SOIL MOISTURE UNDER INTEGRATED SOYBEAN PRODUCTION SYSTEM

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ABSTRACT
The soil moisture is an important factor to be considered, for this reason, the aim of this study is to evaluate the soil moisture in the two integration systems, and verify which adapts better to the soybean crop. Soil moisture was evaluated at 2 days pre-planting (November 08, 2017) and 32 Days Post-Planting (DAP), in which the soil was collected at 10 cm depth in the stratified sampling sites (A; B; C; D; and E) in the $ICLF_{28}$, $ICLF_{22}$, and ICL systems in two repetitions and also in a Cerrado area for comparison purposes. The ICLF (agroforestry-pasture system) systems presented lower soil moisture content at 2 days pre-planting and 32 days post-planting of soybeans.
Key words: Rainfall; Eucalyptus; agroforestry

INTRODUCTION

The farmer seeks to maximize land-use with crop diversification, increasing yield, reducing production costs, conserving the environment and increasing income. Crop-livestock-forest integration is a way to lead to a path of change where the concept of traditional property is left and inserted in a level of integrated and sustainable property (SILVA et al., 2016).

An important aspect, but one that has received little attention is how ICLF affects soil water dynamics. Even if water is not considered as a limiting resource in ICLF systems, compared to the other factors such as nutrients, light, temperature, biological competition among the species used, it still needs attention as climate change has increasingly challenged production systems (GIEZE et al., 2019).

Soil moisture is an important factor to be considered as it is essential for plant growth, aids in the nutrients mobilization and uptake and for its influence on the activity of soil fauna (MORRIS et al., 2006). For this reason, the aim was to evaluate soil moisture in integrated systems, in order to verify which one best suits the soybean crop.

MATERIAL AND METHODS

The experimental area used was 48 ha, located in Campo Grande – MS, Brazil (20º 27' S; 54º 37' W; 530 m altitude) at the Brazilian Agricultural Research Corporation (Embrapa), Beef Cattle Unit. The soil of the experimental area was classified as Red Dystrophic Latosol of clayey texture. The maximum precipitation during the eight months of study in the experimental time corresponding to the 2017/18 harvest, was 1,311.17 mm. The average temperature is 25 °C, and the maximum and minimum: 31.3 °C and 20.8 °C, respectively.

A recovery plan of the degraded area was carried out by means of the Integrated Agricultural Production Systems with a management time of 16 years, according to Table 1.

The treatments were arranged in subdivided plots: agroforestry-pasture system with an inter-row distance of 28 m ($ICLF_{28}$); agroforestry-pasture system with inter-row distances of 22 m ($ICLF_{22}$); and agro-pasture system (ICL).

The subplots were composed of the sampling sites, five sites equidistant between rows of eucalyptus trees (ICLF), with full sun cultivation as a witness (ICL). These sites were demarcated on a transect perpendicular to the tree rows (east-west direction). The sampling sites (north-south direction) were identified by letters (A; B; C; D; E), with the following distances from the tree rows: for $ICLP_{28}$: 7 m; 10 m; 11 m; 9 m; 4 m. As the center row was harvested from the old 14 m row spacing, this became a 28 m row spacing for $ICLF_{22}$: 3 m; 7 m; 10 m; 7 m; 3 m. In both systems, 1 m distance between the rows of eucalyptus and the crop was respected.

Soil moisture was evaluated at 2 days pre-planting (November 08, 2017) and 32 Days Post-Planting (DAP), in which soil was collected at 10 cm depth in the stratified sampling sites (A; B; C; D; and E) in the $ICLF_{28}$, $ICLF_{22}$ and ICL systems in two repetitions.

The gravimetric method was used in the evaluation, with the soil collected in aluminum pots, taken to an oven at 105 °C for 24 hours to obtain dry mass. Soil moisture was determined according to Klar et al. (1966):

$$\%M = [(\text{wet mass} - \text{dry mass}) / \text{dry mass}]*100$$

For the statistical analyses the qualitative factors were submitted to variance analysis and when the F test was significant, the Tukey test was applied, adopting a probability level of 5%.

RESULTS AND DISCUSSIONS

Soil moisture was higher in the ICL, both from 2 days pre-planting and at 32 days post-planting (Table 1). In the $ICLF_{28}$ and $ICLF_{22}$ systems, the presence of the forest component limits the light amount falling on the grass, consequently limiting its growth and mass production. With smaller amounts of dry mass left as residue, the moisture retained by the soil is lower throughout the soybean crop cycle.

