TURFGRASS FERTILIZERS AND FERTILITY PROGRAMS FOR TALL FESCUE

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Basic considerations for developing a fertilizer program for tall fescue.

- Desired level of turfgrass performance
- Timing of temperatures that cause a high growth potential and timing of temperatures that cause a low growth potential
- Fertilizer type and amount (rate)
- Soil physical[z] and chemical[y] properties and issues
- Chemical[y] and nutrient[x] properties of irrigation water

[z] Soil physical properties such as texture. Also, depth of roots as influenced by 1) various types of layers in soil profile and 2) depth of root-zone soil.

[y] Chemical properties such as pH, total salinity, and sodium concentration.

[x] Nutrient properties such as additional nitrogen when recycled water is used.

Basic considerations for developing a fertilizer program for Tall Fescue *(continued).*

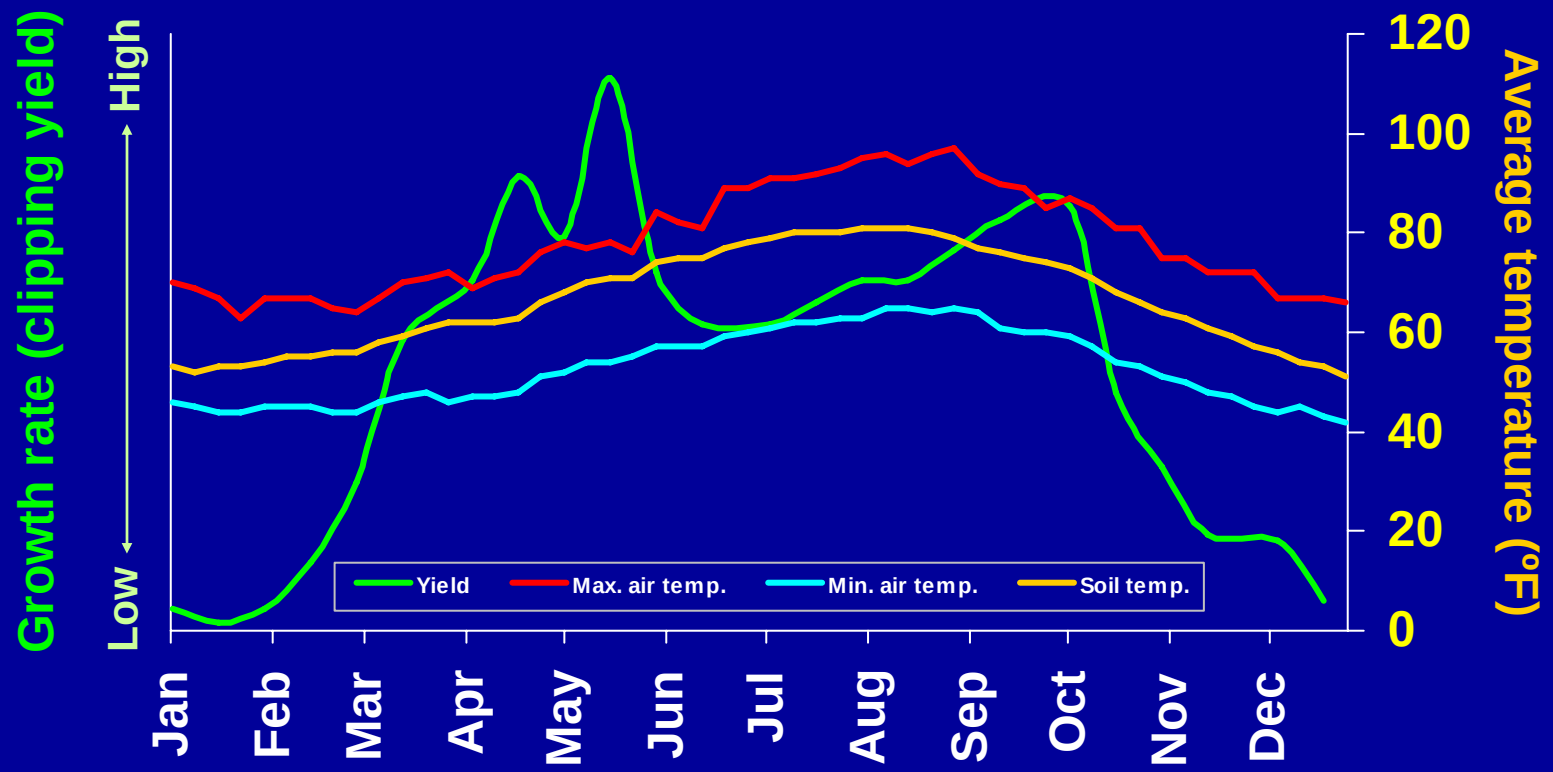
- Influence and timing of cultural practices such as core cultivations to alleviate compaction
- Potential and timing of wear stress and pest problems (e.g., diseases, weeds, and insects)
- Potential environmental issues, such as NO_3^--N contamination of ground and surface waters
- Age of the turfgrass because normally after 10 years less nitrogen may be required
- In conjunction with age, whether clippings are returned or collected

Tall fescue visual turfgrass quality as influenced by annual nitrogen rate.

