EFFECTS OF DIFFERENT LAND USES AND SOIL MANAGEMENT ON SOIL EROSION AND WATER INFILTRATION IN AN OXISOL

Jullian S. Sone[1]; Paulo Tarso S. Oliveira[2]; Pedro A. P. Zamboni[2]; Nelson O. M. Vieira[2]; Glauber A. Carvalho[2]; Alexandre Romeiro de Araújo[3]; Denise Baptalin Montagner[3] & Teodorico A. Sobrinho[2]

1. INTRODUÇÃO

Embrapa Gado de Corte develops a long-term experiment in which crop-livestock-forestry integrated systems are studied since 2009. Another concurrent experiment on rotational grazing under variable stocking rate and different Nitrogen concentrations started in 2008. Those studies focus on comparing agronomic and economic efficiencies in different management systems (Macedo, 2009). Therefore, we aimed to investigate the influence of different land uses in agriculture with varied soil management on soil erosion and water infiltration in an Oxisol site located in the Brazilian Cerrado.

2. MATERIAL AND METHODS

Field experiments were carried out at the Embrapa Gado de Corte, located in Campo Grande, Mato Grosso do Sul, from November 2017 to July 2018. We used a portable rainfall simulator of 0.7 m^2 plots (Alves Sobrinho *et al.*, 2008). We applied a constant rainfall intensity of 74.9 ± 3.6 mm h^{-1} for 60 min after runoff onset, and we estimated the stable infiltration rate (SIR) using Horton's model. For soil loss, we measured runoff volume for 1 min every 2 minutes, and we collected one sample out of three from those measures in one-litre containers. To evaluate the effects of each treatment, we performed Scott Knott test ($\alpha = 0.05$).

Experiment (I) on intensive agriculture: the experimental area is 13.5-ha *Panicum maximum* cv. Mombaça pasture under variable stocking rate and different doses of Nitrogen fertiliser as 100, 200 and 300 kg ha^{-1} (RG100, RG200, and RG300 respectively). Each module contains six paddocks, in which the criterium adopted to distribute 54 steers (avg wt 300Kg) of 15 months old. We run rainfall simulations in four plot replicates with both vegetated and bare soil in each Nitrogen treatment, totalising 18 tests.

Experiment (II) on different soil management and land uses: the experimental area consisted of 14-ha degraded *Brachiaria decumbens* pasture, which was restored to different soil and agricultural management systems as continuous cropping (CC), integrated crop-livestock (CL), integrated crop-livestock-forestry systems (CLF), and continuous grazing (CG). Each of the four agricultural systems is composed of treatments with different soil and agricultural management. Further, we run rainfall simulations in four plot replicates with both vegetated and bare soil; also, we carried out tests in an undisturbed Cerrado area ("cerrado sensu stricto"), totalising 72 simulations.

1) PhD Student: Department of Hydraulics and Sanitation, São Carlos School of Engineering (EESC), University of São Paulo (USP), CxP. 359, São Carlos-SP, 13566-590. Contact: 67 9 9925 0212, julliansone@usp.br
2) Faculty of Engineering, Architecture and Urbanism, and Geography (FAENG), Federal University of Mato Grosso do Sul (UFMS), CxP. 549, Campo grande-MS, 79070-900. Contact: 3345 7440, mail.pedrozamboni@gmail.com, motta4001@gmail.com, glauber.altrao@gmail.com, paulotarsoms@gmail.com e teodorico.alves@ufms.br
3) Embrapa Cattle Beef, Campo Grande-MS, 79106-550. Contact: alexandre.araujo@embrapa.br e denise.montagner@embrapa.br

3. RESULTS

Experiment (I) on rotational grazing under variable stocking rate: Nitrogen fertilisation directly influences vegetation growth playing an important role in water infiltration into the soil. Experimental paddocks with 300 Kg N ha^{-1} showed higher SIR. RG100 and RG200 presented similar SIR but completely different soil loss results. We observed higher soil loss in RG100 compared with RG200 e RG300. Soil loss in those latter treatments did not show statistically different results comparing with the native Cerrado. In terms of water infiltration into the soil, adopting 100 or 200 kg N ha^{-1} does not significantly affect SIR; however, soil erosion reduced 78% from 100 to 200 kg N ha^{-1}. On the other hand, we only observed greater SIR in RG300 than in Cerrado, which also showed the least soil loss. In practice, it means that cattle beef production can increase minimising soil erosion impacts.

Experiment (II) on integration of crop, livestock, and forestry: The agricultural production and management system, in which we observed the highest SIR (an increase of 60%) and lowest soil loss, is *Eucalyptus urograndis* associated with the 4-year cropping followed by 4-year livestock rotation in the cropping phase (CLF-C). Regarding all integrated systems, we particularly observed better results in those, which recently migrated from pasture to cropping phase (CLF-C and CL-4C). Additionally, C1-L3 presented higher SIR even though it migrated from the cropping phase. The rotation period as in C1-L3 was the most suitable for reducing runoff and soil loss due to the balance between cropping and pasture. In plots with vegetation, we found two different groups of SIR ($\alpha = 0.05$): crop-livestock rotation systems and continuous cropping and grazing systems. Regarding soil loss, all treatments presented similar results.

CONCLUSION

We conclude that integration of different land uses and intensive agriculture are not only feasible alternatives to increasing productivity by intensification but also sustainable uses of arable land by improving water infiltration into the soil and reducing soil erosion. Regarding the crop-livestock rotation systems, the most feasible period management studied was 1-year crop followed by 3-year pasture (C1-L3) since it considerably improved water infiltration and reduced soil erosion even after 1-year cropping. Furthermore, we also demystify intensive agriculture production as a villain responsible for deforestation and land degradation. Rotation grazing under variable stocking rate and 300 kg N ha^{-1} (RG300) presented SIR greater than the observed in the Cerrado. With that type of production, farmers have the possibility to increase production using less area reducing soil and water losses since soil and water conservation principles are practiced.

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