Trees are considered natural antagonists because they benefit from water storage, and in the upper part of the soil the grasses also benefit from the water in the upper soil layers, contrasting with trees that their roots take advantage of the underground water resources (SARMIENTO et al., 1984).

Table 1. Soil moisture (%) before and post soybean planting.

	Soil moisture (%)	
System	**2 Days Pre-planting**	**32 Days postplanting**
[1]ICL	21.6 a	17.3 a
[2]$ICLF_{28}$	16.5 b	13.7 b
[3]$ICLF_{22}$	17.7 b	16.2 ab
[4]CV %	8.33	

[1]agro-pasture system (ICL); [2]agroforestry-pasture system with an inter-row distance of 28 m ($ICLF_{28}$); [3]agroforestry-pasture system with inter-row distances of 22 m ($ICLF_{22}$); [4] CV: Coefficient of variation. Means followed by the same lowercase letter in the column do not differ by the Tukey test (P>0.05).

One of the factors for maintaining higher soil moisture is the straw that was left by the Piatã grass prior to soybean sowing, an important factor for maintaining soil moisture in the area. In the system where there is no light restriction (ICL), the grass produces more dry mass, which contributes to the soil moisture retention.

This trend of higher soil moisture in the ICL system extends throughout the soybean cycle (Figure 1), with a significant difference only between the systems with a forest component ($ICLF_{28}$ and $ICLF_{22}$) and the full sun system (ICL). Soil moisture in ICL was higher by 26.31% and 15.72% compared to ICLF, at 2 days pre-planting and 32 days post-planting respectively.

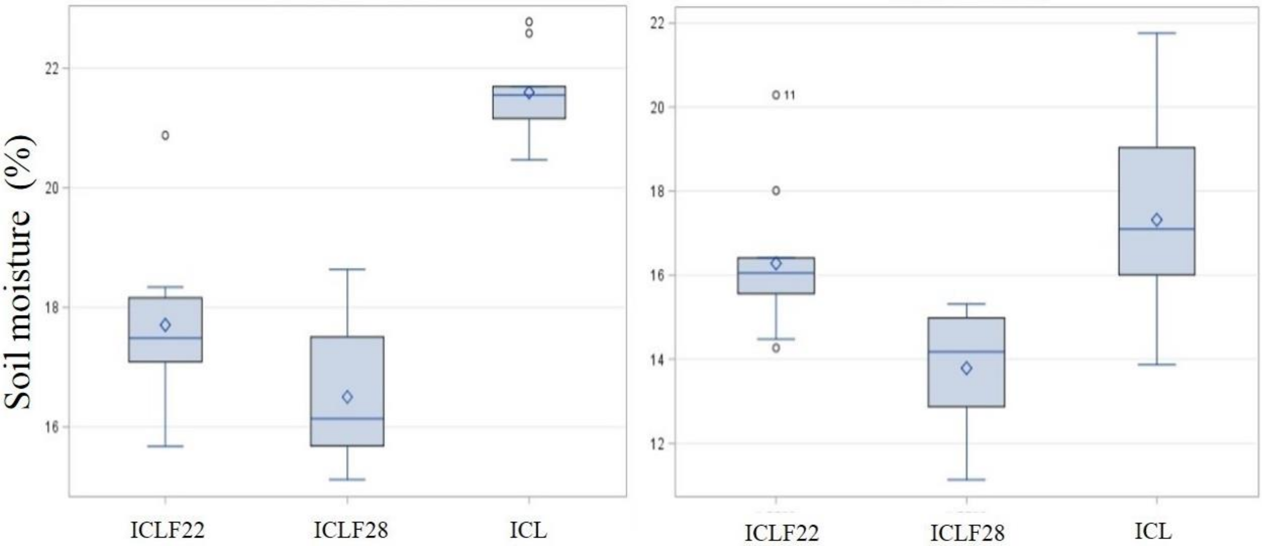

Figure 1. Soil moisture (%) 2 days pré- planting and 32 days post-plantin

The decrease in moisture content in the ICLF system, can be explained by the collection points such as A and D that were close to the row of eucalyptus and that may have reflected in the final mean. In evaluations in the previous two years 2015/16, it was reported that rainfall interception by the tree canopy did not influence the amounts of rainfall received along the points between the tree gradients by the pluviometer. At the points near the tree rows, the plants were approaching the wilting point during the dry season, a strong water stress indicator (GIEZE et al., 2019).

CONCLUSIONS

The ICLF (agroforestry-pasture system) systems presented lower soil moisture content at 2 days pre-planting and 32 days post-planting of soybeans.

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