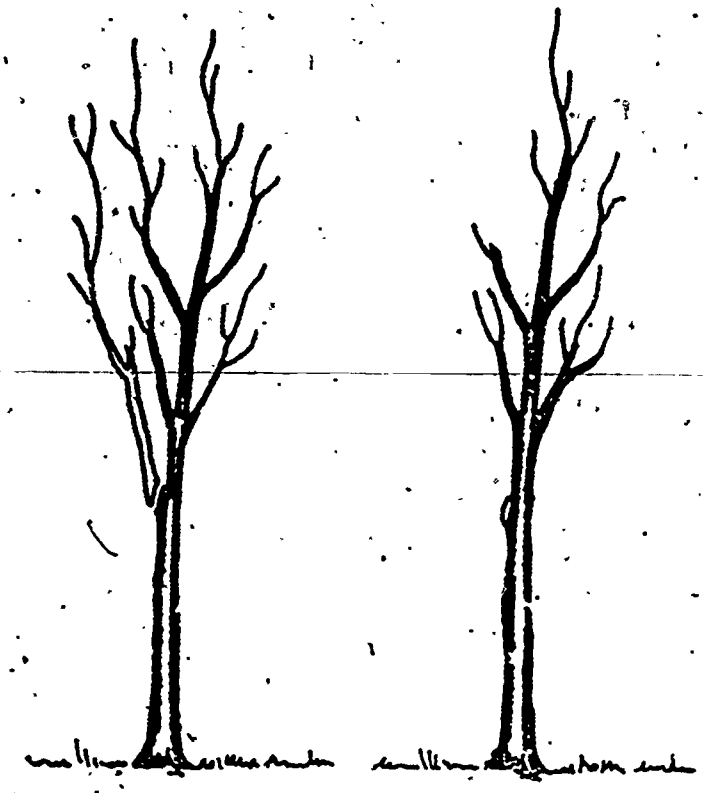
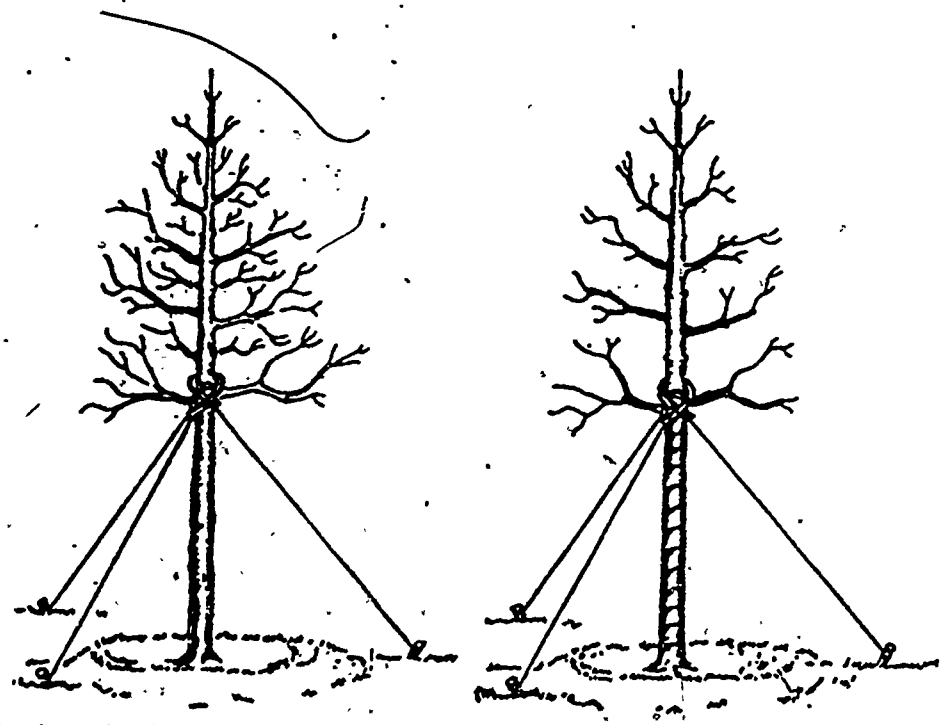
STUDENT ACTIVITIES



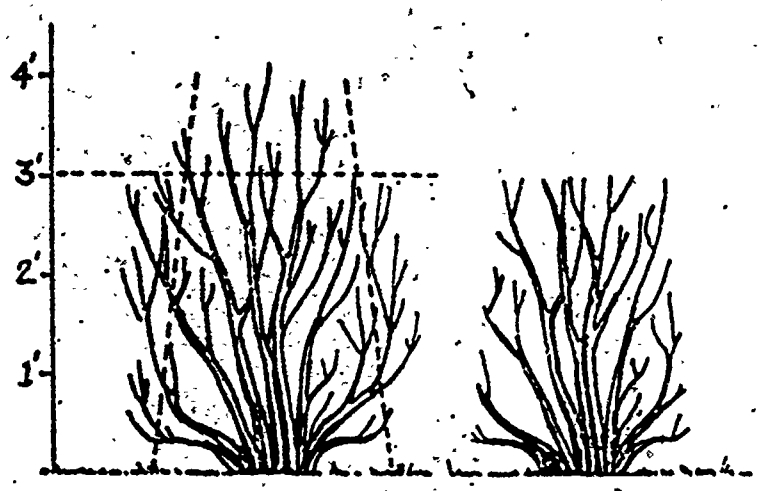
A young shade tree developing a double leader (at left). The space indicates the cut to make. The plant after the cut is shown at right.



