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Soybean yield of degraded pasture after reimplantation with and without phosphating

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The objective of this work was to evaluate the effect of different forms of reimplantation of pasture with and without phosphatation aiming to contribute to the increase of soybean yield. The experiment was conducted at the Experimental Farm of Universidade do Oeste Paulista (Unoeste), located in the municipality of Presidente Bernardes - SP. The design was done with split plot scheme, containing four replicates. The plots were constituted with 4 kg ha^{-1} of *Urochloa brizantha* (Marandu grass), BNS + Seeding in haul, BNS + Seeding in line consortium with soybean as subplots (with and without phosphatation). The following were analyzed: number of tillers and dry mass yield (PMS); analysis of plant tissue from pasture; foliar diagnosis analysis; and components of production and production of soy. Analyzed variables were submitted to analysis of variance (p <0.05) and means were compared by the Tukey test (p <0.05). In this context, it can be concluded that a higher quality production with a reimplantation of pasture intercropped with a soybean crop yielding an increase of 276 kg ha^{-1} compared to the treatment that did not have pasture reimplantation (BNS). Phosphate increased soil phosphorus content in the production of soybean dry matter and no leaf phosphorus content and higher soybean yield.

Key words: Natural seed bank, no-tillage, *Urochloa brizantha*.

INTRODUCTION

Soybean (*Glycine max* L.) is the most important oilseed crop in the world. It is currently one of the most important products in the Brazilian economy, occupying a prominent place in the supply of oil for domestic consumption, in animal feed as the main source of protein, as well as in the export agenda of the country (Val, 2014). Brazilian soybean production in the years 2014/2015 was equivalent to 45 million tons of grains

(Conab, 2015). Soybean has been indicated as an alternative for disease prevention and use in the manufacture of flour, milk, textured protein, biodiesel, paints and varnishes, among others (Ávila et al., 2010).

Another great importance of soybeans is that it stands out as one of the main alternatives in crop rotation in no-tillage systems and, more recently, no crop-livestock integration system, as a consequence of the great

efficiency in fixing N2 (Santos et al., 2006).

The results of different regions indicate that no-tillage can also favor a biological nitrogen fixation (BNF) in legumes (Alves et al., 2003).

However, it is often observed that the lack of management of the soil-plant-animal system, in association with the inadequate management of the enterprise, has led to the degradation of pastures which, lately, is the greatest obstacle to the establishment of a cattle ranch sustainable in agronomic, economic and environmental terms (Martha Júnior and Vilela, 2002).

Pasture degradation can be seen as an evolutionary process of loss of vigor, yield and natural recovery capacity of pastures to sustain economically, production levels and quality required by animals, as well as to overcome the harmful effects of pests, diseases and weeds culminating in the advanced degradation of natural resources due to inadequate management (Macedo, 2001). For this reason, the importance of the rotation of crops and pastures, which is technically and economically feasible strategy for the recovery and renewal of degraded pastures has been demonstrated (Cezar et al., 2000; Vilela et al., 2002).

The highest proportion of pasture area cultivated in Brazil is composed by plants of the genus *Urochloa* (Soares Filho, 1994). *Urochloa* species have high dry mass yield, excellent fertilizer response, are perennial, and remain green during moderate periods of water restriction. Among these species, marandu grass is the most used (Zimmer et al., 1998). The reasons for this preference are that this cultivar is tolerant to low soil fertility and grasshopper, presenting high yield when properly fertilized and managed.

Urochloa brizantha is characterized by its diversity of uses such as direct grazing, forage for fencing and silage, and more recently, for crop-livestock integration or as a straw-growing crop under no-tillage system (NTS) (Dias and Alves, 2008). In the present study, the use of biomass in tropical regions (Rodrigues and Rodrigues, 1987) is important, especially when it receives cultural treatments, soil correction, fertilization, and in some cases, irrigation.

