Grass Species and Fertilization Practices to Minimize Negative Effects of Lawns

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Lawns: Good or Bad?

- Maintained turf covers >50 million acres in the US; majority is lawns
- Turf industry is worth $40 billion annually (2003)
- Turf is dominant vegetative ground cover in urban and suburban areas
Perceived Benefits of Turf

• Reduces soil erosion and filters runoff, improving water quality
• Allows storm water to recharge aquifers
• Traps dust and particulates, improving air quality
• Reduces glare and heat reflection, decreasing need for cooling
• Most tolerant of foot traffic of any vegetation; provides cushioned surface for athletic activities
• Increases mental well-being, particularly in urban areas
Perceived Negatives of Turf

- Nitrogen and phosphorous in runoff and leachate degrade aquatic environments
- Pesticides poison environment and cause human health problems
- Requirements for irrigation deplete aquifers and overwhelm municipal water systems
- Excessive labor and fuel required for maintenance, especially mowing
Can we have the benefits of turf without the negatives?
Reducing Needs for Pesticides

• Invasion of turf by weeds, diseases or insects is often an indication that the turf is stressed
• One approach is to use pesticides to kill the weeds, insects, or pathogens
• Another approach is to improve the environment to reduce stress
• A third approach is to switch to a different cultivar or species of grass which can tolerate the stress
What Stresses Grass?

• Poor soil (Grass is not carpet!)
  – Compacted or shallow with little space for water or roots
  – Low organic matter; limited ability to retain water and nutrients
  – Infertile, too acid or alkaline, high salts or metals

• Shade

• Too much or too little water

• Improper mowing
Improving Poor Soil

• Rhode Island soils tend to be well-drained and acidic with limited ability to hold nutrients
• Organic matter improves retention of water and nutrients and encourages root growth
• Fertilizer provides nutrients to support dense turf able to out-compete weeds
• Lime increases soil pH and nutrient availability
Grasses for Low-input Lawns

• Some grasses are more stress-tolerant; require fewer inputs of water, fertilizer and pesticides

• Definition of low-input:
  – 0-2 lbs nitrogen per 1000 square feet
  – No irrigation after establishment
  – No herbicides after establishment

• Low-input ≠ no mowing
Places for Low-input Lawns

• Home lawns
• Office parks and other commercial sites
• Parks and schools (not athletic fields)
• Cemeteries
• Roadsides and erosion control
• Far rough of the golf course
Key Factors for Success

• Use the right grasses for your site
• Use elite turf-type varieties
• Incorporate organic matter when preparing the site for planting
URI Low-input Lawn Trial
June 2006
URI Low-input Lawn Trial

• **Objective:** Identify grasses which retain acceptable cover on poor soil under low-input maintenance

• **Species:**
  – Kentucky bluegrass
  – Perennial Ryegrass
  – Tall Fescue
  – Fine Fescue
  – Colonial Bentgrass
Results

- Kentucky bluegrass started slow; never achieved >60% cover
- Perennial ryegrass had best establishment but declined rapidly from disease and nitrogen stress
- Hard fescue was slow to establish but developed excellent cover after 1 year
- Red fescue, tall fescue and colonial bentgrass maintained good cover; essentially weed-free
The Grasses, Close Up (late May 2007)

- Perennial ryegrass
- Kentucky bluegrass
- Colonial bent
- Tall fescue
- Hard fescue
- Red fescue
Tall Fescue

• Deepest rooting of any cool-season turfgrass
• Tolerates low fertility; excellent nitrogen use efficiency
• Few diseases if not over-fertilized
• Endophyte enhances drought tolerance and insect resistance
• Excellent traffic tolerance
• Good salt tolerance
• Wide leaf blades and coarse texture
• Newer turf types have darker color, finer texture, slower vertical growth
• Seed readily available
**Red Fescue**

- Very drought tolerant but summer dormant
- Tolerates very low fertility and acid soil
- Good in shade
- Some types have excellent salt tolerance
- Chewings fescue can be cut low
- Allelopathic – suppresses crabgrass
- Low traffic tolerance
- Some cultivars get severe red thread if under-fertilized
Hard Fescue

• Excellent shade tolerance
• Stays green in heat and drought
• No salt tolerance; tolerates metals
• Poor traffic tolerance
• Excellent disease resistance
• Allelopathic
• Low-growing for naturalized areas
• Slow to establish; seed short-lived
Hard Fescue Drought Tolerance

Late August 2007 – no water for 6 weeks!
Colonial Bentgrass

- Does well under low fertility
- Crowds out weeds
- Spreads to fill bare spots
- Shade tolerant
- Can be left unmowed at low density
- Gets puffy and thatchy if mowed >1.5”
- Dormant in summer
- Hard to find seed
How are we doing?