Annual average visual turfgrass quality[z]	Pounds N/1000 ft^2 per year	Use characteristics
–	7.0 to 8.0	–
6.5 to 7.0	6.0	Quality lawns and parks
5.5 to 6.0	4.0	Acceptable lawns and parks
–	0	–

[z]1 to 9 scale, 1= dead or brown, 5 = minimally acceptable, and 9 = best tall fescue. Ranges based on field data. However, ranges can vary depending on such factors as N source, number of N applications per year, irrigation amount, age of turfgrass, whether clippings are collected or returned, and if recycled water is used.

Seasonal clipping yield growth pattern of tall fescue and average weekly maximum and minimum air temperatures and average weekly soil temperatures (6-inch depth) (1994-2001) in Riverside, Calif.



Note: Growth rate based on clipping yield data from six research projects conducted between 1994 and 2001. Average temperature based on weekly averages of daily temperatures generated from on-site CIMIS station from January 1994 to December 2001. CIMIS data retrieved from <http://www.cimis.water.ca.gov>.

Agronomic Principles for Tall Fescue Growth and Fertilization

- Slow to moderate growth is needed for the development of stress tolerance prior to the onset of summer or winter stress (late spring and late fall).
- Moderate growth is needed in the fall and spring to recover from stress, regain losses in shoot density and root development, and for growth during such activities as renovation and core cultivations (spring and fall).

Seasonal and growth-rate considerations for choosing fertilizers for tall fescue.

Season	Growth potential based on temp.	Desired growth	Fertilizer needs, especially nitrogen (in priority)
Early spring	Medium	Moderate	1. Quick release 2. Complete fertilizer[z] 3. Slow release
Late spring	High	Moderate to low	1. Slow release 2. Quick release
Summer	Medium	Moderate to low	1. Slow release
Early fall	High	Moderate	1. Quick release 2. Complete fertilizer 3. Slow release
Late fall	Medium-Low	Moderate to Low	1. Quick release 2. Slow release
Winter	Low	–	1. Quick release

[z]A complete fertilizer contains nitrogen, phosphorus, and potassium.
A soil test for phosphorus and potassium should be taken once every 2 to 3 years.

Essential plant nutrients primarily taken up from the soil.

Macronutrients	Micronutrients
Nitrogen (N)*	Iron (Fe)*
Potassium (K)*	Manganese (Mn)
Phosphorus (P)*	Zinc (Zn)
Sulfur (S)	Copper (Cu)
Magnesium (Mg)	Molybdenum (Mo)
Calcium (Ca)	Boron (B)
	Chlorine (Cl)

* Most commonly applied nutrients by turfgrass managers.

Nitrogen

- Mineral nutrient required in greatest quantities by turfgrasses
- Essential component of chlorophyll, amino acids, proteins, and other plant compounds
- Adequate nitrogen nutrition is necessary for healthy growth
- Most soils rarely possess sufficient nitrogen to meet the nutritional demands of quality or even acceptable turfgrasses

Nitrogen *(continued)*

Nitrogen affects turfgrasses in many ways:

- **Color**
- **Density**
- **Shoot and root growth**
- **Susceptibility to disease**
- **Susceptibility to temperature stress**
- **Susceptibility to traffic stress**
- **Composition of the turfgrass sward**
- **Recuperative ability**

Nitrogen *(continued)*

Nitrogen is a dynamic element and may be:

- **Taken up by the plant**
- **Stored in the thatch or soil**
- **Lost to the atmosphere**
- **Lost to ground or surface waters**

Nitrogen Carriers

- **Quickly available**
- **Slowly available**

Either in complete fertilizers or a straight nitrogen source. An example of a complete fertilizer is 10-10-10 (10%N:10% P_2O_5:10%K_2O), by weight, and example of a straight nitrogen source is 42-0-0 (42%N:0% P_2O_5 :0% K_2O).

Quickly Available Nitrogen Carriers

- **High water solubility**
- **Rapid but short-term turfgrass response**
- **Minimal temperature dependency for nitrogen release**
- **Higher foliar burn potential**

Either in complete fertilizers or a straight nitrogen source.

Quickly Available Nitrogen Carriers *(continued)*

- **Low cost per unit nitrogen**
- **Can be applied in dry or liquid form**
- **The percentage of applied nitrogen recovered in grass clippings tends to be higher than for slowly available nitrogen sources**

Either in complete fertilizers or a straight nitrogen source.

