
Technical Memorandum

Estimation of Nitrogen Loading from Residential Irrigation

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Prepared for:

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1.0 INTRODUCTION

The goal of this work effort was to estimate the amount of usable nitrogen delivered to residential lawns from three irrigation sources; shallow water wells, potable water, and reclaimed water. This effort was performed to provide information to the fertilizer work group to aid in making recommendations for lawn fertilization rates.

The nitrogen loads from each of these sources to residential areas were estimated as the annual quantity per 1,000 ft², assuming one inch of irrigation water per week, and compared to the recommended annual fertilization application rate of nitrogen. The recommended annual fertilization application rate for nitrogen for three common lawn grasses are as follows:

- Bahia grass: 2-4 lbs N/1,000 ft²/yr
- Bermuda grass: 4-6 lbs N/1,000 ft²/yr
- St. Augustine grass: 2-5 lbs N/1,000 ft²/yr

For each irrigation source, the range of nitrogen application from irrigation is supplied based on the range of nitrogen concentrations from each water source, as well as the mean load from each source. For reclaimed water, we have supplied separate nitrogen application rates for counties and municipalities based on analysis of the reclaimed water nitrogen concentration data. Additionally, we have supplied separate loading rates by county for irrigation from shallow water wells.

1.1 Objective

The objective of this study was to determine the recommended annual nitrogen fertilization application rates for three common grasses (Bahia, Bermuda, and St. Augustine) based on the source of water used for lawn irrigation. Annual fertilization application rates were calculated for each grass type based on irrigation water from each water source, per 1,000 ft².

The findings are described in plots and tables that depict the relationships between annual application rates from irrigation sources and resulting annual fertilization rates required to meet the recommended rate.

1.2 Data Sources

Nitrogen concentration data for the three irrigation water sources were obtained from the following organizations:

- Surficial water nitrogen concentrations were obtained from the Florida Ground Water Monitoring Network database (1994-1997),
- Potable water nitrogen concentration data were obtained from Tampa Bay Water, and
- Reclaimed water nitrogen concentration data were obtained from the various domestic water treatment facilities which are responsible for supplying reclaimed water to residents.

2.0 FINDINGS

The nitrogen application rates from each irrigation source (reclaimed water, surficial well water, and potable water) to residential areas were estimated assuming one inch of irrigation water per week. The estimated nitrogen application rates from the different sources were then compared to the recommended nitrogen fertilization application rates for three common grasses in central Florida (Bahia, Bermuda, and St. Augustine). This comparison then provided a determination of the amount of fertilizer required to meet the recommended fertilizer application rate based on the grass type and water source. The fertilizer application rate needed to meet the recommended nitrogen fertilizer application is presented as the annual quantity of nitrogen fertilizer per 1,000 ft² that should be used in addition to irrigation, assuming one inch of irrigation water per week.

2.1 Irrigation with Reclaimed Water

Nitrogen concentration data from domestic water treatment facilities were used to determine the amount of nitrogen loading due to the various facilities. The facilities were then grouped into regions based on similarities in the mean concentration of nitrogen in the reclaimed water from each facility. In the case of multiple facilities that feed a common “master” reuse system, the mean nitrogen concentration for all facilities that feed the master system was determined. The regions are listed below:

- Region 1 – Bradenton, Clearwater, Largo, Oldsmar, and Palmetto
- Region 2 – Hillsborough County, Tampa, and northern Pinellas County
- Region 3 – Pasco County
- Region 4 – Manatee County
- Region 5 – Zephyrhills
- Region 6 - St. Petersburg

The amount of nitrogen required to meet the recommended annual nitrogen loading for residents using reclaimed water for lawn irrigation is presented in Table 1 for the three different grass types for each of the regions defined above. Plots of the range of nitrogen fertilizer application rates required to meet the recommended annual application rate by grass type are presented in Figures 1-3.

