TURFGRASS FERTILIZATION
ACLP TURFGRASS TRAINING
David M. Kopec, Univ. Arizona

I. Essential Elements/Nutrients
✓ Needed for plant to complete its life cycle
✓ Needed for the turfgrass manager to produce a turf of predetermined quality level
✓ Macronutrients: nitrogen, phosphorus, potassium, calcium, magnesium, sulfur
✓ Micronutrients: iron, manganese, zinc, boron, copper, chlorine, molybdenum, cobalt, nickel

II. Tracking Turfgrass Nutrient Status
✓ Color/appearance
✓ Growth (clipping yield, recovery from injury)
✓ Soil testing
✓ Tissue testing

III. Fertilization Programming
✓ Soil nutrient levels
✓ Species/cultivar differences
✓ Desired quality level and intended use of area
✓ Growth rate desired
✓ Soil physical conditions
✓ Other management practices (irrigation, mowing)
✓ Budgetary constraints
✓ Climatic and environmental conditions

IV. Nitrogen Fertilization
A. Major input – FERTILIZERS

B. Secondary inputs
✓ Organic matter decomposition
✓ Effluent (can be high in N)

C. Losses (WHY N IS USED MORE OFTEN AND IN LARGER AMOUNTS THAN OTHER NUTRIENTS)
✓ Leaching of nitrates
✓ Volatilization of ammonia
✓ Denitrification losses
✓ Microbial immobilization
✓ Clipping removal

D. Effects of N fertilization on the turfgrass plant
✓ Positive effects
  ❖ Darker green color
  ❖ Increased shoot growth rate (recovery from injury)
  ❖ Increased resistance to certain diseases (dollarspot, anthracnose, rust)
✓ Negative effects
  ❖ Increased growth rate (higher mowing requirement)
  ❖ Decreased levels of carbohydrates (energy) in the plant
  ❖ Lower root growth rates and/or root die-back
  ❖ Greater irrigation requirement

E. Species N requirements
<table>
<thead>
<tr>
<th>Turfgrass Species</th>
<th>Lbs. N/year per 1000 sq.ft.</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>Sept</th>
<th>early Oct.-early Nov.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Maintenance bermuda</td>
<td>4</td>
<td>0.25</td>
<td>0.25</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50 if not aerify</td>
<td>0.50 if not overseeding</td>
</tr>
<tr>
<td>High Maintenance bermuda</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalograss/Blue grama</td>
<td>½-2</td>
<td>½-1</td>
<td>½-1</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turf-Type Tall Fescue</td>
<td>2-3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>(1)*</td>
</tr>
</tbody>
</table>

* Last fall N application is made while grass is still green, and at least 2-3 weeks before ground begins to freeze. Optional N applications are in ( ); use where a higher quality turf is desired.

F. Quickly-available N sources
   ✓ Advantages
      ❖ low cost per unit of nitrogen (less expensive)
      ❖ quick greening effect (rapid response)
      ❖ high water solubility
      ❖ not dependent on temperature for N release
   ✓ Disadvantages
      ❖ peak and valley feeding
      ❖ shorter residual effect (4-8 weeks)
      ❖ greater burn potential
      ❖ increased potential for leaching and volatilization losses
      ❖ increased labor costs for more frequent application

G. Slowly-available N sources
   ✓ Advantages
      ❖ longer residual effect (N release controlled by coating, solubility, microbial activity, temperature, pH)
      ❖ low/non-existent burn potential
      ❖ avoid peak and valley feeding
      ❖ lower labor costs to provide long term feeding
      ❖ decreased leaching and volatilization potential
   ✓ Disadvantages
      ❖ higher cost per unit of nitrogen (more expensive)
      ❖ initial response is often slow
      ❖ some need high soil temperatures to release N
### Characteristics of some nitrogen fertilizers. As stolen from T. Koski

