

Soil carbon, nitrogen, organic matter, and related nutrients in overseeded ryegrass or clover on bermudagrass pastures after 33 years of stocking

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Application: Fertilization of bermudagrass in the Pineywoods vegetation region of Texas has been used to increase dry matter production in hay meadows and pastures.

Introduction: The primary objectives of this project were to document the changes in soil fertility nutrients in overseeded bermudagrass pastures during 33 years under grazing conditions.

Materials and Methods: ‘Coastal’ and common bermudagrass (BG) were established in different sized pastures at the Overton Center in 1968. Three different stocking rates of each BG were initiated in 1969 using cow-calf pairs. From 1969 through 1984, annual fertilization was 200-44-83 (N-P-K) with split applications of N. The BG pastures were grazed as pure stands through 1974. In fall 1974, all pastures were overseeded with mixtures of annual ryegrass plus clover and stocked starting in Feb-Mar to Oct each year through 1984. In fall 1984, all pastures were subdivided with one half overseeded with ryegrass + N fertilizer and the other half overseeded with clover without N fertilizer. From spring 1985 to 2018, these overseeding and stocking rate regimens have been in place. Fertilization of pastures with N has been split-applied with a single application of P and K (Table 1).

Table 1. Annual fertilizer^{1,2} applications on bermudagrass pastures during various periods.

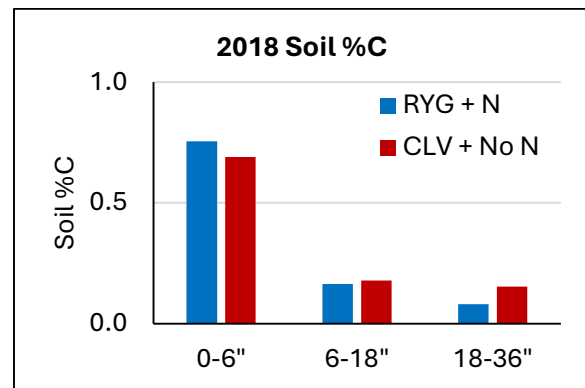
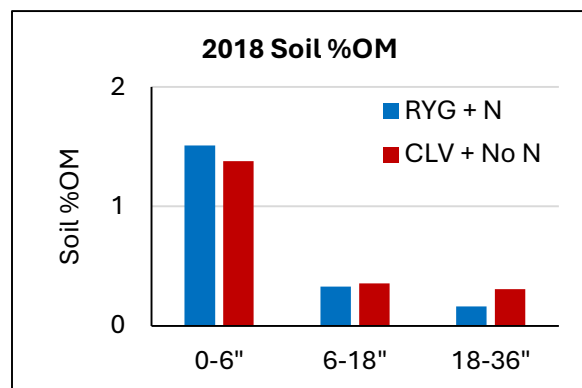
Period	No Years	Ryegrass + N			Clover + No N		
		N	P	K	N	P	K
		lb/ac			lb/ac		
1985-1989	5	410	0	0	0	0	85
1990-1997	8	250	0	0	0	0	85
1998-2004 ³	7	303	46	85	0	46	85
2005-2018 ⁴	14	278	30	54	0	30	54

