

D. Chalmers: Nutrient Management

Turfgrass Nutrient Management: Achieving Agronomic & Environmental Goals!

David Chalmers, Ph.D
Associate Professor &
State Extension Turfgrass Specialist
Texas A&M University System
College Station, Texas
Dchalmers@tamu.edu



D. R. Chalmers - TAMU

<http://aggie-turf.tamu.edu/answers4you/fertilization.htm>

HOME CONSUMER SERIES

SCS-2005-15



Lawn Fertilization for Texas Warm-Season Grasses: Frequently Asked Questions

D. Chalmers, J. McAfee and R. Havlak,*

Nutrient management for Texas lawns

This publication focuses on helping home consumers understand how to best fertilize warm-season lawn grasses. The warm-season grasses include:

- Bermudagrass
- Buffalograss
- Centipedegrass
- St. Augustinegrass
- Zoysiagrass

The goal with any of these lawn grasses is a dense healthy lawn that provides aesthetic and environmental benefits. Turfgrasses need adequate nutrients to maintain these

- 8. Season of application
- 9. Application method.
- 10. Weather conditions.

The objective of this publication is to help Texans effectively fertilize lawn turf in a measured and environmentally sound manner.

What if I don't fertilize?

Without fertilization your lawn is likely to gradually thin and weeds may invade. Proper and timely fertilization can be good for both your lawn and the environment. There is less chance for nutrient runoff and soil erosion to surface waters from a healthy stand of grass than from bare soil or thin grass. Healthy lawns will have less disease, insect and weed

What is a Nutrient Management Plan?

- ✓ Used to be your "Fertilizer Program"
- ✓ An environmentally sensitive approach to fertilizer application. (Nitrogen & Phosphorus)
- ✓ Goals and considerations:
 - targets all agriculture, agronomic
 - environmentally sensitive,
 - business oriented? An Opportunity?
- ✓ Influenced by perception or reality?
- ✓ What "drives" ordinances/regulation is "sensitive locations" -Potential "Non-Point" sources (N&P)



D. R. Chalmers - TAMU

It is hard to separate nutrient managements from water quantity & quality issues!

- ✓ Texas population is expected to double the next 50 years.
- ✓ Summer water use: it is estimated that 25 to 60 % of the water used by residential customers is applied to the landscape.
- ✓ Turf quality
- ✓ Nitrogen & Phosphorus
- ✓ Leaching and Storm Water
- ✓ Ground Water Recharge
- ✓ Protecting the environment



D. Chalmers: Nutrient Management

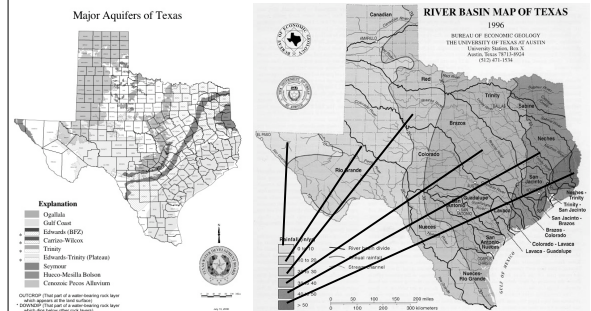
Definitions - Groundwater

- ✓ water that occurs in saturated strata (aquifer) of non-consolidated geologic material in fractured and porous rock (Patrick et al. -1987)
- ✓ recharged by precipitation (4% of hydrologic cycle)
- ✓ In U.S. main source of drinking water for more than 1/2 the population (36% municipal, 95% of rural population)
- ✓ Supplies 30% of stream flow - groundwater contamination from polluted streams can occur with negative aquifer pressure.

D. R. Chalmers - TAMU



Conservation & Protection: Water Sources & Water Quality



Impaired surface water quality segments
(in red) in Texas.