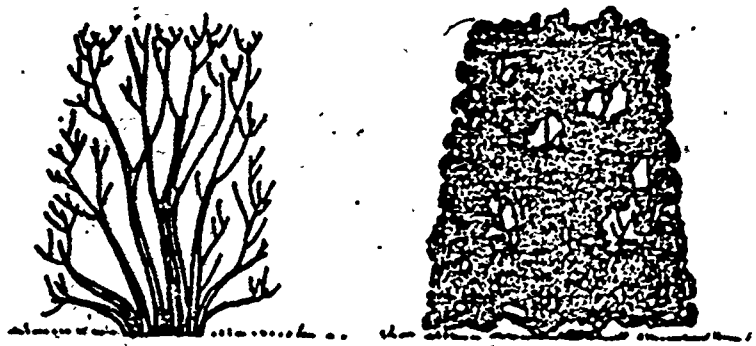
A newly planted shade tree indicating proper planting, bracing, and pruning cuts to make (at left). Same tree after pruning (at right).

F.A. Giles, W.R. Seifert, Pruning Evergreens and Deciduous Trees and Shrubs, Urbana, IL: Cooperative Extension Service, Circular 1033, 1971.

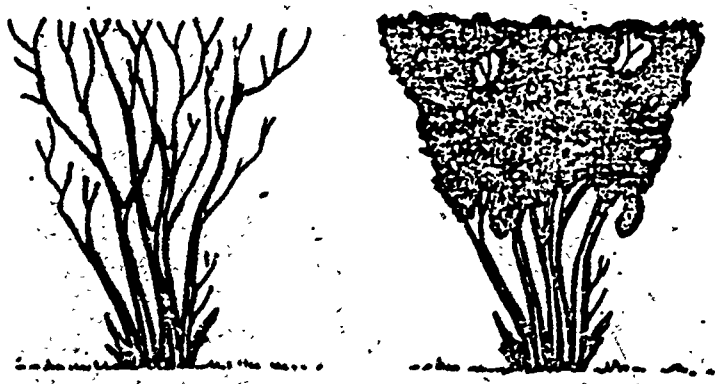
PRUNING DECIDUOUS SHRUBS



The first step in pruning a hedge is to establish lines at the proper angle for cutting (at left). The same hedge immediately after pruning is shown at right.



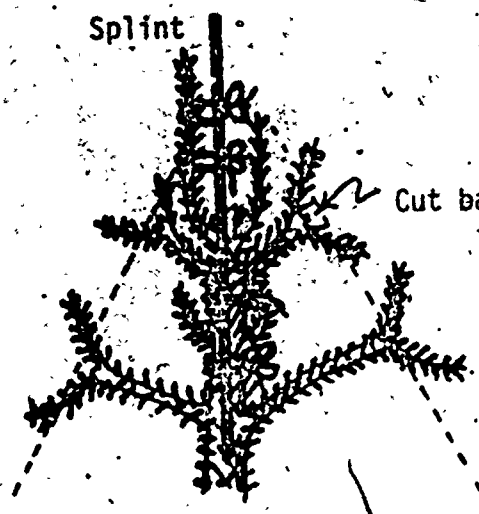
Spring's first growth (left) and hedge in full foliage indicating shape (right).



Hedge immediately after incorrect pruning (at left). Hedge in full foliage showing leggy, sparse condition in the lower part (at right).

F.A. Giles, W.R. Seifert, Pruning Evergreens and Deciduous Trees and Shrubs, Urbana, IL: Cooperative Extension Service, Circular 1033, 1971.

CREATING A NEW LEADER



TO CREATE A NEW LEADER:

- CHOOSE STRONGEST LATERAL CLOSEST TO THE ORIGINAL LEADER
- TIE SELECTED LEADER WITH A SPLINT
- ONCE THE SHOOT IS IN AN UPRIGHT POSITION, PRUNE ALL EXCESS LATERALS TO PREVENT A FLAT TOP FROM FORMING.

F.A. Giles, W.R. Seifert, Pruning Evergreens and Deciduous Trees and Shrubs, Urbana, IL: Cooperative Extension Service, Circular 1033, 1971.

MANAGEMENT PRACTICES THAT HELP PREVENT LAWN DISEASES

These practices are general guides to be used according to one's judgment. Their importance depends on the kind and seriousness of the disease threat. Not all of them are practicable under all conditions.

- Select grass species best adapted to the soil, climatic, and light conditions under which they will be grown.
- Plant mixtures of recommended grasses. Species vary in their susceptibility to different disease organisms, and in a mixture one or more of the grasses usually will survive a severe disease attack.
- Do not clip upright-growing grasses such as Kentucky bluegrass and red fescue too closely—1½ to 2 inches is the best height. Creeping grasses such as bentgrass and zoysia may be clipped at ½ inch or less.
- Mow the grass before it gets too tall; not more than one-half of the leaf surface should be removed at one time.
- Mow the lawn frequently enough in the fall to prevent the accumulation of a thick mat of grass before snow comes.
- Apply enough fertilizer to keep grass vigorously growing, but avoid overstimulating the grass with nitrogen. Apply lime if soil tests indicate a need for it.
- Clippings need not be removed except on heavily fertilized lawns or during periods when the grass is growing rapidly. Clippings provide nutrients for fungi and help to maintain humidity long after the sun has dried off surrounding uncovered areas.
- Water early enough in the day to allow grass leaves time to dry out before night. Avoid frequent, light waterings, especially during warm weather.
- Do not water grass until it begins to wilt, then soak the soil to a depth of 6 inches or more. Provide good surface drainage.

Science and Education Administration. Lawn Diseases - How to Control Them (Revised). Washington, D.C.: U.S. Government Printing Office, Home and Garden Bulletin 61, 1979.