Region	Bahia grass			Bermuda grass			St. Augustine grass		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
1	1.4	3.4	2.4	3.4	5.4	4.4	1.4	4.4	2.9
2	1.3	3.3	2.3	3.3	5.3	4.3	1.3	4.3	2.8
3	0.2	2.2	1.2	2.2	4.2	3.2	0.2	3.2	1.7
4	0	1.7	0.7	1.7	3.7	2.7	0	2.7	1.2
5	0	1.2	0.2	1.2	3.2	2.2	0	2.2	0.7
6	0	0	0	0	0.7	0	0	0	0

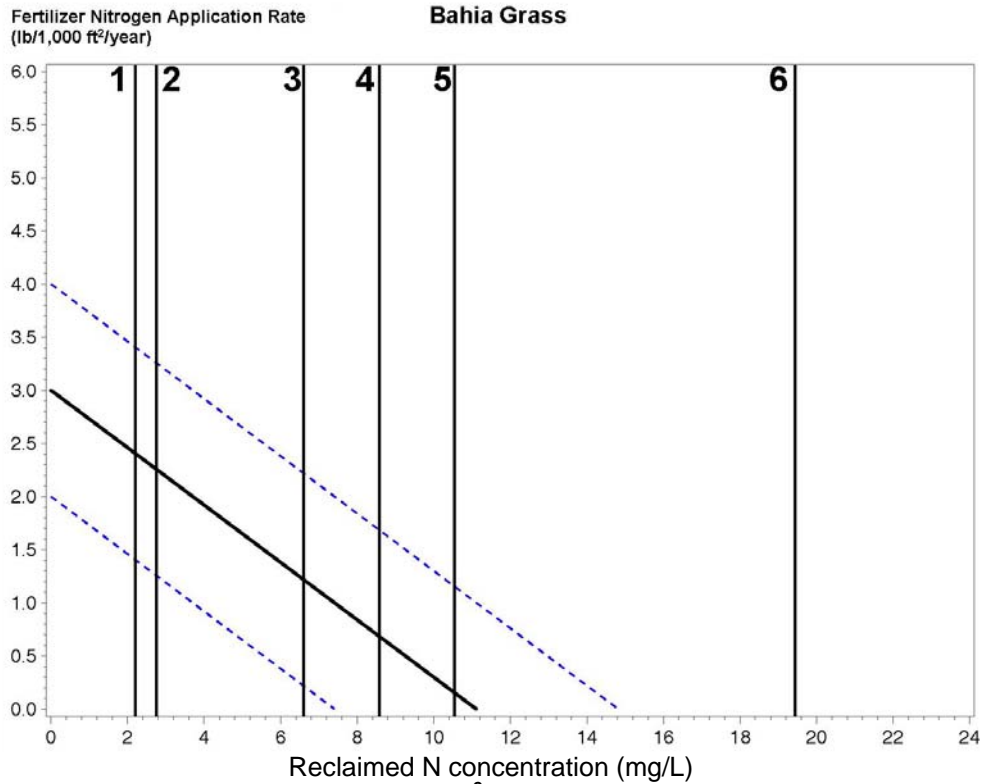


Figure 1. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for Bahia grass when using reclaimed water for lawn irrigation.