Chalmers - TAMU



Eutrophication

- ✓ Increased biological productivity in streams, lake, estuaries from nutrient enrichment.
- ✓ Phosphorus (P) and nitrogen (N)
- ✓ Background levels 0.3 mg/L N and 0.5mg/L P
- ✓ Prolific algae growth at "elevated" nitrate and phosphorus levels
- ✓ RESULT = Oxygen deficits, turbidity, decline in SAV and habitat

D. R. Chalmers - TAMU



D. Chalmers: Nutrient Management

Minimum Nutrient Concentrations for Algal Blooms in Lakes

N 1 mg/L total N

P 0.025 mg/L total P

* 0.10 mg L⁻¹ total P in streams

US EPA

D. R. Chalmers - TAMU



Sequence of changes in surface water quality with increasing nutrients

- ✓ Increased algal growth
- ✓ Reduced water clarity
- ✓ Water treatment problems
 - odor and bad taste
 - increased filtration costs
 - disinfectant byproducts w/ possible health effects
- ✓ Reduced water O₂
- ✓ Altered fisheries/fish kills
- ✓ Possible toxins from blue-green algae- human and animal health effects



D. R. Chalmers - TAMU



Environmental Concerns: N and P Application

- Ground water & Surface waters
 - Nitrate leaching & runoff AND Phosphorus runoff
- Nitrate leaching (10 mg/L = drinking water standard but 3 mg/L in wells = human impact)
 - Nitrate reduction to nitrite in gastrointestinal tract moves into blood stream and reacts with hemoglobin. Result is oxygen transport impairment in humans
 - methemoglobinemia (blue baby syndrome) but susceptibility varies. Infants less than 3 months
- Non-point source impacts = surface runoff (storm water) & groundwater

D. R. Chalmers - TAMU



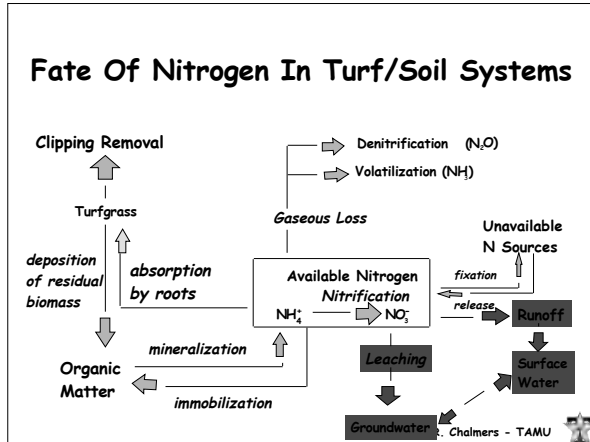
Nutrient Management Issues: The Non-Point Source Focus



- ✓ Potential Non-Point Sources - Areas of Impact
 - Cropping systems
 - Turf: Home Owner, Lawn Care, Golf, Sports Turf
- ✓ Application Windows
 - Agronomic: Best Management Practices or BMP's
- ✓ Nutrient Carry Over/Excess Nitrate or P Availability
 - Application Rates & Timing
 - Nutrient Availability (N sources)
 - short-term vs. long term influence
- ✓ Storm Water Issues with Nitrate and Phosphorus

D. R. Chalmers - TAMU





Fate of N Applied to Turfgrass

Literature review by Petrovic. 1990. JEQ 19: 1-14.

Nitrogen fate reported...	% of applied
Plant uptake	5 - 74%
NH ₃ volatilization	0 - 36%
Denitrification	0 - 93%
Leaching	0 - 53%
Residual N (soil)	15 - 21%
Residual N (thatch)	21 - 26%
Runoff	< 7%

D. R. Chalmers - TAMU

- ### Determination of Turf Requirements
- ✓ soil tests (everything but Nitrogen - do not apply Phosphorus if not needed)
 - ✓ tissue tests (golf courses use)
 - ✓ visual observations
 - ✓ yearly programs (nitrogen)
- D. R. Chalmers - TAMU