- Pesticides poison environment and cause human health problems
  - Dense turf crowds out weeds
  - Allelopathic fescues suppress crabgrass
  - Disease resistant cultivars don’t need fungicides
  - Endophytes discourage insects

- Requirements for irrigation deplete aquifers and overwhelm municipal water systems
  - Fescues tolerate drought

- Excessive labor and fuel required for maintenance, especially mowing
  - Colonial bentgrass and fine fescues need less mowing

- Nitrogen and phosphorous in runoff and leachate degrade aquatic environments
  - Even low-input species benefit from some fertilizer
Turf Fertilizer and Eutrophication

• Turf fertilizer is easily controlled non-point source of nitrogen and phosphorous pollution

• Turf fertilizers get into aquifers through runoff and leaching

• Runoff is worst during first year after seeding new stand (Easton and Petrovic 2004)

• Quick-release nitrogen fertilizers result in higher N content in runoff than do slow-release fertilizers

• Fertilization decreases runoff by increasing shoot density
  – 2-fold increase in shoot density decreases nutrient runoff 3-fold (Easton and Petrovic 2004)
• Runoff unlikely on RI soils except steep slopes (Morton, Gold & Sullivan 1988)

• Leaching is worst from October-March when grass is not actively growing

• Leaching is greatest on newly established turf (Easton and Petrovic 2004)

• Higher application rates result in more leaching (Easton and Petrovic 2004)

• Quick-release nitrogen formulations leach significantly more than either slow-release synthetic formulations or composted manure products (Guillard and Kopp 2004)
• Over-irrigating increases leaching, particularly in August and September (Morton, Gold & Sullivan 1988)
• Risk of leaching following moderate fertilization higher for Kentucky bluegrass than for tall fescue (Liu and Hull 2006)
• Fall fertilization with quick-release nitrogen increases leaching with later fertilization dates resulting in more leaching (Magniafico and Guillard 2006)
• Even unfertilized turf leaches some nitrogen
Minimizing Leaching

- Frequent small applications of fertilizer, especially on new stands
- Use slow-release nitrogen, especially for fall fertilization
- Sod slopes to decrease runoff during establishment
- Don’t over-irrigate – 1” total water per week is plenty
- Plant tall fescue where leaching is a particular concern
- Maintain a dense, actively growing turf and good soil organic matter levels
When to Fertilize

- Late summer or early fall fertilization promotes shoot density and rooting
- Spring fertilization improves color
- Early summer fertilization increases leaf growth and need to mow; favors crabgrass and may increase diseases
- Cool season grasses grow best at temperatures of 60-75°; growth stops at soil temperatures below 50°
- Fertilizing after October increases leaching without improving turf quality

From Brede 2000
What Kind of Fertilizer?

- Urea and nitrogen salts release >70% of nitrogen within 4 weeks of application regardless of soil temperature.
- Compost-based and coated products release N at a moderate level over 10-18 weeks with faster release in warm, moist soils (>65°).
- Organic products build soil organic matter but may contain excessive levels of phosphorous and potassium relative to nitrogen.
- Ideal soil NPK ratio for turf is 3:1:2.

From Brede 2000
How Much Fertilizer?

• Kentucky bluegrass requires 4-5 lbs of nitrogen per 1000 square feet each year
• Fescues are happy with only 1.5-2.5 lbs of nitrogen
• Returning clippings to the lawn can reduce fertilizer needs by 50% (Kopp and Guillard 2002)
• 10% white clover in the mix can add 2 lbs of nitrogen per 1000 square feet each year
• Established turf (older than 10 years) requires less fertilizer than younger turf
• Never apply more than 1 lb of quick-release N at once; 0.5 lbs is safer
Fertilizer Conclusions

• “Spoon feed” turf in the first year, with frequent small applications to minimize leaching and runoff
• If clippings are left on the lawn, middle-aged Kentucky bluegrass needs 2.5-3 lbs N/1000 sq. ft. and middle-aged fescue needs only 1-1.5 lbs N/1000 sq. ft.
• Reduce fertilizer application rate for lawns older than 10 years
• Fall is the most important time to fertilize, but avoid quick-release nitrogen after soil temperatures drop below 50°
• In general slow-release nitrogen is unlikely to leach or run off from healthy, established turf
• Maintain good soil organic matter levels and avoid over-irrigating
To Maximize Benefits of Turf while Minimizing Environmental Damage

- Improve soil texture and organic matter
- Plant elite varieties instead of common types
- Use thick turf instead of herbicides to control weeds
- Match the turf species to the stresses present in your site and desired input level
- Fertilize just enough to maintain turf quality; return clippings
- Use slow-release nitrogen or frequent light applications
- Irrigate only enough to prevent drought stress
- Sod slopes to minimize runoff during establishment
Questions?