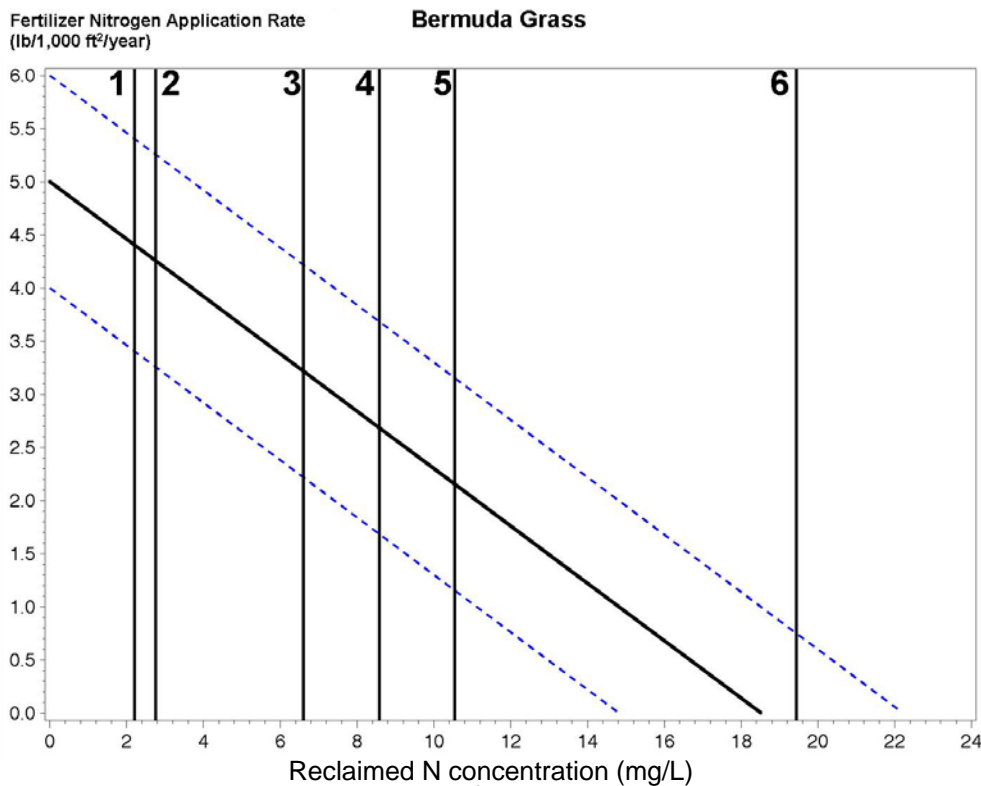


Figure 2. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for Bermuda grass when using reclaimed water for lawn irrigation.

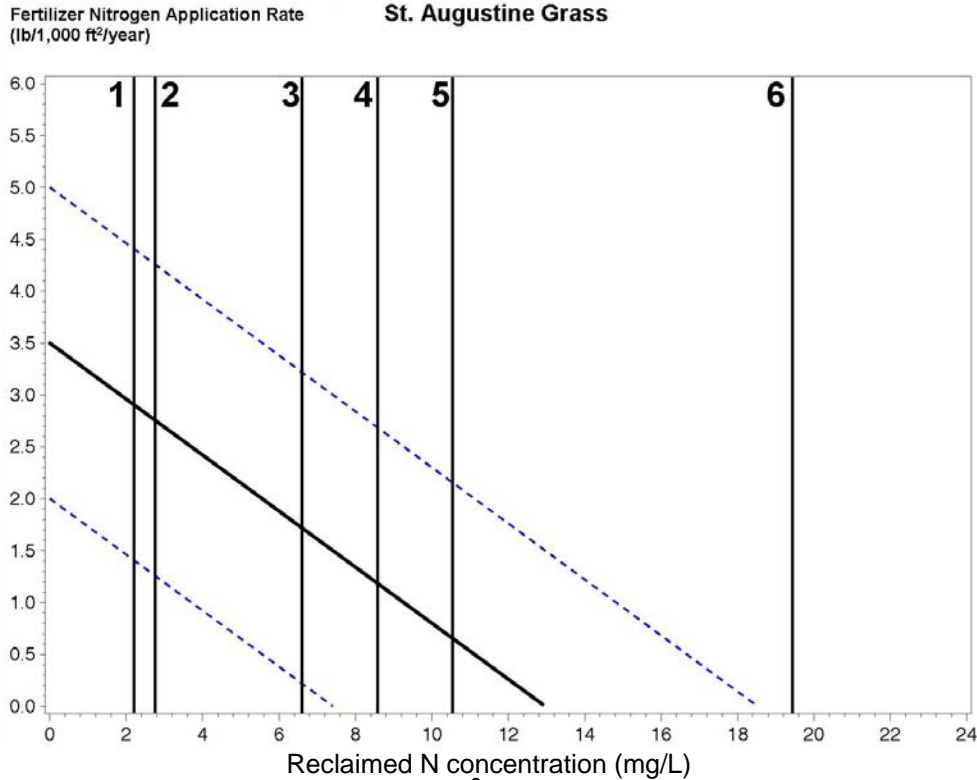


Figure 3. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for St. Augustine grass when using reclaimed water for lawn irrigation.

2.2 Irrigation with Surficial Well Water

Nitrogen concentration data from surficial well sampling were used to determine the amount of nitrogen loading due to surficial well irrigation. The surficial well samples were grouped by county. The counties are listed below:

- Hillsborough County
- Manatee County
- Pasco County
- Pinellas County.

The amount of nitrogen required to meet the recommended annual nitrogen fertilization application for residents using surficial well water for lawn irrigation is presented in Table 2 for the three different grass types, by county. Plots of the range of nitrogen application required to meet the recommended annual nitrogen fertilizer application by grass type are presented in Figures 4-6.