- ### Organizing A Nutrient Management Program
- ✓ Project an amount of N/1000 sq. ft/year
 - ✓ Consider use, climate, soil type
 - ✓ Schedule N: timing & rate (agronomic principles/N source/demands)
 - ✓ Soil test (P, K, Ca, Mg)
 - ✓ Determine need for complete analysis fertilizer or single nutrient sources
- 
- D. R. Chalmers - TAMU

D. Chalmers: Nutrient Management

Annual Nitrogen Recommendations For Texas Lawns

Lawn Grass Type (species)	LBS Nitrogen per 1000 sq. ft per year		
Warm Season Grasses			
Bermudagrass (common type)	1-2	2-3	3-5
Bermudagrass (hybrid types)	2-3	3-4	4-6
Bahiagrass	1-2	2-3	3-4
Buffalograss	0-1	1-2	NR
Carpetgrass	0-1	1-2	2-3
Centipedegrass	1/2	1	2
Seashore paspalum	1-2	2-3	3-4
St. Augustinegrass (sun)	1-2	2-3	3-4
St. Augustinegrass (shade)	1/2 to 1	1-2	2-3
Zoysiagrass	1-2	2-3	3-4
Cool Season Grasses			
Kentucky Bluegrass	2-3	3-4	4-6
Tall fescue	2-3	3-4	4-5
Texas bluegrass	?	?	?

D. R. Chalmers - TAMU

The amounts of various types of fertilizers required to apply certain rates of N per 1000 sq ft

Fertilizer Analysis	Pounds of actual nitrogen desired/1000 sq ft			
	1/2	1.0	1.5*	2.0*
	Pounds of fertilizer to apply above N rate			
6-2-0	8.3	16.6	25	33
10-10-10	5.0	10.0	15.0	20.0
12-4-8	4.1	8.3	12.5	17.0
16-8-8	3.1	6.2	9.4	12.0
20-0-16	2.5	5.0	7.5	10.0
23-3-7	2.1	4.3	6.5	8.6
28-0-12	1.8	3.6	5.3	7.2
31-0-0	1.6	3.2	4.8	6.4
38-0-0	1.3	2.6	3.9	5.2
46-0-0	1.1	2.2	3.2	4.4

* These rates only for use with slowly available N sources

Setting Up An Annual Nutrient Management Strategy - Soil Test for P, K, Ca, Mg, pH

	Analysis	N	P	K	Ca	Mg	Other	pH
Jan		5	2	4	????	????	????	????
Feb								
Mar								
Apr	15-0-30	1	0	2				
May	15-5-5	0.75	0.25	0.25				
Jun	25-5-15	1	0.2	0.6				
Jul								
Aug	16-4-12	1	0.25	0.75				
Sep	20-20-20	1	1	1				
Oct								
Nov								
Dec								
Total		4.75	1.75	4.5				

D. R. Chalmers - TAMU

Fertilizer Programs

Avoiding Confusion and Inefficiency

- ✓ Similar N sources to all areas
- ✓ Minimize the total number of products
- ✓ Efficient applications (use "complete" fertilizers) BUT only if needed!



D. R. Chalmers - TAMU

Nitrogen Source Response

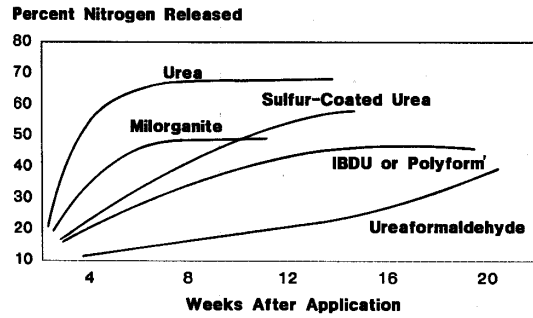
- ✓ Quickly available
 - Inorganic: ammonium nitrate, am. sulfate, am.phosphates
 - Organic: urea
- ✓ Slowly available
 - Slowly soluble: IBDU
 - Slow release: SCU, polymer coated
 - Microbial release: UF, Natural Organics