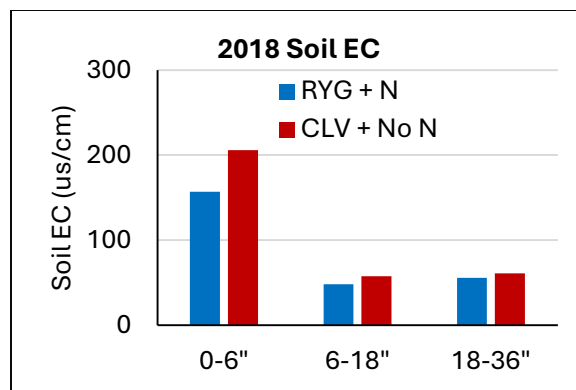
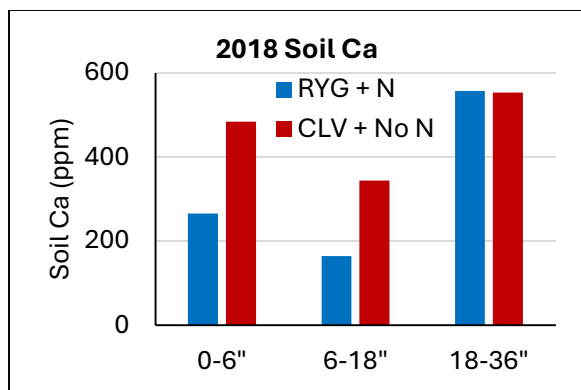
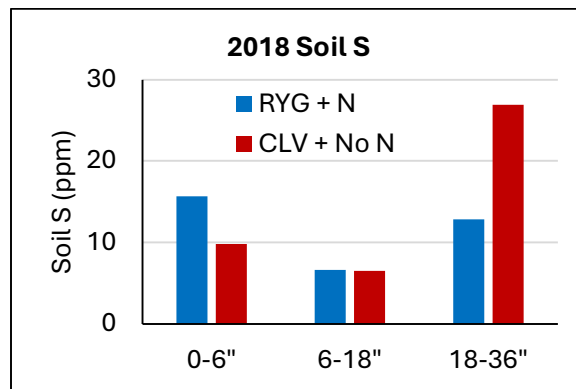
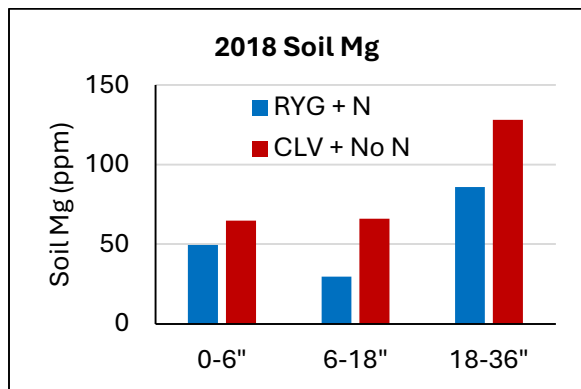
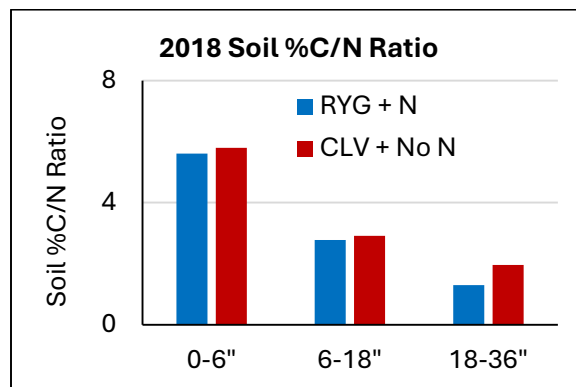
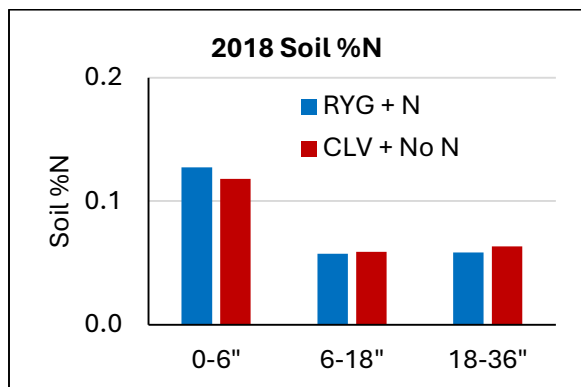
¹ Fertilizer $P_2O_5 \times 0.46 = P$; $K_2O \times 0.83 = K$.

² Limestone was applied to all pastures at 6 t/ac from 1968-1984; 8 t/ac from 1985-2005; 3.5 t/ac from 2006-2013.

³ From 1998-2004, all pastures received S, Mg, and B at 50, 27, and 1.0 lb/ac, respectively.

⁴ From 2005-2018, all pastures received S, Mg, and B at 28, 15, and 0.7 lb/ac, respectively.





Results:

Soil percent organic matter (OM), carbon (C), and nitrogen (N) were greater in N-fertilized pastures at 0-6" depth. The soil %C:N ratio in N-fertilized vs non-N-fertilized pastures was similar. Soil magnesium (Mg), sulfur (S), and calcium (Ca) showed accumulation at the 18-36" depth with higher levels of Mg and S in the non-N-fertilized pastures. Soil electrical conductivity (EC), a measure of soil water-salt content, is an indicator of soil health and exhibited higher status in non-N-fertilized pastures at 0-6" depth.

Conclusions and Implications:

After 33 years of pastures receiving N vs no N fertilizer, soil percent organic matter remained low in these sandy, acid soils. The levels of percent soil C and N are indicative of stabilized C and N sequestration.