Turf Tips for the homeowner

Mowing A Lawn

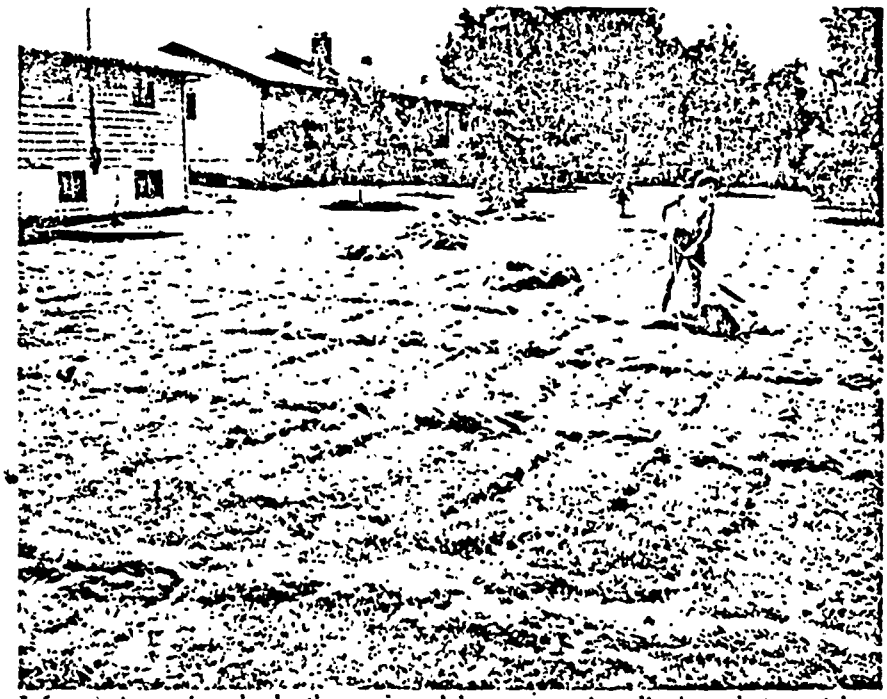
By Thomas M. Smith, Greg Patchan, Kenyon T. Payne, and John E. Kaufmann
Department of Crop and Soil Sciences

Proper mowing is important for maintaining a healthy, well groomed lawn. Mowing should provide a uniform, aesthetically pleasing surface, while improving the density of the turfgrass stand by increasing the development of tillers and leaves. Although high density discourages weed invasion, the actual mowing process also inhibits development of many weeds.

Height of Cut

Turfgrasses are well adapted to frequent mowing, if not cut too short. The grass blades manufacture carbohydrates for the entire plant. When leaf surface area is reduced, a lower level of carbohydrates will be produced. As cutting height is lowered, the root system of the plant is reduced. With a reduced root system, the plant takes up smaller amounts of water and nutrients. A compromise must be reached where the area still looks well-groomed and dense, and is also healthy and actively growing.

The turfgrass species and cultivars growing in the area are the most important factors to consider when selecting the height of cut. For example, creeping bentgrass has many of its leaves oriented horizontally. At low heights of cut (under ½ inch) creeping bentgrass produces adequate leaf tissue to support the rest of the plant. This allows for shorter mowing such as practiced on a golf green. Kentucky bluegrass, fine-leafed fescues, and improved perennial ryegrasses have a more upright growth habit. These lawngrasses should be cut between 1½ and 2½ inches for maximum health of the grass plants.



Infrequent mowing shocks the grass and leaves excessive clippings that must be removed.

At higher cuts, lawngrasses also will be more stress tolerant. There is little need to vary the cutting height during the summer or prior to winter. Shady areas should be mowed at 2½ or 3 inches to obtain the maximum leaf surface.

Mowing Frequency

A general "rule of thumb" in determining mowing frequency is never to remove more than ⅓ of the total leaf surface at any one mowing. This may require mowing twice a week in the spring, every two weeks in the summer and once a week in the fall. If more than ⅓ of the total leaf surface is removed, the grass may be stressed. Scalping may occur if most of the green leaf area is removed. When scalped, the lawn will appear brownish or yellowish because all that remains are the stemmy parts of the plant. If an area is scalped too frequently, the grass may die. Scalping often occurs on uneven lawn areas and rolling terrain.

Clipping Removal

Excessive accumulation of clippings from infrequent mowing may shade and smother the grass if not removed promptly. When the lawn is mowed frequently, with less than ⅓ of the total leaf surface removed, grass clippings can be left on the lawn. Grass clippings are made up of leaf blades that contain mostly water. Clippings break down very rapidly and do not contribute significantly to the thatch layer. By re-

turning grass clippings, nutrients in the leaves are recycled, and therefore reduce fertilizer needs of the lawn.

It may be desirable to remove clippings in some circumstances. On golf putting greens or around swimming pools, clippings may interfere with putting or may get into the pool. Evaluate the particular use of the turfgrass area to determine whether clippings will interfere with the planned use. In most cases, clippings can be returned without problems.

Mowing Equipment

The key to a quality cut is to use sharp, well adjusted mowers. Dull, poorly adjusted equipment tears rather than cuts the grass, leaving a ready site for disease invasion and giving the lawn a frayed, brownish look. The mowing direction should be varied each time to distribute the wear pattern. The grass should not be wet when mowing. Dry grass will cut more cleanly, and the clippings will tend to disperse rather than clump up and clog the mower. The rotary mower and reel mower are the two most common designs of mowing equipment. Each has its advantages and disadvantages, although the rotary mower is much more commonly used.

Rotary mowers are less expensive and easier to maintain than reel mowers. Rotary mowers readily cut coarse grass or tall weeds, and the simpler design requires less adjustment for proper operation. Any mower is dangerous and care should be taken to keep feet and hands away from the blades. Rotary mowers can discharge rocks, glass and other debris. Be certain the lawn is cleared of all debris prior to mowing. Dull rotary blades will still cut the grass, but should be kept sharp for best results. Blades are easily sharpened and should be ground several times a season. It is important that the blade be balanced following sharpening. Sharp blades permit cutting at the lower speeds which improves the safety and energy efficiency of the mower. A mulching mower is a type of rotary mower that finely chops the clippings. The finer clippings filter down through the grass to the soil-thatch surface where they rapidly decompose. Mulching mowers also pulverize a light covering of leaves, adding some extra nutrients to the soil.

Reel mowers are most effective for high quality turfgrass areas. When properly adjusted, a very high quality cut is possible. Reel mowers are more complex to maintain and operate than rotary mowers. Frequent mowing is necessary because reel mowers will not effectively cut tall grass. A light, uniform contact between the bedknife and reel must be maintained. This is a critical adjustment that should be checked before every mowing. Reel mowers require professional sharpening at least once per year, and more frequently if the blades are damaged.