GUARANTEED ANALYSIS	
Total Nitrogen (N)	20%
6.8% Water Insoluble Nitrogen	
9.2% Ammoniacal Nitrogen	
5.0% Urea Nitrogen	
Available Phosphoric Acid (P ₂ O ₅)	0%
Soluble Potash (K ₂ O)	10%
Sulfur (S)	4.0%
Iron (Fe)	1.0%
Nutrient Sources: Urea, Methylene Ureas, Ammonium Sulfate, Sulfate of Potash, Sulfates.	
Potential Acidity Equivalent: 1,000 lbs. Calcium Carbonate per Ton.	

D. R. Chalmers - TAMU

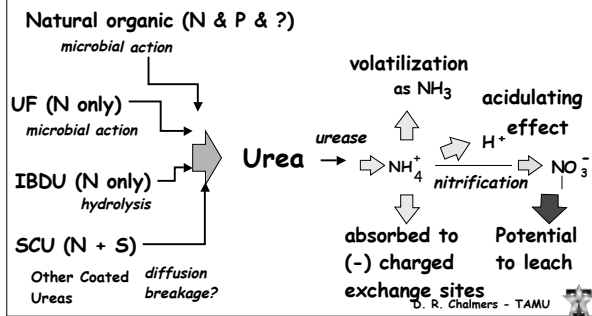
Nitrogen Release Rates

Soluble > Organic > Slow release



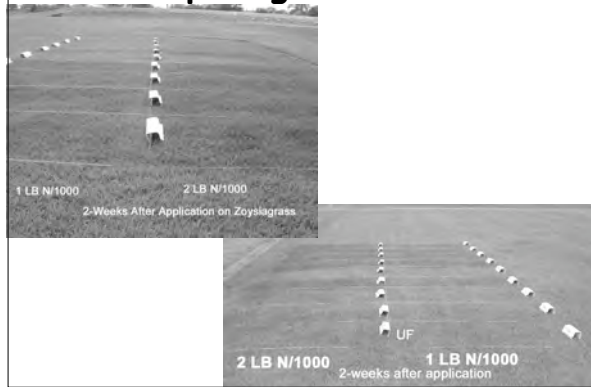
D. R. Chalmers - TAMU

Nitrogen Source Conversion to Inorganic Nitrogen



D. R. Chalmers - TAMU

Comparing N-sources



D. Chalmers: Nutrient Management

Knowing how your fertilizer will respond so you can use it properly!

- ✓ Nitrogen fertilizers sold can be:
 - All readily available N
 - All slowly available N
 - Or mixtures of readily available and slowly available N sources
- ✓ Often homeowner-type fertilizers are a mixture of readily available N and slowly available N
- ✓ Knowing what proportion of the nitrogen that is readily available and what if any is slowly available allows you to use nitrogen wisely!

D. R. Chalmers - TAMU

**Ready Response
and Residual Response**

TURF FOOD 12-4-8
50% ORGANIC

MINIMUM GUARANTEED ANALYSIS

Total Nitrogen (N)	12.0%
3.6% Water Insoluble Nitrogen	
Available Phosphoric Acid (P ₂ O ₅)	4.0%
Soluble Potash (K ₂ O)	8.0%

Potential acidity equivalent to 600 lbs. Calcium Carbonate per ton.