The use of pastures in farming areas, for a period of time, can contribute to the improvement of the physical quality of soils. The herbage legume consortium, that is, the diversification of production, mainly in the use of forage, provides several advantages in the production system, both in the physical properties and in the chemical part of the soil (nitrogen fixation). It also reduces the use of pesticides, promotes the breakdown of diseases and pests, reduces the population of invasive plants, and has a great influence on the increase of farmers' profitability (Cobucci, 2001; Oliveira and Vidor, 2001). The dry mass residues of the pastures allow to recover the organic matter contents of the soil to values close to the original (Freitas et al., 2000; Wendling et al., 2005). Furthermore, plant residues are indispensable to increase the size and stability of the aggregates, favoring erosion control and soil resistance to compaction (Costa et al., 2015). Therefore, Igue (1984) reports that *Poaceae* contains a greater amount of root, also contributing to the improvement of soil porosity and aggregation.

In the case of phosphorus, since phosphorus (P) has low mobility (Barber, 1984) and low availability in oxidic soils (Novais et al., 2007), the amount of P available to plants can be modified, since the absorption of P is related to the amount of available nutrient (Anghinoni, 1992; Model and Anghinoni, 1992; Klepker and Anghinoni, 1995) and the different plant species and different soil textures that cause variations in the critical levels of phosphorus.

The most commonly used forms of phosphate fertilization in the production of grain crops are the haul on the surface with or without incorporation in the soil and in the sowing groove in strips (Sousa et al., 2004). Nunes et al. (2011) report that the use of surface phosphating is advantageous in a production system that has a higher response rate at planting, where fertilization occurs before or after planting. Therefore, in order to be able to perform highly efficient phosphating, its application must take place in the best way, allowing a better positioning in relation to the roots (Anghinoni and Barber, 1980), thus reducing the fixation by iron and aluminum oxides (Sousa and Volkweis, 1987).

The objective of this work was to evaluate the effect of different forms of reimplantation of pasture with and without phosphatation aiming to contribute to the increase of soybean yield.

MATERIALS AND METHODS

The experiment was conducted at the Experimental Farm of the Universidade do Oeste Paulista (Unoeste) in Presidente Bernardes - SP, at 22°17'27 "S, 51°40'51". The 385 m altitude in the period from January 2014 until February 2015. According to the Brazilian Soil Classification System (Embrapa, 2006), the soil of the experimental area is classified as dystrophic Red Argissolo, with smooth undulating relief.

The experiment was done with *Urochloa brizantha* (culture Marandu) with five years of implantation, but with low forage production capacity due to degraded pastures. The experimental design was done in bands in a subdivided plot scheme, with four replications. The plots consisted of four systems of pasture implantation and the subplots, with and without phosphate fertilization (Table 1).

For the implementation of T3 and T7 treatments, the John Deere seeder was used, seven rows with a 0.45 m spacing. For T4 and T8 implantations, two operations were carried out, the first for sowing the forage and the other for soybean sowing.

Before the implementation of the experiment, the soil chemical characterization was performed at a depth of 0 to 20 cm.

The following parameters were determined: organic matter, P (resin), K, Ca, Mg, pH and (H + Al), total cation exchange capacity (CTC) and base saturation. In January 2014, 1.0 Mg ha^{-1} of limestone and 1.0 Mg ha^{-1} of gypsum (Raij et al., 1997) were applied after chemical characterization of the soil. Phosphating was performed after limestone application with 500 kg of single superphosphate ha^{-1}.

Table 1. Systems of pasture implantation and subplots with and without phosphate fertilization.

Treatment	Plot-Systems	Subplot-Fertilizer With P
T1	NSB (control)	
T2	NSB + Seeding	Without phosphating
T3	NSB + Seeding	
	In line	
T4	NSB + Seeding in line Intercropped soybean	-
T5	NSB	
T6	NSB + Seeding	With phosphating
T7	NSB + Seeding	
	In line	
T8	NSB + Seeding in line Intercropped soybean	-

NSB: Natural seed bank; In the sowing of *Urochloa Brizantha* (cv. Marandu) were sowed 4 kg ha^{-1}.

Table 2. Chemical analysis of the soil before the implantation of the experiment.