The plastic string trimmer is another type of mowing equipment. Electric or gasoline units are available. Trim-work is easy with string trimmers. Whirling plastic twine cuts the grass around trees, fences and other hard to reach areas. Most models designed for the homeowner operate at low enough speed to prevent any type of serious injury. Goggles are recommended, especially when using heavy duty, industrial models. The nylon string can injure the lower trunks of small trees with thin bark and shrubbery, so care should be exercised.

The edger is another common lawn maintenance tool. Gas, electric or manual types are used to form a clean edge between walks, drives, curbs and the lawn areas. A vertical, rotating blade provides the cutting action.

Mower Safety

Mowing should be done regularly and carefully to protect the health of the grass and the safety of the operator. The following safety tips should be observed:

- pick up all debris before mowing
- keep children or pets away from mowers
- wear sturdy shoes; tennis or jogging shoes provide little protection
- wear long pants to prevent debris from hitting the legs
- always push the mower
- be familiar with the control and operation of the mower
- never put hands or feet near the discharge when the engine or motor is running
- be sure feet are away from the mower blade when starting the engine
- refuel the mower only when the engine is shut off and is cool
- clean and maintain the mower with the spark plug wire detached
- wear goggles when operating string trimmers or power edgers
- operate at low speed whenever possible to conserve gas and improve safety
- don't leave a running mower unattended.

MICHIGAN STATE UNIVERSITY
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Turf Tips for the homeowner

Watering A Lawn

By Greg Patchan, Thomas M. Smith, Paul E. Rieke and Kenyon T. Payne
Department of Crop and Soil Sciences

Water is essential for all living organisms, including grass. Water is necessary for many plant processes but it is especially important for transpiraton—the evaporation of water from the leaf surface which allows cooling of the plant. Green grass is about 90% water.

During normal summers in Michigan, rainfall is not sufficient to keep a lawn green. Grass then becomes dormant, turns brown and growth stops. The lawn normally recovers when adequate moisture becomes available. If a prolonged drought occurs, some plants will be killed.

There are both advantages and disadvantages in allowing a lawn to go dormant.

Advantages are:

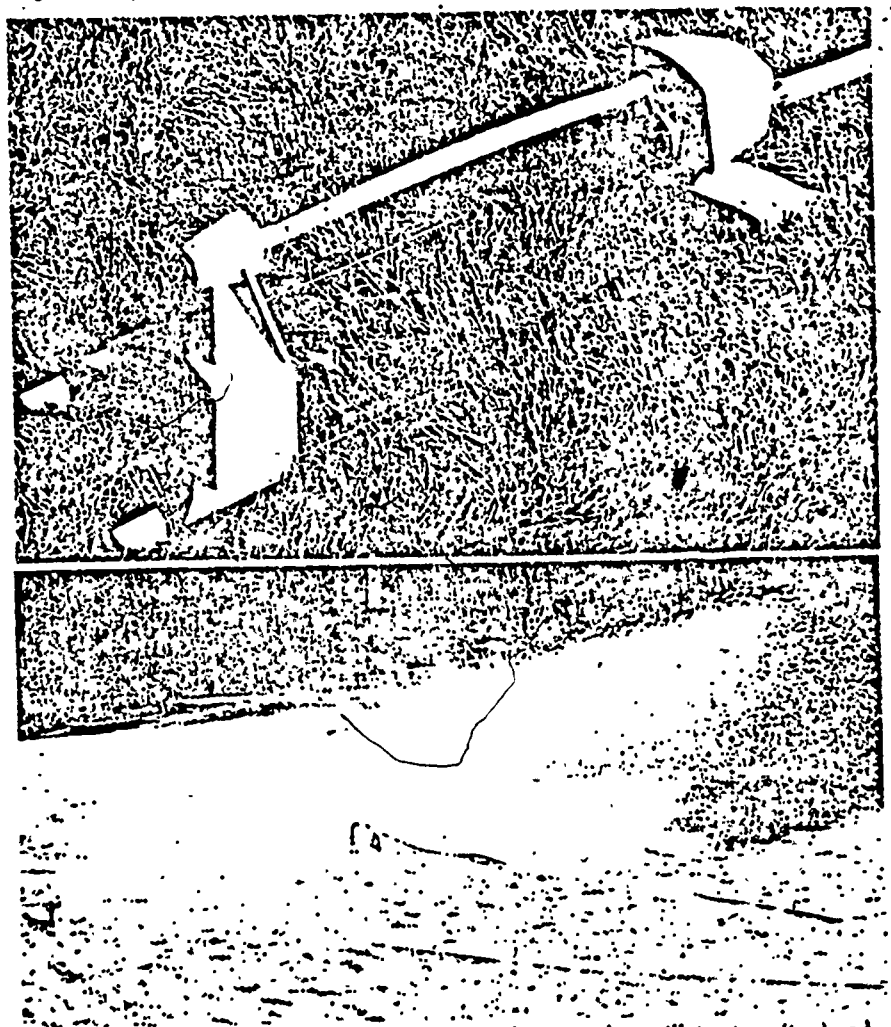
1. Reduced mowing and fertilizing as growth slows or ceases.
2. Minimal costs for water and irrigation equipment.

Disadvantages are:

1. More weeds due to lack of competition.
2. Slow recovery from additional stress such as traffic, disease or insect attack.
3. Aesthetics—a brown lawn is less attractive than a green lawn.

As summer approaches, you should determine whether watering will be practical. Plans should be made for watering if a dense, green, vigorous lawn is desired.

If the lawn is to be watered, decisions must be made on how often, how much, and when to water. A given watering program cannot be applied to all lawns. Varying soil types, exposure, slope, weather conditions, and availability and cost of water and equipment must be considered. The following guidelines will help to maintain a desirable lawn quality, and avoid wasting water.



Two types of sprinklers that can be attached to a hose are the oscillator type (top) and the rotary impact (bot.).