County	Bahia grass			Bermuda grass			St. Augustine grass		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Hillsborough	1.5	3.5	2.5	3.5	5.5	4.5	1.5	4.5	3.0
Manatee	1.7	3.7	2.7	3.7	5.7	4.7	1.7	4.7	3.2
Pasco	1.6	3.6	2.6	3.6	5.6	4.6	1.6	4.6	3.1
Pinellas	1.6	3.6	2.6	3.6	5.6	4.6	1.6	4.6	3.1

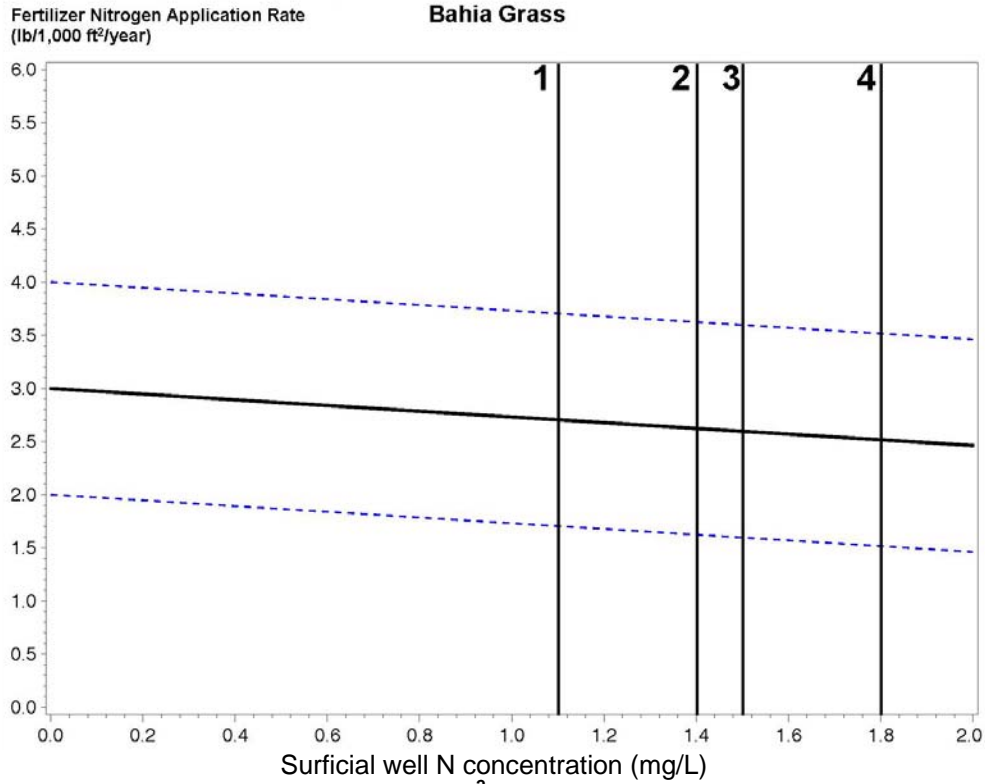


Figure 4. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for Bahia grass when using surficial well water for lawn irrigation.