Prof.	pH	M.O g dm^{-3}	P	SO$_4^{-2}$ mg dm^{-3}	Al^{+3}	H+Al	K	Ca	Mg mmol$_c$ dm^{-3}	SB	CTC	m	v %
0-20 cm	5.2	11.5	1.7	6.2	0	19.6	0.9	10.1	9.1	20.1	39.6	0	50.6

The desiccation of the degraded pasture was carried out in December 2013 and the re-planting of the *U. brizantha* grass together with the soybean occurred at the beginning of January 2014. At the beginning of November 2014 the entire pasture of the area was desiccated and the line consorted with soybean, which served as a vegetable cover for soybean farming. The soybean cultivar used was TMG 1264 RR, which seeded 17 m^{-1} seeds at the end of November 2014. The treatment of the soybean seed was carried out with the agrochemical Fipronil in the dosage 40 ml 100 kg of seed, containing germination: 80% and minimum purity: 99%. The fertilization of sowing was 260 kg ha^{-1}, using formulation 04 30 10, being 10 kg ha^{-1} of N, 78 kg ha^{-1} of P$_2$O$_5$ and 26 kg ha^{-1} of K$_2$O, respectively, also performed A potassium chloride coverage fertilizer, the first at 20 DAE (days after emergence) at the dosage of 125 kg ha^{-1}, 75 of K$_2$O ha^{-1}. The equipment used to apply the liquid inoculant doses was coupled to the header of the seed drill, it has a tank with a capacity of 200 L and has a constant stirrer, providing a better homogenization of the solution. The inoculant was released when the seedlings touched the soil and started the sowing process, done in eight doses of the product. In this way, the solution was injected into all the sowing grooves at the same time. This solution was applied at a dosage of 50 L ha^{-1}.

The parameters evaluated were soil chemical analysis at a depth of 0 to 20 cm, a soil sampling of each treatment was carried out. After homogenization, 300 g were retained for the chemical analysis of fertility in the Unoeste second soil analysis laboratory (Raij, 2011). Samples were collected in an area of 0.15 m^2 (four replicates) for the determination of shoot dry matter yield. The collection was carried out five months after sowing of the pasture, randomly within the useful area of the plots. The plants were dried

in an oven with forced circulation of air and temperature of 60 to 70°C until reaching constant mass (dry matter determination). After drying, the samples were ground in a Willey type mill to perform the nutritional analysis. In the R1 stage, the 3rd trifolia were collected from the apex on the main stem of 30 plants per plot. The leaves were dried in the forced circulation oven at 60°C for 48 h and then were ground and sent to the Laboratory of Analysis of foliar tissues of the Faculty of Agrarian Sciences of the University of the West (Paulista University) for macronutrient leaf analysis. At the end, soy production and productivity components were evaluated.

The variables analyzed in each treatment were submitted for analysis of variance (p<0.05) and the means were compared by the Tukey test (p<0.05) using the SISVAR software (Ferreira, 2011).

RESULTS AND DISCUSSION

None of the soil attributes were influenced by the interaction between pasture reimplantation systems and phosphate fertilization (Table 2). Grassland reimplantation systems influenced only the pH and organic matter (MO), potential acidity (H + Al) and magnesium (Mg) levels of the soil (Table 3). The highest values of pH were verified in the seeding system of the forage intercropped with soybean, in relation to the systems with natural seed bank and sowing of the forage to the haul (Table 3). However, in tropical soils under

Table 3. Chemical analysis of soil with and without phosphatization in diferente   forms of pasture reimplantation.