When to Water

The best time to water is early morning so that the lawn will have water during the heat of the day. Watering at mid-day is not harmful, but is less efficient because evaporation is often high, and wind conditions may cause uneven water distribution. Reduced water pressure may also be a mid-day problem.

Another efficient time for watering is in the evening or at night. Although wet conditions lasting through the night have been thought to increase disease problems, this is

usually not a concern on home lawns. For many homeowners, the evening is the most practical time to water, though water pressure may be low at this time.

Irrigation Equipment

A vast array of watering systems and equipment is available. Selection should be determined by:

1. Budget
2. Lawn area (size)
3. Quality of lawn desired
4. Convenience

A hose and a spray nozzle are the least expensive. However, this approach is suitable only for small areas or light applications because uniform coverage is difficult with hand watering. Approximately two hours are normally required to apply an inch of water to a 1000 square foot area.

A sprinkler attachment is the usual choice for most homeowners. Most sprinklers are a variation of either a rotary or wave-form (oscillator) design. Such equipment is reliable and readily available at a reasonable cost. A drawback on large lawns is that timing the application of each area and moving the hose can be inconvenient. For narrow sites and steep slopes, a soaker hose is a suitable choice. This will avoid wasting water on driveways and sidewalks, although considerable time will be needed to apply the water.

The most convenient and effective method of watering is provided by an underground sprinkler system. For best results, the system should be designed and installed by a trained specialist. Manual or automatic controllers can be used to activate the system, and periodic checks should be made to insure proper performance. An underground system is relatively expensive but frequently adds to the value of a homesite.

Water Frequency

For best results, start watering before grass dormancy develops. Look for signs of wilting. A dark, blue-green color and footprints that persist for some time are signs that a lawn needs water. Once a watering program is started, it should be continued throughout the dry period. If a lush, fertilized lawn is not watered, and no rain occurs during hot weather, serious thinning and slow recovery can result.

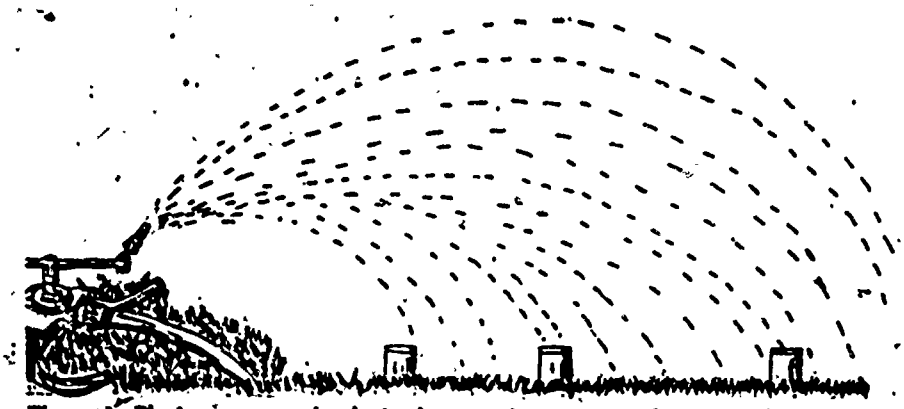


Figure 1. Placing cans randomly in the watering area can determine the delivery rate of the sprinklers.

When wilting is observed, apply enough water to wet the soil throughout the entire root zone. For bluegrass lawns on non-compacted, porous soils, this zone is usually 4 to 8 inches deep. Since lawngrasses require 1.0 to 1.5 inches of water per week, watering, plus rainfall, should supply this amount. An application of 640 gallons of water on 1000 square feet of lawn equals one inch.

Soil characteristics and natural rainfall determine the amount of water needed and the frequency of application. For example, a sandy, porous soil will hold no more than .5 inch of water in a six inch depth. If this amount of water is applied twice per week, the water lost from the root zone is fully replaced. A clay soil holds about one inch of water in the normal root zone. This can be replaced by a single, gradual application of one inch of water.

To determine the delivery of a sprinkler system, place cans of equal height randomly in the watering zone. When the water reaches the desired level in the cans, the sprinkler may be shut off and moved to the next area. This approach will insure that the entire root zone is moistened (Fig. 1).

The amount of water applied and the frequency of application is important. Avoid frequent, light waterings, as this practice promotes shallow rooting. Deep watering will promote the development of an extensive root system. Excessive watering results in wasted water and fertilizer, and may increase weeds and disease problems. Bentgrass, annual blue grass and rough bluegrass may also increase in overwatered lawns.

Special Considerations

Some areas in a lawn may dry more quickly than others. South and west exposures, sandy areas, slopes and areas near buildings, curbs and sidewalks are common examples. These areas may need more frequent watering to meet the needs of the grass, whereas low spots, north exposures, and shady areas may not need watering as frequently. Grasses with poorly developed root systems caused by compacted soil, insect damage or *Fusarium* blight also need special attention. These conditions result in shallow rooting. The result is a reduced reservoir of soil moisture and nutrients available to the grass plants. To compensate for this problem, more frequent watering at reduced application rates will be required. A lawn infected with *Fusarium* blight may require daily watering to prevent moisture stress, but always apply enough water to wet the root zone.

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Turf Tips for the homeowner
Extension Bulletin E-60 July 1986 Reprinted March 1988

Sodding A Lawn

By Greg Patchan, Thomas M. Smith, Paul E. Rieke and Kenyon T. Payne
Department of Crop and Soil Sciences

Using sod to establish lawns is a common practice. When compared to seeding, sodding offers both advantages and disadvantages that should be considered.

Advantages are:

1. Fast establishment.
2. Sod can be laid any time soil can be prepared.
3. Better establishment on high use areas.
4. More dependable results on banks and slopes where erosion is a problem.

Disadvantages include:

1. Higher cost.
2. A limited number of grass cultivars available as sod.
3. Limited availability of sod with grasses adapted to shady locations, heavy traffic or utility areas.

Improper watering of sod results in poor establishment.

