

# Stock and carbon emission in different soil management systems



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## Introduction

The economically viable options to mitigate the greenhouse emission gases is increase the stocks of C in croplands.

Liming is paramount in soil acidity remediation and increases crop yields in acidic tropical soils, but can result in carbon emission in the atmosphere.

Gypsum application increases root depth in acid soils. Hence lime application mixed to gypsum may improve the balance of soil carbon than to the use of lime only.

## Objective

The main objective of this work was to study the changes in the carbon storage in the soil profile as well as carbon emission affected by soil acidity amelioration under no tillage and conventional system.

## Results

Table 1: Average soybean yield, carbon exports soybean grains and total CO<sub>2</sub> emissions as affected by soil acidity amelioration under no till (NT) and conventional tillage(CS).

Treatments	Soybean yield		Carbon exports in soybean grains		Total CO <sub>2</sub> emissions	
	NT	CS	NT	CS	NT	CS
	kg ha <sup>-1</sup>		Mg ha <sup>-1</sup>		g m <sup>2</sup> h <sup>-1</sup>	
Control	2421,4 cA	2592,8 cA	1,2 cA	1,3 cA	10,7 aB	11,3 cA
Lime	3642,6 aA	3454,4 aA	1,8 aA	1,7 aA	9,9 aB	14,3 bA
Silicate	2605,2 bcB	3016,8 bA	1,3 bcB	1,5 bA	8,7 bB	11,7 cA
Gypsum+Lime	3449,2 aA	3405,4 aA	1,7 aA	1,7 aA	10,3 aB	15,6 aA
Gypsum+Silicate	2737,6 aB	3485,4 aA	1,4 bB	1,7 aA	9,9 aB	13,5 abA
Mean	2971,2	3190,9	1,5	1,6	9,7	13,2

Treatment means within a row and column followed by the same letter are not significantly different at the 0.05 level by LSD (P<0.05). Lowercase letters compare soil acidity amelioration and capital letters compare the systems.

## Materials and Methods

Treatments: (lime and silicate rates calculated to raise soil base saturation to 70%) control, lime, silicate, gypsum+lime and gypsum+silicate. The initial soil pH was 3.7

Soybean was sown one year after the treatment application (November, 2013 – April, 2014)

Soil samples:

Taken at depths of 0-10, 10-20, 20-40 cm, before soybean sowing

Gas sample:

Carbon dioxide emissions were monitored using vented static chambers after treatment applications from early October, 2012 through late August 2013 and collateral information collected include weather data, soil temperature and volumetric soil moisture at the time of sampling.

Analysis:

Soybean yield and carbon exports in soybean grains .

Soil C stock was calculated according to soil bulk density.

Carbon dioxide emissions

- Higher soybean yields under conventional tillage. There was decreased soybean production when silicate is used.

- Lower effect of silicate on carbon exports in soybean grains. However, higher export was observed in the lime or lime mixed gypsum treatment.

- Conventional tillage resulted in higher carbon emission when compared with no-till. Lime mixed with gypsum increased carbon dioxide emissions in the both system.

Table 2: Average soil carbon stock at 0-10, 10-20, 20-40 cm before soybean sowing (November, 2013) as affected by soil acidity amelioration under no tillage (NT) and conventional system (CS).

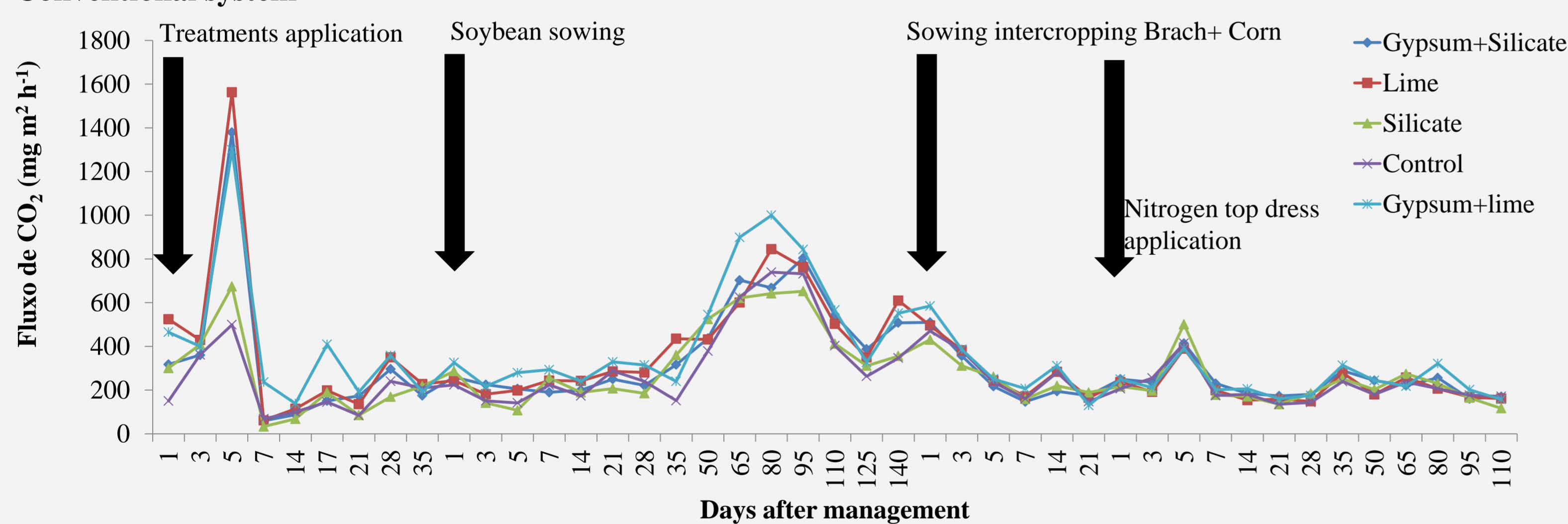
Treatments	NT		CS		NT		CS	
	0_10 cm		10_20 cm		20_40 cm			
	Mg ha <sup>-1</sup>							
Control	37,0 A	27,7 B	29,8 A	26,8 B	25,5 A	21,8 B		
Lime	34,3 A	25,2 B	30,8 A	28,0 A	24,2 A	22,0 A		
Silicate	37,9 A	27,3 B	32,6 A	26,3 B	26,1 A	20,4 B		
Gypsum+Lime	38,6 A	25,6 B	32,9 A	29,9 B	27,3 A	22,1 B		
Gypsum+Silicate	34,0 A	27,9 B	33,5 A	28,8 B	24,5 A	23,5 A		
Mean	36,4	26,7	31,9	27,9	25,5	22		