Quickly Available Nitrogen Carriers

A. INORGANIC SALTS

Ammonium nitrate
Ammonium sulfate
Potassium nitrate
(Many more)

B. ORGANIC CARRIERS

Urea
Methylol ureas

Slowly Available Nitrogen Carriers

- **Nitrogen is in an insoluble form or is a water-soluble nitrogen that is encapsulated in an impermeable coating.**
- **Low water solubility**
- **Lower salt index**
- **Release of nitrogen from these carriers may involve biological or physical processes (versus dissolution in water)**
- **Slower initial turfgrass response with the response lasting for a longer duration**

Either in complete fertilizers or a straight nitrogen source.

Slowly Available Nitrogen Carriers *(continued)*

- Low (IBDU[z], SCU[y]) to high (UF[x], natural organics) temperature dependency
- Generally low foliar burn potential
- Moderate to high cost per unit of nitrogen
- Reduced loss of nitrogen from leaching and volatilization

[z]IBDU = Isobutylidene diurea.
[y]SCU = Sulfur coated urea.
[x]UF = Urea formaldehyde.

Slowly Available Nitrogen Carriers

A. NATURAL ORGANICS

Bone meal Activated sewage sludge (Milorganite) Other materials

B. SYNTHETIC ORGANICS

Longer chained urea formaldehyde reaction products: Nitroform Hydroform			
Shorter chained urea formaldehyde reaction products: Hydrolene, Nutralene, Triaform			
IBDU	Oxamide	Triazone	Others

C. COATED FERTILIZERS

Sulfur coated urea (SCU): Several products
Polymer coated SCU's: TriKote, Poly S, Poly Plus, others
Polymer coated fertilizers: ESN, Once, Polyon, Multicote, others

Parameters which affect mechanisms of nitrogen release among different slow release fertilizers.

Fertilizer	Temperature	Bacterial	Moisture	pH	Particle size	Coating characteristic		
						Thickness	Chemical composition	Durability
Natural organics	High to very high	Very high	High	Slight	Moderate	n/a	n/a	n/a
Longer chained UF	High to very high	High to very high	Slight	Slight	None	n/a	n/a	n/a
Shorter chained UF	Moderate to high	Moderate	Moderate	Slight	Slight	n/a	n/a	n/a
Isobutylidene diurea	Slight to moderate	Slight	High	Slight to moderate	Very high	n/a	n/a	n/a
Polymer coated sulfur coated urea	Moderate	Slight	Moderate	None	Moderate	Moderate	Moderate	High
Polymer coated fertilizers	High	None	Slight	None	High	High	Moderate to high	High

Harada, G., A. Van Peter, K. Parkins, and R. Green. 1995. Nitrogen fertilization: Slow release nitrogen fertilizers. Turf Tales Mag. 2(3):4,6-9.

Agronomic considerations for slow and quick release nitrogen fertilizers.

Agronomic situation	Best choice	Worst choice
Sandy soil	Slowly available	Quickly available
Cold temperatures	Inorganic salts (nitrate)	Slowly available
Warm temperatures	Slowly available	Inorganic salts (nitrate)
Groundwater issues	Slowly available	Quickly available
Extended release	Slowly available	Quickly available
Tight Turf Canopy	Quickly available or small particles of slowly available	Large particles of slowly available

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Operational considerations for slow and quick release nitrogen fertilizers.

Agronomic situation	Best choice	Worst choice
Minimal budget	Quickly available	–
Low-skilled employees	Slowly available	Quickly available
Irrigation scheduling:		
Lack of water	Slowly available	Quickly available
Too much water	Slowly available	Quickly available
Decreased staffing levels	Slowly available	Quickly available

Harada, G., A. Van Peter, K. Parkins, and R. Green. 1995. Nitrogen fertilization: Slow release nitrogen fertilizers. Turf Tales Mag. 2(3):4,6-9.

Fertilizer rate recommendations for potassium and phosphorus.

Element	Symbol	Fertilizer component	Recommendation
Potassium	K	K_2O	Annual application rate initially is based on soil tests, with a range of 50% to 70% of the annual nitrogen rate used as a guide in subsequent applications.
Phosphorus	P	P_2O_5	Annual application rate is based on soil tests, applied once or twice per year with a fall or spring timing. Phosphorus applications normally made via a complete fertilizer.

Fertilizer rate recommendations for sulfur, iron, and other nutrients.

Element	Symbol	Recommendation
Sulfur	S	Usually only applied where a specific deficiency has been diagnosed.
Iron	Fe	Apply as visual deficiency symptoms are diagnosed or to increase color.
Magnesium	Mg	Deficiencies may occasionally occur on selected soil types. The appropriate nutrient carrier should be applied if a specific nutrient deficiency is diagnosed.
Manganese	Mn	
Zinc	Zn	
Copper	Cu	
Molybdenum	Mo	