Site Preparation

Proper site preparation is important in the establishment of a lawn. Prepare the site for sodding as you would for seeding. For detailed information on site preparation, refer to Extension Bulletin E-1401, "Site Preparation for Lawn Establishment." The suggestions which follow provide an overview of the preferred practices.

Weedy perennial grasses, such as quackgrass, tall fescue, and bentgrass, should be killed before an area is sodded. Tilling alone will not eliminate these undesirable species. Use a suitable herbicide to eradicate these weedy grasses.

For a high quality lawn, extensive and deep rooting is important. For this, porous, well-drained topsoil with good water-holding capacity is desirable. How much is enough? The more, the better — from a minimum of 3-4 inches to a preferred 6 inches. If an adequate depth of topsoil is not already spread on the site, additional topsoil can be purchased. Avoid using topsoil contaminated with troublesome weedy grasses such as quackgrass. Do not use fine textured, dark muck as a topsoil because, being an organic soil, it breaks down too quickly. Good topsoil need not be black in color.

Do not simply apply a thin layer (less than 3 inches) of topsoil without tilling into the soil below. A shallow layer becomes a barrier to rooting and drainage, making it difficult to maintain a healthy lawn.

If adequate topsoil is not available, there are alternatives for improving sandy soils or clay subsoils. Sandy soils have a low water holding capacity that can be improved by working 2-3 inches of loamy topsoil or fibrous peat into the soil to a 6 inch depth. Fine textured clay sub-soils present a more common and difficult problem. These soils compact easily and are not favorable for root development. To improve these soils, apply 2-3 inches of sandy topsoil or 2 inches each of coarse sand and fibrous peat and mix into the existing soil to a 6 inch depth.

If topsoil or amendments (sand, peat) are not used, the existing subsoil should definitely be loosened to a 4 to 6 inch depth. Grading and traffic on the site often leaves the soil highly compacted and undesirable for sodding. Tilling the soil will reduce

this compaction and improve root growth. Before tilling the soil, be sure it is dry enough to work without forming clods. The site can be tilled in much the same way as when preparing a garden. Break up large clods and remove sticks, stones and other debris.

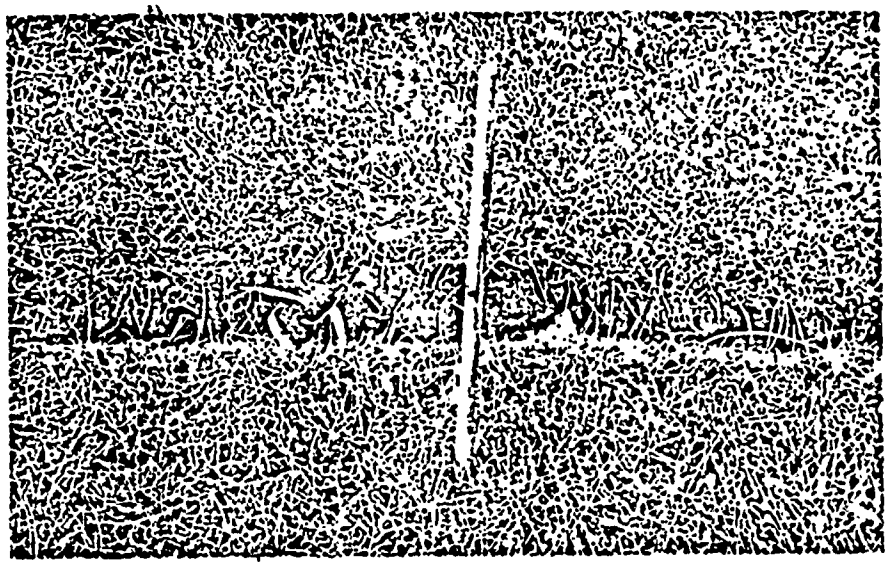
Fertilizer and lime should be applied according to a soil test available from your county Cooperative Extension Service office. If soil tests are not available, apply 10 to 15 pounds of 5-20-20 or 6-24-24 per 1000 square feet. Do not use lime unless indicated by a soil test. Incorporate this fertilizer into the upper 3-4 inches of soil. Complete the preparation process by smoothing the surface. Pay special attention to firming the soil over pipes and tile lines. Water thoroughly and allow time for settling, with the finished grade about 1½ to 2 inches below walks and drives.

Sod Selection

Sod should be free from weeds and weedy grasses (bentgrass, quackgrass, tall fescue) and should contain species and cultivars recommended for the location to be sodded. Most sod grown today has been selected for higher quality lawns in sunny locations. Usually blends of improved bluegrasses are grown and respond well to watering and fertilization. Blends of several cultivars also provide improved disease resistance when compared to a single cultivar. A few growers provide sod adapted to shady or utility areas. If your needs for sod are unique, be sure to inquire about adapted sod. For more information refer to Turf Mimeo No. 1, "Recommended Turfgrass Species and Cultivars for Michigan." This can be obtained from your county Cooperative Extension office.

Sod Installation

The grass plants in sod produce heat that cannot be dissipated when the sod is rolled or stacked for too long. This hea may kill the sod. To prevent this damage, the sod should be laid within 24 hours of its harvest during warm weather, and always within 48 hours.



Sod can be staked to prevent slippage off of a slope. In this case the sod was stretched during installation and gaps were formed once the sod dried.

Sod can be laid nearly any time of the year if the soil is dry enough to allow soil preparation. Problems may exist with early winter sodding because the sod may dry out and die if the roots are not established before the ground freezes. Sodding should not be done during dry periods if watering is not possible.

Avoid laying sod on powdery, dry soil. A soil that is moist to a depth of 6 inches, but not saturated, allows the new roots to establish rapidly. The ends of the sod pieces should be staggered to prevent lines across the turf caused by slow establishment at the edges. Make sure that the edges of the sod are in good contact with each other but not overlapping. Avoid stretching the sod or gaps will develop between the pieces when the sod drys. Once the sod is laid, roll to insure good contact with the soil. Roots will dry out rapidly if air pockets are left between the sod and the soil. If sod is laid on a slope, it may be necessary to peg the sod strips with wooden stakes to prevent slippage.