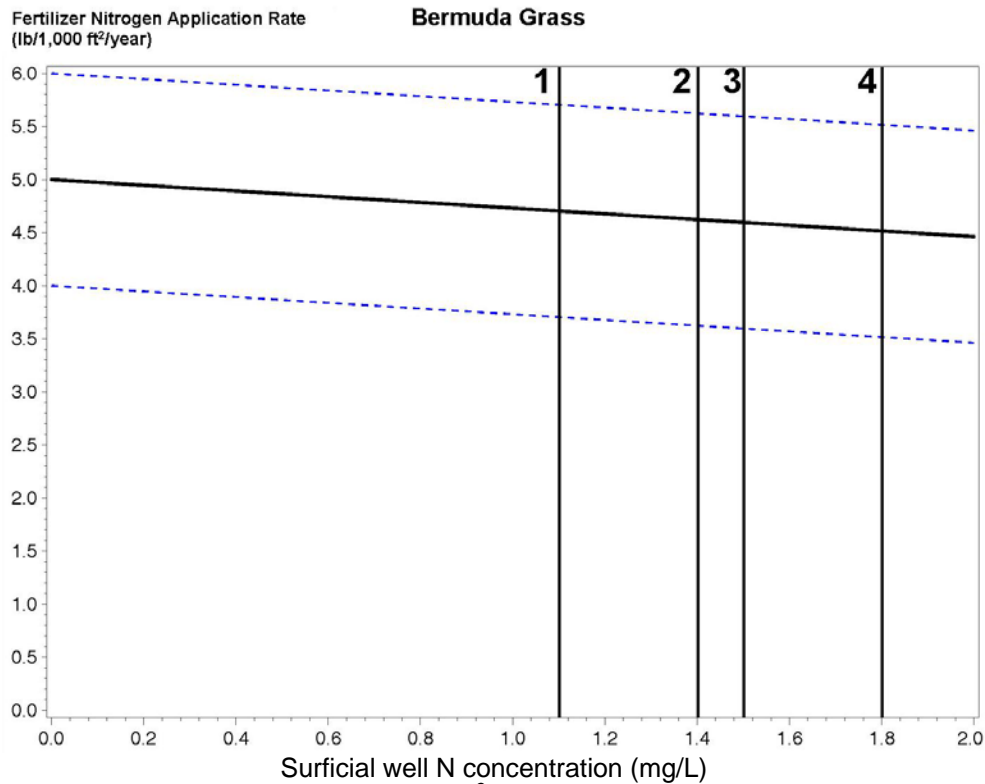


Figure 5. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for Bermuda grass when using surficial well water for lawn irrigation.

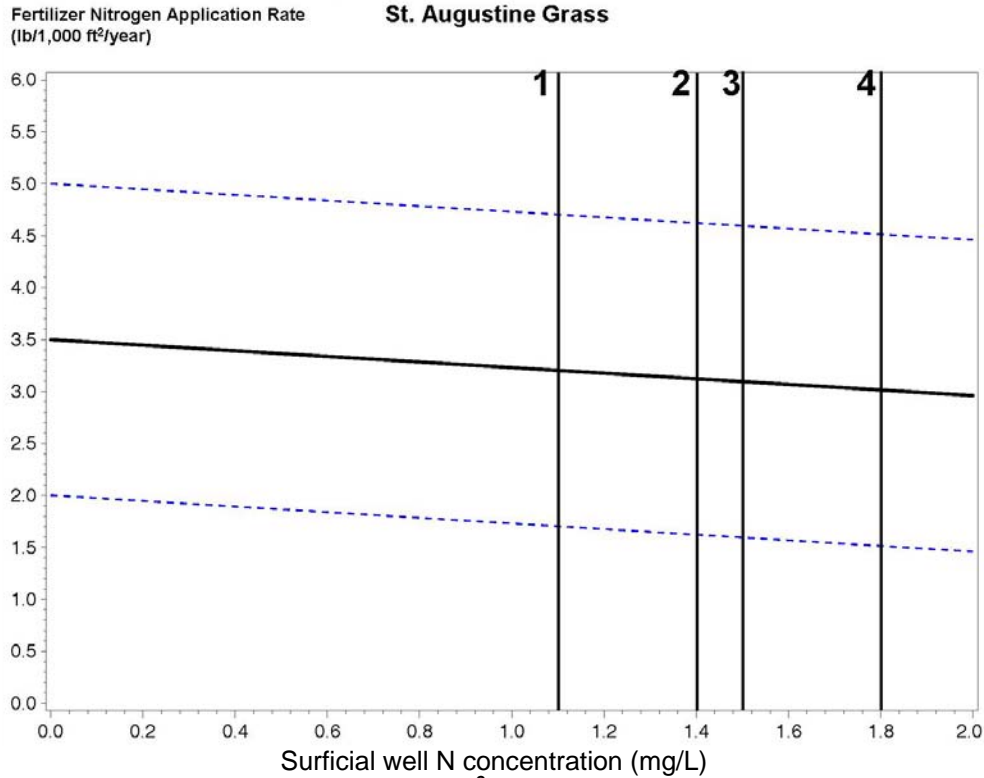


Figure 6. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer, by region (see list above), for St. Augustine grass when using surficial well water for lawn irrigation.