<table>
<thead>
<tr>
<th>Fertilizer Name</th>
<th>Analysis</th>
<th>Source of N</th>
<th>Moisture Dependence</th>
<th>Low Temperature Response</th>
<th>Residual N Activity</th>
<th>Salt Index (per N unit)</th>
<th>Leaching Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>QUICKLY-AVAILABLE N FERTILIZERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>33-0-0</td>
<td>ammonium nitrate</td>
<td>minimal</td>
<td>rapid</td>
<td>4-6 weeks</td>
<td>3.2</td>
<td>high</td>
</tr>
<tr>
<td>Ammonium sulfate</td>
<td>21-0-0</td>
<td>ammonium sulfate</td>
<td>minimal</td>
<td>rapid</td>
<td>4-6 weeks</td>
<td>3.3</td>
<td>high</td>
</tr>
<tr>
<td>Ammonium phosphate</td>
<td>18-46-0</td>
<td>diammonium phosphate</td>
<td>minimal</td>
<td>rapid</td>
<td>4-6 weeks</td>
<td>1.6</td>
<td>high</td>
</tr>
<tr>
<td>Urea</td>
<td>46-0-0</td>
<td>urea</td>
<td>minimal</td>
<td>rapid</td>
<td>4-6 weeks</td>
<td>1.6</td>
<td>moderate</td>
</tr>
<tr>
<td><strong>SLOWLY-AVAILABLE N FERTILIZERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur-coated urea</td>
<td>22-38% N</td>
<td>urea</td>
<td>moderate</td>
<td>mod. rapid</td>
<td>10-15 weeks</td>
<td>NA</td>
<td>low</td>
</tr>
<tr>
<td>Resin/plastic-coated</td>
<td>24-35% N</td>
<td>urea, nitrate, ammon.</td>
<td>moderate</td>
<td>mod. rapid</td>
<td>15-36 weeks</td>
<td>NA</td>
<td>low</td>
</tr>
<tr>
<td><strong>Slowly-Soluble Sources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBDU</td>
<td>31-0-0</td>
<td>isobutylidene diurea</td>
<td>high</td>
<td>mod. rapid</td>
<td>10-16 weeks</td>
<td>0.2</td>
<td>moderate-low</td>
</tr>
<tr>
<td><strong>Ureaform reaction fertilizers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitroform</td>
<td>38-0-0</td>
<td>ureaformaldehyde</td>
<td>high</td>
<td>slow</td>
<td>10-30 weeks+</td>
<td>0.3</td>
<td>very low</td>
</tr>
<tr>
<td>FLUF</td>
<td>18-0-0</td>
<td>urea/ureaformaldehyde</td>
<td>moderate</td>
<td>medium</td>
<td>6-10 weeks</td>
<td>NA</td>
<td>low</td>
</tr>
<tr>
<td>Nutralene</td>
<td>40-0-0</td>
<td>methylene ureas</td>
<td>moderate</td>
<td>medium</td>
<td>7-9 weeks</td>
<td>NA</td>
<td>low</td>
</tr>
<tr>
<td>Methylene urea</td>
<td>39-0-0</td>
<td>methylene ureas</td>
<td>moderate</td>
<td>medium</td>
<td>7-9 weeks</td>
<td>0.7</td>
<td>low</td>
</tr>
<tr>
<td>Coron</td>
<td>28-0-0</td>
<td>urea/methylene ureas</td>
<td>minimal</td>
<td>mod. rapid</td>
<td>7-9 weeks</td>
<td>NA</td>
<td>moderate</td>
</tr>
<tr>
<td>N-Sure</td>
<td>28-0-0</td>
<td>triazone/urea sol.</td>
<td>minimal</td>
<td>mod. rapid</td>
<td>6-9 weeks</td>
<td>NA</td>
<td>moderate</td>
</tr>
<tr>
<td><strong>Natural organic fertilizers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ringers</td>
<td>6-1-3</td>
<td>blood, bone, seed meals</td>
<td>high</td>
<td>medium</td>
<td>10-12 weeks</td>
<td>0.7</td>
<td>low</td>
</tr>
<tr>
<td>Sustane</td>
<td>5-2-4</td>
<td>composted turkey waste</td>
<td>high</td>
<td>medium</td>
<td>10-12 weeks</td>
<td>0.7</td>
<td>low</td>
</tr>
<tr>
<td>Richlawn</td>
<td>6-3-2</td>
<td>DPW, blood, bone meals</td>
<td>moderate-high</td>
<td>med./mod. rapid</td>
<td>8-12 weeks</td>
<td>0.7</td>
<td>low</td>
</tr>
<tr>
<td>Milorganite</td>
<td>6-2-0</td>
<td>activated sludge</td>
<td>high</td>
<td>slow</td>
<td>10-12 weeks</td>
<td>0.7</td>
<td>low</td>
</tr>
</tbody>
</table>
V. PHOSPHORUS FERTILIZATION
A. Important functions
✓ Component of ATP (adenosine triphosphate)
✓ Seedling growth and development
✓ Root formation