Thoroughly water the sod immediately after rolling. As a general rule, uniform watering will be necessary every day to keep the sod moist until the roots have grown into the soil. It is best to water the sod during mid-day to obtain rapid establishment. Be sure to apply enough water to wet the soil under the sod. Rooting normally requires two to three weeks. Once the sod is established, watering can be reduced gradually to once a week or less, depending on when the grass begins to wilt.

Mowing should begin when required by the growth of the grass. The recommended mowing height for bluegrass sod is 1½ to 2½ inches. Avoid removing more than 1/3 of the leaf surface at any one mowing.

After the sod is rooted, follow a fertilization program suggested for established lawns. Generally four fertilizer applications per year are suggested for higher quality lawns. Once the sod is established, good management practices will be necessary to maintain a high quality turf.

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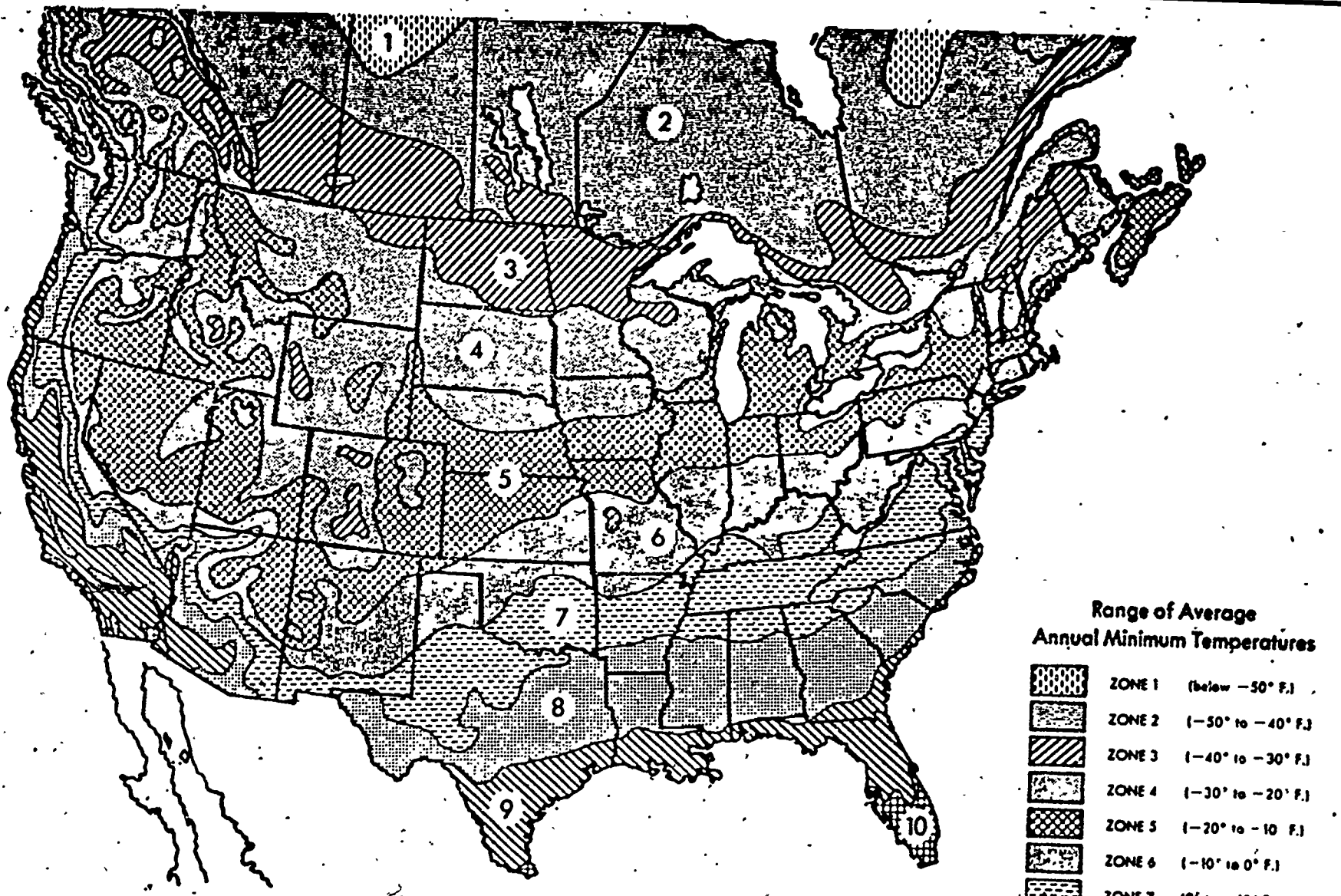

Zones of Plant Hardiness

SCORE CARD

Implementing the Landscape Plan

Evaluation check-off form for maintaining a piece of property.
(Max. score = 100 pts.)

10	_____	1. Are landscape prints explained thoroughly?
10	_____	2. Are %'s of grade calculated correctly?
15	_____	3. Is surface swale graded properly?
15	_____	4. Can lay and construct sub-surface tile ditches.
5	_____	5. Understand elements of installing a sprinkler system.
10	_____	6. Take and analyze soil.
5	_____	7. Know and prepare soil amendments.
10	_____	8. Plant a B&B tree/shrub.
10	_____	9. Plant and stake a bare root tree/shrub.
10	_____	10. Sow seed and lay sod.

100 pts

OR

Evaluation check-off form for establishing and maintaining a lawn.
(Max. score = 100 pts)

10	_____	1. Take and analyze soil.
10	_____	2. Select right grass seed.
10	_____	3. Know and prepare soil amendments.
10	_____	4. Correctly apply seed at recommended rates with a spreader.
10	_____	5. Apply a starter fertilizer, raking and rolling.
10	_____	6. Lightly water seedlings--24" depth, and know how this can be calculated.
10	_____	7. After seedling stage fertilize lightly with Nitrogen 4 times a growing season.
10	_____	8. Mowing. (note: Rule of thumbs for mowing.)
10	_____	9. Raking up clippings.
10	_____	10. Water regularly. (note: Time of day and amount of water used.)