2.3 Irrigation with Potable Water

Nitrogen concentration data from potable water was used to determine the amount of nitrogen loading due to potable water irrigation. The amount of nitrogen required to meet the recommended annual nitrogen loading for residents using potable water for lawn irrigation is presented in Table 3 for the three different grass types. Plots of the range of nitrogen required to meet the recommended annual nitrogen loading by grass type are presented in Figures 7 through 9.

Source	Bahia grass			Bermuda grass			St. Augustine grass		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Potable water	1.6	3.6	2.6	3.6	5.6	4.6	1.6	4.6	3.1

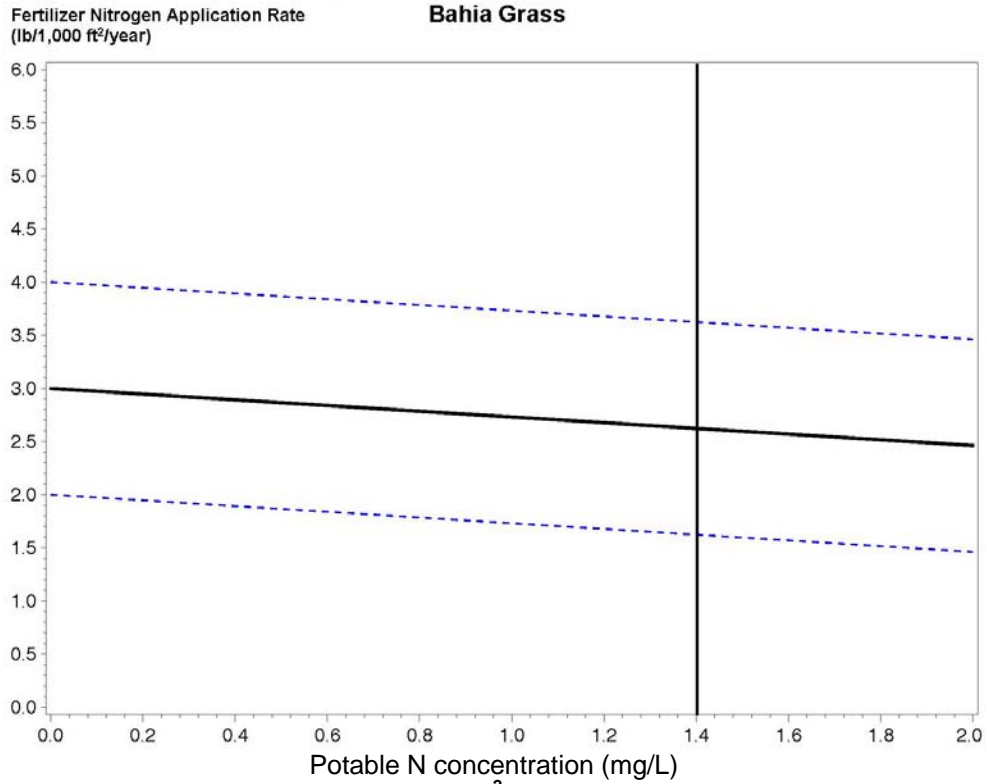


Figure 7. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer for Bahia grass when using potable water for lawn irrigation.