Treat.	pH	M.O.	P	S	Al	H+Al	K	Ca	Mg	CTC	V
		g dm^{-3}	mg dm^{-3}				mmolc dm^{-3}				%
NSB	5.0^b	13.4^b	2.8	6.4	0.3	22.7^a	1.2	10.4	6.1^b	40.4	43.2
Seeding(S)	5.0^b	15.0^a	3.1	6.7	0.1	22.5^{ab}	1.2	11.3	6.3^{ab}	41.4	45.3
S + line	5.1^{ab}	15.5^a	2.9	5.9	0.0	23.0^a	1.0	12.0	7.0^{ab}	42.5	46.0
S + line + soybean	5.2^a	14.4^{ab}	3.4	3.3	0.0	20.3^b	1.2	13.0	9.0^a	43.3	52.1
CV	1.6	7.7	25.4	45.0	380.1	7.6	31.9	24.8	22.1	8.6	14.4
Phosp.											
with P	5.1	14.3	3.5^a	5.89	0.0	21.1^b	1.1	12.4	7.2	42.0	49.0
withoutP	5.1	14.8	2.7^b	5.25	0.2	23.0^a	1.2	11.0	7.0	42.0	44.3
CV	1.8	7.5	32.3	44.8	434.0	7.2	16.2	30.0	28.8	11.0	14.0
Probability (P≥F)											
Sist. (S)	0.013	0.021	0.505	0.481	0.436	0.044	0.513	0.379	0.031	0.590	0.116
Phosp. (P)	0.208	0.261	0.043	0.484	0.217	0.005	0.021	0.273	0.552	0.927	0.096
S × P	0.619	0.694	0.380	0.153	0.534	0.953	0.916	0.910	0.926	0.930	0.989

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

Table 4. Dry mass yield (DMY) of forages in different pasture reimplantation systems, with and without phosphating.

Treatment	DMY (Mg ha^{-1})
NSB	4.7^b
Seeding(S)	5.5^{ab}
S + line	6.1^a
S + line + soybean	6.6^a
CV	14.4
Phosphorus	
with P	5.6
withoutP	5.8
CV	18.5
Probability (P≥F)	
Sist. (S)	0.006
Phosp. (P)	0.554
S × P	0.706

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

pasture it is rare to find excessively high values of pH, even if liming is frequent, based on technical recommendations (Oliveira et al., 2008).

The highest values of MO were verified in forage systems in line and in the haul, in relation to the system with natural seed bank. The forage seeding system in line with soy reduced consortium H + Al content compared to systems with natural seed bank and seeding forage increased in line and Mg content compared to the system with natural seed bank. The levels of H + Al were reduced with the use of phosphate fertilization in relation to the absence of this fertilization (Table 3).

According Raij (1991), Brazilian soils are poor in phosphorus as a result of its source material and the strong interaction of P with the ground, so the match can be considered the most limiting nutrient of biomass of tropical soils (Novais and Smyth, 1999). Prior to redeployment pasture together with the phosphorus fertilization was the value of P (1.7 mg dm^{-3}) after reimplantation of sowing and phosphorus fertilization systems was increased to P (3.5 mg dm^{-3}) (Table 3). However, the use of phosphate fertilization contributed to the increase of phosphorus levels, since there were no significant differences in P content (Table 3). Sa (2004) reports that the application of phosphate fertilizers haul without incorporation into tillage, it is a viable and fertilizer maintenance practice and/or refund for soils that have been fertilized and have average levels to high P (Table 3).

The highest yields of dry matter (DMY) of the forages were verified in forage sowing in line (6.1 Mg ha^{-1}) and forage in line with soybean (6.6 Mg ha^{-1}) and BNS (4.7 Mg ha^{-1}) (Table 4). Phosphate fertilization did not influence forage PMS. According to Kluthcouski et al. (2003), good soil protection requires about 7 Mg ha^{-1} of dry matter mass, even if the following work did not reach this value (7 Mg ha^{-1}), the dry mass yield found was very

Table 5. Mineral composition of pasture with and without phosphatization in different forms of pasture reimplantation.

Treatment	N	P	K	Ca	Mg	S
			g kg^{-1}			
NSB	15.1[a]	2.1[a]	19.0[ab]	5.2	5.9	1.1
Seeding(S)	14.5[ab]	2.0[ab]	24.0[a]	4.8	6.6	1.2
S + line	11.7[bc]	1.5[bc]	12.3[bc]	4.6	4.8	1.1
S+line+ soybean	11.0[c]	1.2[c]	14.4[c]	4.7	4.6	1.2
CV	22.2	23.2	21.3	18.5	26.1	27.7
Phosp.						
with P	11.9b	1.8	16.1	4.8	5.5	1.1
withoutP	14.3a	1.6	18.7	4.8	5.3	1.2
CV	9.6	20.1	21.1	28.8	30.6	24.5
Probability (P≥F)						
Sist. (S)	0.503	0.006	0.000	0.549	0.030	0.954
Phosp. (P)	0.000	0.047	0.071	0.911	0.780	0.466
S x P	0.058	0.099	0.490	0.284	0.216	0.557

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

close to this (6.6 Mg ha^{-1}).