TEST

Implementing the Landscape Plan

Fill-in-the-Blanks

1. When planting B&B trees/shrubs, prepare the hole twice the width and 4 inches deeper than required by the plant's roots.

2. Before setting B&B's into the ground, prune equal amounts of plant's roots to equal amounts of plant's branches.

3. Soil amendments of nitrogen, phosphorus and potash should be added before a tree is planted.

4. After a tree is planted water thoroughly twice a week for a month or so.

5. B&B trees/shrubs means Balled and Burlapped trees and shrubs.

6. Before planting bare rooted trees/shrubs, immerse whole plant in warm water for 24-48 hours.

7. After planting a bare rooted tree, wrap and stake the tree.

8. Cool season plants are plants that prefer relatively cool conditions of below 70 degrees F.

9. Warm season plants are plants that prefer relatively warm conditions of above 70 degrees F.

10. Requirements for seed germination are: moisture, nutrients, oxygen, and optimum temperature.

11. A "starter" fertilizer has a Nitrogen source.

12. When mowing a lawn, cut no more than 1/3 of the foilage at any one time.

13. Freshly sown lawn seed should be watered to a depth of 24 inches.

14. Sod is layed staggered so a continuous line of separation does not occur during drying.

15. A pH test determines how acid or how alkaline a soil is.

Matching

a 1. topography survey

b 2. slope ratios

c 3. Micro climates

d 4. measurement scales

e 5. swale

f 6. subsurface drainage

g 7. soil fertility

h 8. essential minerals nutrients

i 9. soil pH

j 10. tillage operations

k 11. organic amendments

l 12. inorganic amendments

m 13. types of soil

n 14. B&B

o 15. harden

a. map that consists of lines called contour lines.
b. the relationship between the horizontal and the vertical measurement of the contour lines
c. sun, shade, wet and dry areas.
d. 1/8 inches = 1 ft.
e. a gentle indulation in a lawn
f. one or more ditches that border a land being drained and are continuous with a disposal system
g. the ability of the soil to supply the nutrients required for maximum plant growth.
h. N, P, and K.
i. the acidity or alkalinity of a soil
j. using a roto-tiller, mixing up fertilizers and chemicals into soil up to 6" deep
k. soils that are 20% or more high in organic matter
l. soils that are generally less than 10% organic matter
m. sandy, loam, clay
n. balled and burlapped tree or shrub
o. setting plants outdoors for short periods before transplanting into ground

Multiple Choice

1. The chemical reaction, or pH of a soil refers to the soil's:
   a. fertility
   *b. relative acid or alkaline content
   c. leaching
   d. nutrient retention

2. Most ornamental plants grow best in a soil that is:
   a. very acid
   *b. slightly acid
   c. neutral
   d. slightly alkaline

3. A complete fertilizer contains:
   a. nitrogen and iron
   *b. nitrogen, phosphorus and potassium
   c. all 16 elements needed by plants
   d. more nitrogen than anything else

4. Fertilizer analysis is always stated in this order:
   *a. nitrogen, phosphorus and potassium
   b. phosphorus, nitrogen and potassium
   c. nitrogen, potassium and phosphorus
   d. potassium, phosphorus and nitrogen

5. Special materials added to the soil to help improve it are known as
   a. fertilizer
   b. amendments
   c. compost
   *d. all of the above

6. An excess of moisture in the growing medium is likely to cause which of the following to be reduced:
   a. support
   b. nutrients
   *c. aeration

7. Which amendment in this list is not organic?
   a. peat moss
   *b. sand
   c. sawdust
   d. compost

8. A mixture of decomposing organic materials such as leaves, straw and manure is known as:
   a. peat moss
   b. perlite
   *c. compost
   d. vermiculite

Multiple Choice (Cont.)

9. As organic matter decomposes in the soil it produces:
   a. peat moss
   *b. humus
   c. perlite
   d. vermiculite

10. Amendments are normally added to soil so they make up about what percentage of the final volume?
   a. 5%
   b. 15%
   *c. 25%
   d. 50%

11. Before planting a lawn or ground cover, how deeply should the soil be prepared?
   a. no more than 2"
   b. about 4 inches
   *c. about 8 inches
   d. it makes no difference

12. Immediately after sowing and lightly raking the lawn seed we apply:
   a. fertilizer
   b. top soil
   *c. mulch
   d. weed killer

13. A strip of established grass about one inch thick to a few square feet in area is called:
   a. mulch
   b. ground cover
   *c. sod
   d. amendment

14. For established lawns the soil should be kept moist to about what depth?
   a. 2"
   *b. 4"
   c. 6"
   d. it makes no difference

15. If a lawn is to be mowed back to 1/2 inch tall it should be mowed:
   a. every 3 days
   *b. when it reaches a height of 1"
   c. not until it reaches a height of 2"
   d. not until it reaches a height of 3"

True or False

1. T Before planting a lawn, it is necessary to prepare soil carefully.
2. T An established lawn can be renovated or replanted without completely removing the lawn.
3. F A soil test usually isn't necessary before planting a lawn because we can estimate how much fertilizer is needed.
4. F Grass seed is sown in two directions to help give the lawn a smooth texture.
5. F The joints between sod pieces should overlap about 2 inches.
6. T When watering a lawn it is best to water infrequently but heavily
7. F It is usually best to apply all the fertilizer needed by a lawn at one time.
8. T A growing medium is a mixture of special materials that can be used for growing ornamental plants.
9. F Most ornamental plants will grow well under conditions of little aeration.
10. T Peat moss is an amendment used to hold moisture in the growing medium.
11. T Sand is used to improve drainage and aeration.
12. F Perlite promotes rapid water movement but is very heavy.
13. F Soils that are mostly sand have a nutrient-holding capacity.
14. T Peat moss will usually make the soil more acid.
15. T Nitrogen is used by plants in large amounts and is therefore classed as a macro-element.