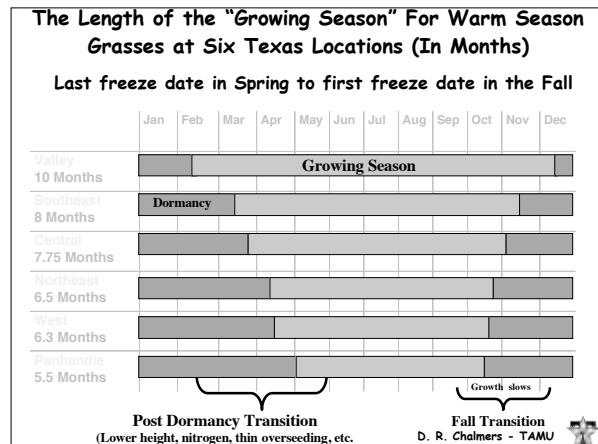
MANUFACTURED FOR

D. R. Chalmers - TAMU

Nitrogen Rates Per Application

- ✓ Maximum nitrogen in a single application
 - 1 lb. from a soluble N source.
 - If slowly available nitrogen carrier is used application can exceed 1 lb
 - the nitrogen exceeding 1 lb. N must be from a slow release source.
- ✓ Slowly available N source rate can be higher than 1 lb N
 - BUT the amount of N in the soluble fraction should not exceed 1 lb. N

D. R. Chalmers - TAMU



D. Chalmers: Nutrient Management

Ending the Season:
Late Winter to Spring Nitrogen Application:
Warm-Season Grasses - not overseeded

✓ **Last application:**

- No later than 6 weeks month prior to the expected first fall freeze date

✓ **Exceptions:**

- overseeded warm-season grasses

Figure 2. Average dates for the first autumn frost.

D. R. Chalmers - TAMU

Nitrogen Fertilization for Warm Season Grasses in North Texas

Quality Desired	Number of nitrogen applications/season
Low	Spring and/or late summer to early autumn applications adequate (1 or 2)
Medium	“Low” applications with 1 supplemental summer application to enhance quality (3)
High	“Low” applications with 2 to 3 supplemental summer apps to enhance quality (4 to 5)

D. R. Chalmers - TAMU

Advantages of Fall Fertilization
Cool-Season Grasses

- ✓ Increased density
- ✓ Increased root growth
- ✓ Decreased spring mowing
- ✓ Improved autumn to spring color
- ✓ Decreased weed problems
- ✓ Improved drought tolerance
- ✓ Decreased summer disease

D. R. Chalmers - TAMU

Nitrogen Fertilization for Cool Season Grass Lawns in North Texas

Quality Desired	Annual nitrogen requirement
Low	2 to 3 lbs of nitrogen/1000 sq ft per year
Medium	3 to 4 lbs of nitrogen/1000 sq ft per year
High	4 to 6 of nitrogen/1000 sq ft per year

D. R. Chalmers - TAMU

D. Chalmers: Nutrient Management

1. Late-summer to late-autumn period apply (2/3 to 3/4 of the total annual N)
2. Delay spring application, at modest rates, until after the spring flush of re-growth subsides (typically late March through April, depending on location)
3. Applications in successive months 4 to 6 weeks apart.
4. Shaded areas should not be fertilized as much as areas in full sun.
5. Up to 1 lb of nitrogen may be applied per 1000 sq ft in the "Spring" period if nitrogen was not applied the previous fall or to help a new lawn get better established.

D. R. Chalmers - TAMU



Nutrient Management & Environmental Sensitivity

- Adjust nitrogen rates and application scheduling
- Adjust nitrogen carriers (N release rates)
- Adjust irrigation rates & frequencies
- Know your soil types & use soil tests - P
- Don't rely on only nitrogen to make your reputation
- Make adjustments based upon species, season and environmental conditions

D. R. Chalmers - TAMU



Your Nutrient Management Plan...

- ✓ Used to be your "Fertilizer Program"
- ✓ Is an environmentally sensitive approach to fertilizer application. (Nitrogen & Phosphorus)
- ✓ Is environmentally sensitive
- ✓ Is agronomic
- ✓ Is business oriented and an opportunity!
- ✓ Deals with perceptions but anchored in science!
- ✓ Attempts to avoid non-point source movement of nitrogen and phosphorus to groundwater and surface waters AND find an "acceptable" level of turf quality.
- ✓ Impacts turfgrass water requirement & use



D. R. Chalmers - TAMU