None of the attributes of the pasture mineral composition was influenced by the interaction between pasture reimplantation systems and phosphate fertilization (Table 5). In the table of mineral composition of the pasture in relation to the reimplantation systems of the pasture, the nitrogen content (N) was higher in the natural seed bank system (NSB) and lower in the seeding system of the forage intercropped with soybean (Table 5). Corsi and Nússio (1992) found that the increase of forage production has as one of the promoters, the adequate availability of nutrients, among which nitrogen stands out.

Thus, the same occurred for the phosphorus (P). As for potassium (K), the highest content was in the sowing system to the haul and the lowest in the sowing of the forage in line consorciada with soybean. In relation to phosphate, the difference was only observed for the N content, and when N fertilized with phosphorus, N was lower than without phosphate fertilization (Table 5).

The P contents of the soybean shoot were higher in the sowing system of the forage in relation to the sowing in line (Table 6). The use of phosphate fertilization also increased the levels of P of the aerial part of the soybean in relation to the absence of this fertilization, demonstrating the positive effect of this fertilization on the availability of P for the soybean crop, in a pasture reimplantation area. The levels of K, Ca, Mg and S were influenced by the interaction between pasture reimplantation and phosphatic fertilization systems (Tables 6 and 7). The highest levels of K were verified

with the use of phosphatization in the forage sowing system to the haul. In the sowing system of forage intercropped with soybean, the highest levels of K were verified in the presence of phosphate fertilization, whereas in the absence of fertilization, the lowest value was verified in the sowing system of forage in the haul and superior in sowing of the forage in line consorted with.

In the sowing system of the forage to the haul the absence of the phosphate fertilization contributed to the value of Ca which was superior. The content of Ca in the presence of phosphate fertilization was higher in sowing of the forage in line, while in the sowing system of the forage to the lace was lower (Table 7).

In the forage sowing and sowing systems of in-line forage, phosphate fertilization contributed to lower Mg content in both systems of pasture reimplantation. In the absence of phosphatization, the highest Mg content was verified in the sowing system of the forage harvested and the lowest in the sowing of forage intercropped with soybean.

Malavolta (2006) established sufficiency ranges for nutrients P (4-5 g kg^{-1}), K (22-25 g kg^{-1}), Ca (9-10 g kg^{-1}), Mg (3,5), S (2.5-3.5 g kg^{-1}), in order to better understand and interpret the results of foliar diagnosis, therefore the contents of P and S are all below, both in the pasture reimplantation system variable and with and without phosphate fertilization. K has the ideal content only in the sowing system of forage intercropped with soybean. The Ca and Mg contents are all mentioned earlier.

Phosphate contributed to the decrease of S values

Table 6. Mineral composition of the aerial part of the soybean with and without phosphatization in different forms of pasture reimplantation.

Treatment	N	P	K	Ca	Mg	S
				g kg^{-1}		
NSB	30.9	2.3[ab]	11.3[b]	24.3	10.3[ab]	1.6
Seeding(S)	29.3	2.4[a]	12.7[b]	26.6	11.7[a]	1.5
S + line	29.8	2.1[b]	14.1[b]	29.0	10.4[ab]	1.7
S+line+ soybean	32.6	2.2[ab]	27.9[a]	26.0	9.4[b]	1.6
CV	8.1	9.6	11.5	14.5	9.9	6.7
Phosphorus						
with P	31.0	2.5[a]	17.5[a]	25.0[b]	10.0[b]	1.6
withoutP	30.3	2.0[b]	15.5[b]	28.0[a]	10.9[a]	1.6
CV	11.0	8.5	15.2	11.6	11.1	13.4
Sist. (S)	0.101	0.045	0.000	0.214	0.013	0.028
Phosp. (P)	0.519	0.000	0.049	0.034	0.059	0.628
S × P	0.083	0.064	0.012	0.023	0.020	0.043

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

Table 7. Deployment of the mineral composition of the aerial part of the soybean with and without phosphatization in different forms of reimplantation of pasture.