Treatment means within a row followed by the same letter are not significantly different. (LSD , P<0.05).

- Conventional tillage decreased soil C stocks one year after tillage.

- There wasn't difference on soil C for soil amendments.

### Conventional system



### No till

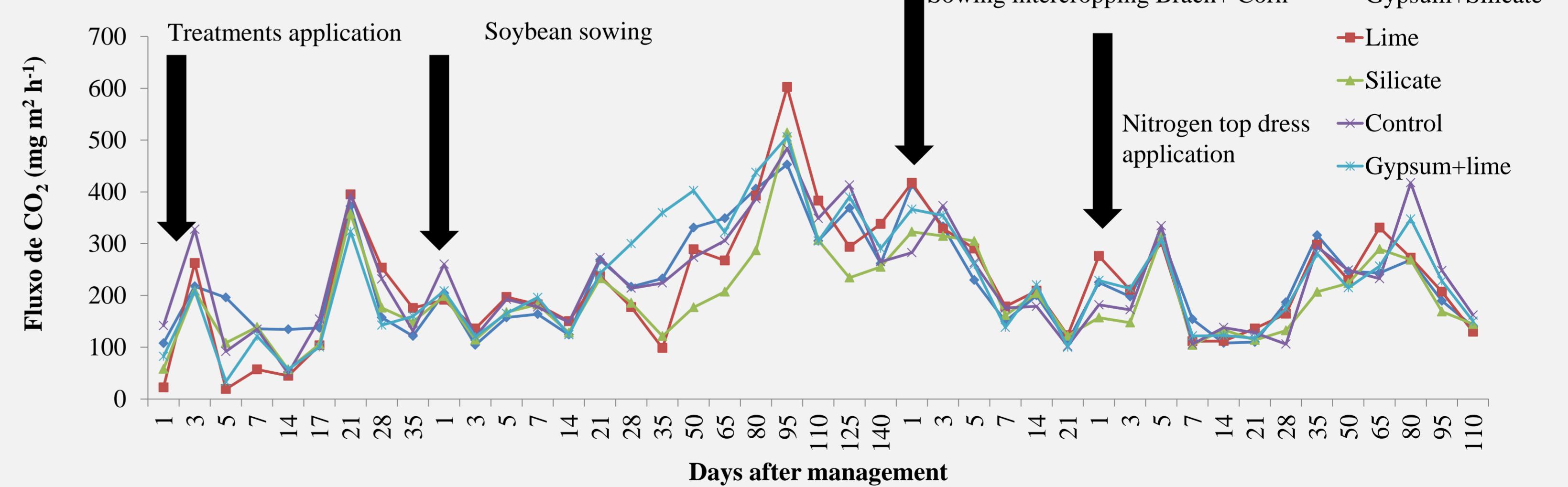


Figure 1: CO<sub>2</sub> flux as a function of treatments application (October / 2012), soybean sowing (November / 2012), sowing intercropping brachiaria+corn (April / 2013), N top dress application in the form of urea in corn (May / 2013) in conventional and no till system.

## Conclusion

High quantity of carbon emission was observed when gypsum is used, and we did not observe any increase in the soybean yields and carbon stock in soil when compared to lime only application or silicate.

Moreover, when silicate was used, there is less carbon dioxide emission in both systems and the soybean yield has lowered.



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