

BAHIAGRASS NITROGEN REQUIREMENT

Objective: Determination of the agronomic N rate for the bahiagrass to be grown in order to know the quantity of the sewage sludge (biosolids) permitted to be added on the experiment field at Kirton Ranch.

Calculation according to Chapter 7 of EPA Process Design Manual for Land Application of Sewage Sludge and Domestic Septage.

- According to the UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops [UF/IFAS SL129], the total N requirement for bahiagrass to be grown is **160 lb/acre**.

There is no other sources of nitrogen provided in this field (no previous legume crop, fertilizer, N added by irrigation water, previous sludge and manure application).

- The PAN/dry ton for the sludge to be applied is defined as:
$$\%PAN = NO_3-N + Kvol(NH_4-N) + Km(Org-N)$$

PAN=Plant-available N

NO₃-N=Nitrate N content of the sewage sludge

Kvol=Volatilization factor that estimate the NH₄-N remaining after loss of NH₄-N in the atmosphere

NH₄-N=Ammonium N content of the sewage sludge

Km=Mineralization rate for the sewage sludge

Org-N= Organic N content of the sewage sludge

Biosolids contains 9.7% of total Nitrogen¹. From Dr. Obreza²'s hypothesis based on his experience, total Nitrogen is divided between 9.0% of Organic N, 0.7% of Ammonium-N. Nitrate-N is negligible.

The Kvol is estimated to be 0.75%, meaning that 0.25% of the NH₄-N is volatilized.

The Km is 0.5%.

$$\text{So, } \%PAN = 0 + (0.75)(0.7) + (0.5)(9.0) = \mathbf{5.0\%}$$

The PAN/dry ton for the sludge that will be applied is $20 * 5\% = \mathbf{100 \text{ lb/ton}}$.

The expected treatments for the biosolids are 0, 0.5, 1 and 5 tons per acre dry weight basis³. The first year, the Available N will be:

$$1000 * 5\% = \mathbf{50 \text{ lbs/ac}} \text{ (for 0.5 ton/ac)}$$

$$2000 * 5\% = \mathbf{100 \text{ lbs/ac}} \text{ (for 1 ton/ac)}$$

$$5000 * 5\% = \mathbf{500 \text{ lbs/ac}} \text{ (for 5 tons/ac)}$$

¹ According to the City of Boca Water Reclamation Facility WWRF

² UF/IFAS

³ These treatments were formulated using IFAS recommendations for both N and P nutrient requirements of south Florida pasture lands.

- The agronomic N rate of sewage sludge is $160/100=1.6\text{ton/acre}$.

DETERMINATION OF MINERALIZED PAN FROM RESIDUAL ORGANIC N APPLIED AS SEWAGE SLUDGE AFTER 1 YEAR FROM APPLICATION.

Objective: Determination of the available Residual-N 1 year after application, considering the mineralization process. The available Residual-N will be taken in account for the overall budget for PAN.

According to Dr. Obreza's assumptions, Biosolids contains 9% of Organic N.

For 1ton/acre, the starting Org-N is $2000*9\%=180\text{ lbs/ac}$

We consider a mineralization rate (Kmin) of 0.5 the first year, 0.05 the second year and 0.025 the third year, according to experiences with South Florida Climate⁴.

We can anticipate the mineralization fraction of the sewage sludge for the three years following the first application:

Year of growing season	Starting Org-N	Mineralization rate (Kmin)	Mineralized org-N or PAN (lb/acre)	Org-N remaining (lb/acre)
0-1 (sludge applied)	180	0.5	90	90
1-2 (one year later)	90	0.05	4.5	85.5
2-3 (two years later)	85.5	0.025	2.25	83.25

⁴ UF/IFAS