Fosfatagem	NSB	Seeding	S+Line	S+Line+ Soybean
		K (g kg^{-1})		
With	12.67[aB]	16.50[aB]	13.87[aB]	26.92[aA]
Without	9.95[aBC]	9.00[bC]	14.32[aB]	28.92[aA]
		Ca (g kg^{-1})		
With	21.95[aA]	24.02[bA]	26.17[aA]	27.87[aA]
Without	26.65[aAB]	29.12[aAB]	31.12[aA]	23.55[aB]
		Mg (g kg^{-1})		
With	10.62[aA]	10.20[bA]	9.50[bA]	9.77[aA]
Without	10.02[aBC]	13.15[aA]	11.27[aAB]	9.07[aC]
		S (g kg^{-1})		
With	1.40[bA]	1.47[aA]	1.70[aA]	1.72[aA]
Without	1.82[aA]	1.50[aAB]	1.67[aAB]	1.45[bB]

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

within the NSB system, whereas the opposite was verified in the sowing system of the forage intercropped with soybean, and the phosphate fertilization contributed to the increase of S in this system of reimplantation of pasture. In the absence of phosphate fertilization, the highest value of S was verified in the NSB system and the lowest value in the sowing system of the forage intercropped with soybean (Table 7).

None of the soil attributes was influenced by the interaction between pasture reimplantation systems and phosphate fertilization (Table 8). Regarding soybean yield, the highest value was verified in the system of sowing of forage intercropped with soybean and lower in the NSB and sowing of the forage to the haul. Phosphate fertilization contributed to the increase of shoot dry mass (MSPA) and soybean yield (Yield).

Table 8. Production and productivity components of soybeans with and without   phosphate in different forms of pasture reimplantation.

Treatment	Pop. Plant m^{-1}	Pod n° plant^{-1}	Grain n° vagem	Weight 100 grãos	Yield Kg ha^{-1}
NSB	13.1	34.4	2.0	14.0	1.848[b]
Seeding(S)	12.7	31.0	2.2	14.2	1.886[b]
S + line	13.1	35.2	2.1	14.4	2.070[ab]
S+line+ soybean	13.4	32.7	2.0	14.5	2.124[a]
CV	12.1	34.5	10.9	7.8	7.4
Phosp.					
with P	13.0	32.9	2.0	14.8	2.106[a]
withoutP	13.1	33.6	2.0	13.9	1.854[b]
CV	15.9	48.5	10.8	8.7	8.5
Probability (P≥F)					
Sist. (S)	0.847	0.878	0.195	0.700	0.009
Phosp. (P)	0.947	0.901	0.702	0.071	0.001
S × P	0.728	0.491	0.061	0.089	0.394

Means with the same letter in the columns do not differ by the Tukey test (P≤0.05). NSB, Seeding, Seending in line and Seeding in line + Soybean: natural seed bank, sowing of the forage to the haul, sowing of the forage in line and sowing of the forage in line consorciated with soybean, respectively.

According to Malavolta et al. (1997), the P sufficiency range indicated for soybean is 2 to 5 g kg^{-1}, therefore, P levels are suitable for soybean cultivation.

In many areas under the ecosystem, soybeans have been shown to have higher yields on straw of *Brachiaria* genus, mainly in succession to *U. brizantha* (Pitol et al., 2001; Kluthcouski and Stone, 2003)

Conclusion

Soybean yield was higher with reimplantation of intercropped pasture with soybean crop. This treatment provided an increase of 276 kg ha^{-1} in relation to treatment that did not have pasture reimplantation.

Phosphate fertilization provided an increase in soil phosphorus content, production of soybean dry matter, on leaf phosphorus content, and higher soybean yield.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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