Soil carbon and soybean yield as affected by tillage and liming

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Introduction

Liming is paramount in soil acidity remediation and to increase crop yields in acidic tropical soils, but C emission to the atmosphere is increased by liming.

However, with increased plant growth, C is sequestered back to the soil. Hence the balance in soil C stock may be positive after liming.

If gypsum is used mixed to lime, it may further improve deep root growth and the balance of soil carbon.

Objective

To study changes in carbon storage in the soil profile and soybean yields as affected by soil acidity amelioration under no tillage and conventional systems.

Materials and Methods

Treatments: (lime and silicate rates calculated to raise soil base saturation to 60%) control, lime, silicate, gypsum +lime and gypsum+silicate.

Soybean was planted after 30 days of treatment application

Soil samples:
Taken at depths of 0-10, 10-20, 20-40 e 40-60 cm, before soybean planting.

Analysis:
Soybean root weigh and C content at R6, yield at maturity.
Soil C stock was calculated according to soil bulk density.

Results

Average soybean yield, root dy matter and root carbon content of soybean as affected by soil acidity amelioration under no till (NT) and conventional tillage(CS).

	Soybean yield		Root dry matter		Root Carbon Content	
Treatments	NT	CS	NT	CS	NT	CS
	kg ha^{-1}		Mg ha^{-1}		Mg ha^{-1}	
Control	2272 bC	3297 aB	0,93 bD	1,09 aB	0,37 aD	0,41 aB
Lime	3090 bAB	3886 aA	2,74 aA	1,14 bAB	1,08 aA	0,42 bB
Silicate	2759 bB	3256 aB	1,04 bD	1,26 aB	0,34 bB	0,46 aB
Gypsum+Lime	3340 aA	3668 aAB	1,82 aB	1,74 aA	0,71 aB	0,66 aA
Gypsum+Silicate	3041 bAB	3665 aAB	1,39 aC	1,25 aB	0,53 aC	0,47 aB

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

Higher soybean yields under conventional tillage

Higher effect of gypsum on soybean yield under no-till

Lime and gypsum increased root dry matter

In general, more C in roots under no-till

Average soil carbon stock at 0-10, 10-20, 20-40 and 40-60 cm before soybean planting (November, 2012) as affected by soil acidity amelioration under no tillage (NT) and conventional system (CS).

	0-10 cm		10-20 cm		20-40 cm		40-60 cm	
Treatments	NT	CS	NT	CS	NT	CS	NT	CS
	----------Mg ha^{-1} ----------							
Control	32,9 a	24,2 b	28,4 a	23,2 b	35,5 a	20,9 b	22,3 a	19,0 b
Lime	33,3 a	25,4 b	27,9 a	23,6 b	31,2 a	19,0 b	21,0 a	20,1 a
Silicate	34,5 a	23,8 b	30,1 a	23,1 b	30,9 a	20,5 b	22,0 a	19,6 a
Gypsum+Lime.	32,2 a	24,8 b	27,9 a	23,7 b	37,2 a	20,1 b	23,9 a	18,3 b
Gypsum+Silicate	34,8 a	25,9 b	29,1 a	25,7 b	38,9 a	20,6 b	22,8 a	20,7 a

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

Conventional tillage decreased soil C stocks 3 months after tillage.

There was no time for soil amendments to have an effect on soil C.

Conclusion

Tillage area – 07/31/2012

Treatment applied 10/03/2012

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Soybean sowing – 11/06/2012

Soybean crops – at R2 – 01/21/2013

Soybean harvest – 03/28/2013

Soil acidity amelioration increases soybean root growth and yields.

In the first year, soybean response to soil amelioration was better with tillage.

Soil tillage decreases soil C stock in a very short time (3 months)

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