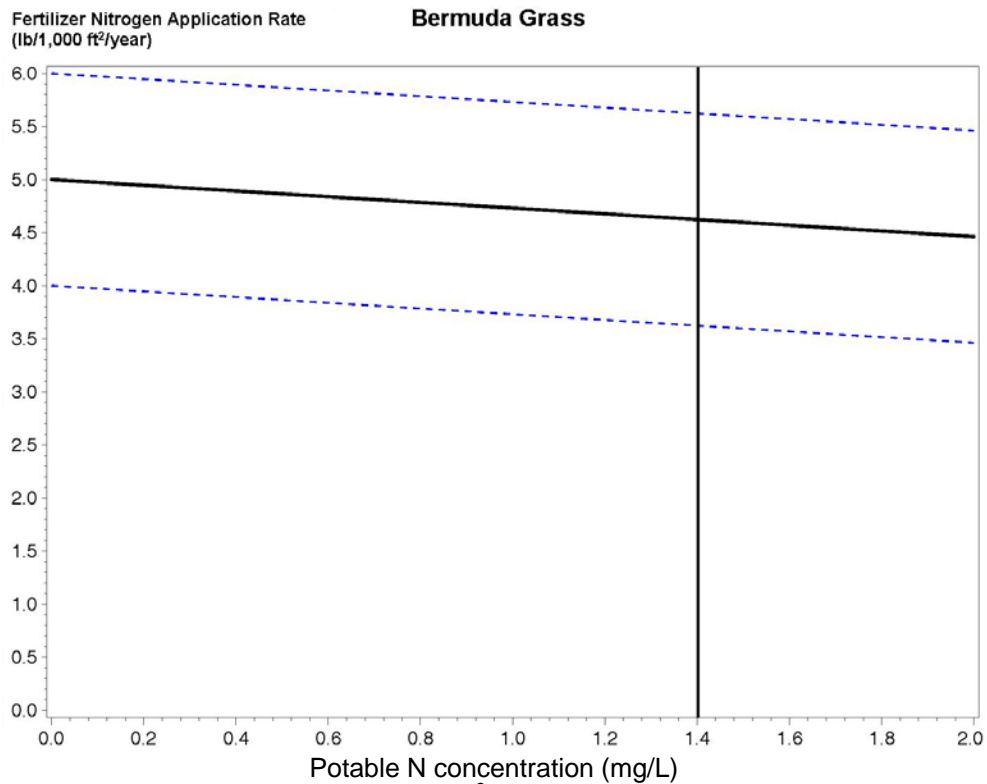


Figure 8. Annual nitrogen load (lb/1,000 ft²) recommended from fertilizer for Bermuda grass when using potable water for lawn irrigation.

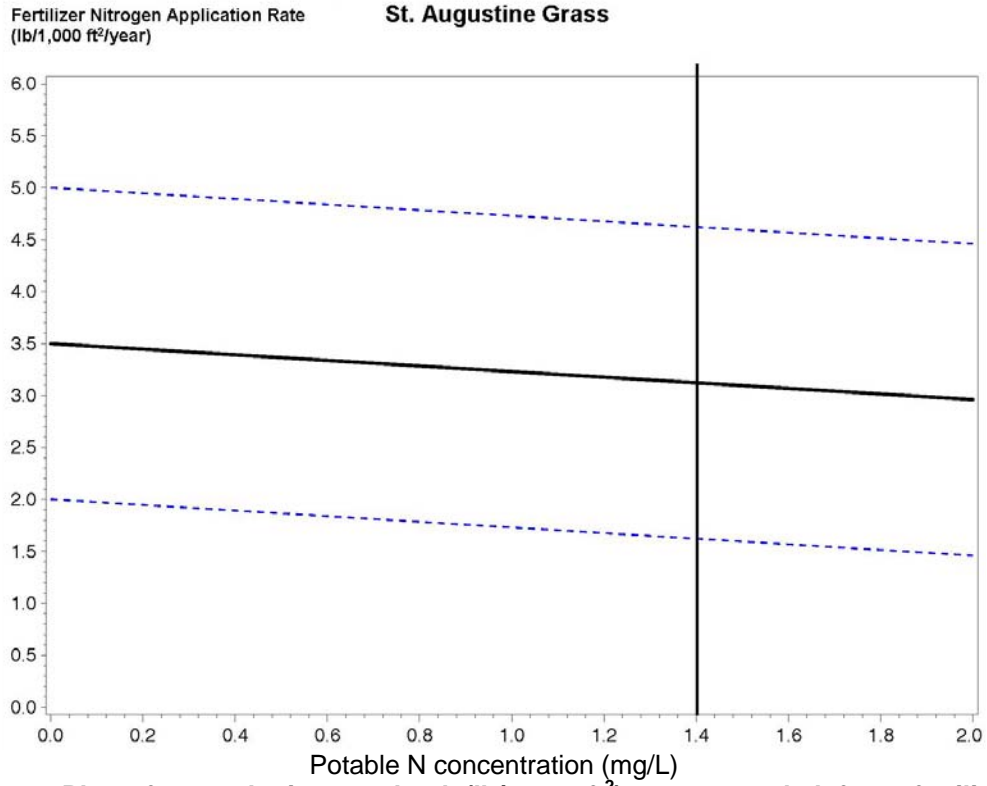


Figure 9. Plot of annual nitrogen load (lb/1,000 ft²) recommended from fertilizer for St. Augustine grass when using potable water for lawn irrigation.