

Summary of Relevant Science Considered for Alachua County Fertilizer Ordinance Amendments

1) Nitrate Leaching From Established Grasses (IFAS Research funded by FDEP)

- a) **Finding:** Leaching highest following sod installation.
- i) **Staff Comment:** The Alachua County fertilizer ordinance prohibits fertilizer use for the first 30 days after sodding.
- b) **Finding:** “These results suggest that actively growing, healthy turfgrass mitigates NO₃-N leaching from fertilization events.... Further research is needed to determine the impacts of runoff from lawn fertilizers.
- i) **Staff Comment:** While staff understands the conclusion that healthy turf utilized nitrate in the study, there is concern about what “healthy” turf is and how achievable it is to maintain 100% healthy turf. With the introduction of homeowner behaviors (mowing height, over-irrigation, exceeding IFAS rates, etc) staff is concerned that leaching and runoff will exceed the study results.
- c) **Finding:** Irrigation treatments consisted of 1.3 cm applied twice weekly or 2.6 cm (roughly one inch) applied once weekly. Irrigation rate had little effect on nutrient leaching across the three years of research.
- i) **Staff Comment:** Irrigation restrictions limit irrigation to $\frac{3}{4}$ of an inch per irrigation day and two days are allowed in the summer. This adds up to 1.5 inches a week, which exceeds the irrigation rate in the study. Based on local enforcement of irrigation restrictions and analyzing residential water use data, over irrigation definitely occurs in Alachua County. Research shows that over irrigation can lead to nutrient leaching (citations follow) from fertilized landscapes.
- (1) Starrett et al. (1995) reported 30 times greater N in leachate from the columns that received heavy irrigation following fertilization treatment compared to a lighter more frequent irrigation following fertilizer treatment.
- (2) Barton and Colmer 2004 highlight the importance of optimizing irrigation to minimize N losses
- (3) Potential Impacts of Improper Irrigation System Design. 2017. IFAS Document AE73 states, “Excess applications of water and the resulting leaching of chemicals can result in pollution of surface or groundwater supplies. In Florida, leaching can readily occur through the typical sandy soils. Water pollution can occur both as a result of inefficient applications of chemicals and from leaching.”
- d) **Finding:** “Monthly rainfall for all years of the study was generally below historical averages; rainfall on an annual basis over the months comprising the study period was 19 and 17% below average for 2006 and 2007, respectively.

However, there were months (Aug and Oct 2005, July 2006, and Oct 2007) when rainfall exceeded historical averages and some dates where daily rainfall events exceeded 25 mm (1 inch). For example, in 2006, there were 5 daily rainfall events during LSFC that exceeded 25 mm (1 inch).”

- i) **Staff Comment:** It is of concern that rainfall was below average. What would the results look like if rainfall was above average? The study looked at leaching, not stormwater runoff. Many yards in Alachua County are sloped towards the street and have a high runoff potential.

2) Quantifying nitrogen Leaching from residential soils in Alachua County. 2018. proposal by IFAS Faculty

- a) **Finding:** “Ultimately, this project found that healthy, actively growing turf did not exhibit significant NO₃ - leaching (Carey et al. 2012), and the study recommended reducing fertilizer application rate recommendations for three of five common turfgrass species (Trenholm et al. 2012), but this project did not investigate other forms of N beyond NO₃ - , and results were from idealized, experimental plot conditions. The age of the turf plots were also relatively young (<5yrs) and therefor may not have accounted for increasing source of mineralizable nitrogen as soil organic matter and thatch accumulates in the soil profile over time. Additional factors such as human behavior, non-turf landscapes, and other forms of N beyond NO₃- such as organic N may contribute to N leaching from residential landscapes managed by individual homeowners or green- industry professionals.”

- i) **Staff Comment:** Staff agrees that leaching and runoff will likely vary in a real world situation verses a highly controlled study (like the study explored in item one above) that only looked at one form of nitrogen.

3) The Fate of Nitrogen Applied to Florida Turfgrass by Shaddox and Unruh (IFAS)

- a) **Finding:** The authors recognize that 0 to 55% of nitrogen could be leached, with the higher percentages occurring when UF/IFAS recommendations are not followed.
 - i) **Staff comment:** While many point to the leaching study discussed in number one above (which leaching was reported as low), the literature and IFAS recognize that leaching can be much higher. Homeowner and applicator behavior is a major factor to consider.
- b) **Finding:** “When all the N fertilizer applied in Florida is considered, the amount applied to turfgrass is comparatively low, contributing only 11% to the total N applied in Florida (FDAC 2017).”