B. Factors affecting availability
✓ Soil type – clays fix more P; organic matter holds P
✓ pH – forms insoluble precipitates with iron at low pH; with Ca at high pH
✓ Aeration/root health

C. Deficiency symptoms
✓ Purpling of leaves
✓ Deep greening
✓ Lack of growth
✓ Soil test level of less than 5 ppm P (10 lbs P/acre)

D. Phosphorus fertilizer sources
✓ Superphosphate (0-18-0)
✓ Triple superphosphate (0-45-0)
✓ Monoammonium phosphate (11-48-0)
✓ Diammonium phosphate (18-46-0)

VI. POTASSIUM FERTILIZATION
A. Importance
✓ Enhances root growth
✓ Better heat tolerance
✓ Better drought resistance
✓ Increased cold tolerance
✓ Enhanced resistance to disease

B. Factors influencing availability
✓ Soil type (clays fix more K than do sands)
✓ Ca and Mg levels in soil (can compete with K for CEC sites)
✓ Compaction/root health

C. K fertilizer sources
✓ Potassium chloride (0-0-60) – less expensive and has higher salt index
✓ Potassium sulfate (0-0-50) – more expensive, with lower salt index

VII. IRON FERTILIZATION
A. Value of iron
✓ An essential element
✓ Promotes greening of turf without stimulating shoot growth (allows reduced N use)
✓ May reduce winter desiccation
✓ Increases shoot density and enhances root growth

B. Causes of iron deficiency
✓ High soil pH
✓ Excessively cold/warm, wet, and/or poorly-aerated soils
✓ Unhealthy/damaged roots
✓ High levels of nitrate, phosphorus, micronutrients (zinc, copper, manganese)

C. Diagnosis of iron deficiency
Yellowing of youngest leaves in shoot (immobile element)
✓ Interveinal chlorosis
✓ Patchy yellowing of turf
✓ Severity increases with nitrogen applications
✓ Soil test level less than 5 ppm Fe

D. Correction of deficiency
✓ Foliar iron applications often most effective (especially on high pH soils)
   ❖ 2% solution (0.33 lb. iron sulfate in 2 gallons of water) at a rate of 0.5 gal/1000 sq. ft.)
   ❖ Apply iron chelates at a rate of 0.1-0.3 lb. actual iron per 1000 sq. ft. FOLLOW LABEL INSTRUCTIONS!!!
   ❖ Do NOT water following application; allow leaves to absorb iron.
✓ Soil applications
   ❖ If applying iron chelates to SOIL with pH greater than 7.2, use ONLY Fe EDDHA (Sequestrene 138)

VIII. Sulfur
✓ Functions and importance of sulfur
   ❖ Essential nutrient
   ❖ Soil acidifier
   ❖ Aid in reclamation of sodic soils
✓ Sources of sulfur
   ❖ Organic matter
   ❖ Atmospheric pollution
   ❖ Sulfur-containing fertilizers
✓ Deficiency symptoms include: chlorosis (yellowing) which intensifies with N fertilization; stunted growth
✓ Annual S requirements of turf: 10-20 lbs./acre/year (4-8 oz. S/1000 sq. feet/year)
✓ Sulfur-containing fertilizers
   ❖ Ammonium sulfate
   ❖ Superphosphate
   ❖ Gypsum
   ❖ Potassium sulfate
   ❖ Iron sulfate

VIII. Sampling procedures for plant analysis
✓ Hand clip grass at normal mowing height, if feasible. Mower clippings are acceptable if mower and collection basket are free of soil
✓ Sample randomly to obtain a representative sample, but avoid mixing samples from areas that are "different"
✓ Avoid sampling diseased, dying, or dead turf
✓ Sample actively growing turf, but avoid flush periods that occur after recent fertilization
✓ Air-dry samples before sending in mail. Fresh samples can be brought directly to a nearby lab
✓ Submit soil samples from same area which was the source of plant samples.