- i) **Staff comment:** While 11% may seem like a low percentage, Alachua County is responsible for reducing nitrogen pollution to local waterways through the various adopted BMAPs. Reducing any new inputs is much more economically feasible than restoration projects to attempt to remove nitrogen from the system.
- c) **Finding:** “When UF/IFAS recommended N rates are followed, turfgrass uptake of applied N ranges from 40-68% (Brown 2003; Sartain 1985; Shaddox 2001; Stiegler et al. 2011)...”
 - i) **Staff comment:** If uptake is 40-68%, then that leaves 60-32% available for leaching or running off. Additionally, we know that IFAS rates are sometimes exceeded, which would increase the pollution potential.
- d) **Finding:** “Thus, UF/IFAS recommends refraining from applying any N when the National Weather Service has issued a flood, tropical storm, or hurricane watch or warning, or if heavy rains are likely.”
 - i) **Staff comment:** This indicates that UF/IFAS recognizes the potential of nitrogen pollution from recently fertilized landscapes due to excessive rain. It is difficult to determine when a rain forecast will become “heavy rain”. Most businesses operate on a quarterly schedule and may feel pressure to apply nitrogen, even if rain is in the forecast.

4) **Effect of Fertilizer Source on Nitrate Leaching and St Augustinegrass Turfgrass Quality. Subhrajit Saha and Laurie Trenholm (UF IFAS). 2007. HortScience42(6)**

- a) **Finding:** “In a nutrient management study comparing St. Augustine grass and a mixed landscape planting, Erickson et al (2001) observed that a greater amount of nitrate was leached from ornamentals (1.46 mg/L) than from turfgrass (less than 0.2 mg/L). More than 30% of the applied nitrogen was leached from the ornamental and less than 2% from the turfgrass.”
 - i) **Staff Comment:** The Fertilizer ordinance applies to ornamentals and turf. While 2% leaching from turf is a low rate, it still adds up to additional nitrogen loading that the County may be accountable for in meeting TMDLs.

5) **Managing Landscape Irrigation to avoid Soil and Nutrient Losses. 2013. IFAS Publication SL384**

- a) **Finding:** “Nonpoint source pollution can be caused by over-watering in two main ways. The first is leaching or percolating through the soil beyond the plant roots. Irrigation runoff transports sediment, soil, and landscape clippings. The second way is if fertilizer was recently applied and it not irrigated in, it can also be transported as runoff.”

- i) **Staff Comment:** Over irrigation occurs in Alachua County, so there is concern that it contributes to non-point source pollution.

6) Urban Water Quality and Fertilizer Ordinances.

a) **Finding:** “Losses are most likely when fertilizer is applied just before or during heavy rainfall (Soldat and Petrovi, 2008), when fertilizer is applied before the turf root system is established (Erickson et al., 2010; Trenholm et al., 2011), or when fertilizer is applied in excess of research-based recommendations (Trenholm et al., 2011).”

- i) **Staff Comment:** Again, it is difficult to predict when heavy rains will occur. To minimize losses fertilizer use should be prohibited during the periods when we get the most rain. The proposed ordinance would prohibit fertilizer use in the early months of the year when roots are not established.

b) **Finding:** “Healthy turfgrass means turfgrass that maintains a complete and dense cover over the soil to reduce erosion and weed growth. Healthy turfgrass has an expansive root system that fills the soil and absorbs nutrients and water. Healthy turfgrass is reflected in the medium-green color that is desired for aesthetic purposes and to add value to the home and community. Healthy turfgrass consists of strong plants that stand up to the wear and tear of athletic use.”

- i) **Staff Comment:** IFAS literature repeatedly states that “healthy” turf will utilize fertilizer effectively without leaching. As healthy is defined above, many yards do not fit this definition so may not perform as studied in research plots. The above definition includes expansive roots that fill the soil. It is difficult for roots to establish in compacted soils typical in new construction.

7) Irrigation and Fertilizer Strategies for minimizing nitrogen leaching from turfgrass. 2004. Louise Barton and Tim Colmer. School of Plant Biology, Faculty of Natural Resources & Agricultural Sciences. The University of Western Australia.

a) **Finding:** “Reported annual rates of N leaching from turfgrass range from 0 to 160 kg/N/ha/yr, representing up to 30% of applied N”... “Applying fertilizer to warm-season grasses at cooler times of the year can increase N leaching.”

- i) **Staff comment:** This study also shows a range of nitrate leaching and supports prohibiting fertilizers in cooler months.

8) $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ Reveal the Sources of Nitrate-Nitrogen in Urban Residential Stormwater Runoff .Yun-Ya Yang and Gurpal S. Toor. Soil and Water Quality Laboratory, Gulf Coast Research and Education Center, University of Florida, IFAS.

a) **Finding:** “We are first to report and quantify the contribution of N fertilizers (average of 42%) to $\text{NO}_3\text{-N}$ in urban stormwater runoff from a residential catchment. This data suggests that proper application of urban N fertilizers in residential areas dominated by turfgrass is important to reduce $\text{NO}_3\text{-N}$ concentrations in stormwater runoff.”

i) **Staff Comment:** The study demonstrates that it is important to look at runoff also, not just leaching.

9) Technical Memorandum: Model-based Estimates of Nitrogen Load Reductions Associated with Fertilizer Restriction Implementation. November 2008. Tampa Bay Estuary Program.

a) **Finding:** “One Study of the Lake Tarpon watershed found that an estimated 79% of the groundwater nitrogen load to the lake was derived from fertilizer sources (LBG 2004).”

i) **Staff Comment:** This study shows residential fertilizer to be a major source of pollution.

10) Identification of Nitrogen Sources and Transformations within Karst Springs Using Isotope Tracers of Nitrogen. 2010. Andrea Albertin, James Sickman, Agnieszka Pinowska, R Stevenson. Biogeochemistry 108:219-232.

a) **Finding:** “Our study demonstrates that nitrate inputs to Florida’s springs are derived predominately from non-point sources....”. “Katz and Griffin (2008) found that inorganic fertilizers were the major source of nitrogen at Ichetucknee Head Springs and Blue Hole....”

i) **Staff Comment:** Residential fertilizer is one main non-point source in our County. Some of the inorganic fertilizers are also likely from agricultural sources.

11) Sources of Nitrate and Estimated Groundwater Travel Times to Springs of the Santa Fe River Basis Revised Report. 2013. Conducted by AMEC for Alachua County.

a) **Finding:** Residential landscapes were estimated to contribute 229,000 lb/year of nitrate to the Santa Fe River Springsheds in 2004.

- i) **Staff Comment:** Alachua County is accountable to reduce nitrate loading to the springs of the Santa Fe River through the BMAP process.

12) Fate and Transport of Nitrogen Applied to Six Warm-Season Turfgrasses. 2002. D.C. Bowman, C.T. Cherney, and T.W. Ruffy, Jr. Crop Science 42,3.

- a) **Finding:** This greenhouse study showed leaching was greater from Zoysiagrass compared to St Augustine grass. “These results document differences between the warm season turfgrasses for nitrate leaching potential, possibly related to root distribution, and emphasize that species selection is an important factor in minimizing environmental impacts from turfgrass management.”
- i) **Staff Comment:** Zoysiagrass is becoming the most prevalent turf used in new construction in Alachua County. In several studies reviewed by staff, it appears that this species has an even greater leaching potential. IFAS nitrogen recommendations in our region are lower for Zoysiagrass (2-3 lbs/1,000ft²) compared to St Augustinegrass (2-4 lbs/1,000ft²). However, in a recent discussion regarding the Fertilizer ordinance, a local fertilizer distributor stated that Zoysiagrass needs 3-5 lbs/year. This is a concern, as this distributor is advising professionals on purchases and they are not aware of the recommended rate.

13) Nitrogen Input from Residential Lawn Care Practices in Suburban Watersheds in Baltimore County, MD. 2004. Neely Law, Lawrence Band, and Morgan Grove. Journal of Environmental Planning and Management. Vol. 47, No. 5.

- a) **Finding:** “Results indicated that the annual input of nitrogen from fertilizer is a major component of the urban watershed nitrogen budget and it is both spatially and temporally variable.” “It was found that approximately 53% of the total nitrogen budget in Glyndon is from lawn fertilization.”
- b) **Finding:** “There is a wide range in the application rate of fertilizer N to residential lawns applied by homeowners and by professional lawn care companies.” “The average application rate of fertilizer on a lawn area basis reported by professional lawn care companies is higher compared to that calculated for homeowners.”
- i) **Staff Comment:** This study does not support exempting lawn care companies.

14) Florida Department of Environmental Protection Department. Various Documents.

- a) **Finding:** FDEP, in various Basin Management Action Plans and in guidance documents for calculating load reductions, assumes 30% of nitrogen from landscape fertilizers may be leached to the aquifer either directly where it is

applied (infiltration) or through stormwater management facilities after it has been transported by stormwater runoff.

- i) **Staff Comment:** Alachua County is held responsible by FDEP for reducing load reductions from urban turf fertilizer, so must use their estimates of leaching.
- ii) **Staff Comment:** FDEP gives load reduction credit for fertilizer ordinances, public education and stormwater retrofit projects.
- iii) **Staff Comment:** FDEP also notes in various Basin Management Action Plans that local ordinances are the primary mechanism for controlling future growth in nutrient loads.