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ANALYSIS OF SOIL TEMPERATURE IN DIFFERENT COVERS OF SECOND CROP CORN IN TRANSITION AREA OF AMAZON AND CERRADO BIOMES

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ABSTRACT
The objective of this work was to evaluate the variation of the average, minimum and maximum temperatures in two (2) type of surfaces: soil with crop residues and straw of Brachiaria and the soil under it or bare soil in two experimental areas at Embrapa Agrossilvipastoral located in Sinop, MT. Those area were managed with conventional cultivation and corn and brachiaria intercropping. Thermal images and GPS locating were used to produce maps of variability using IDW metodology. As expected, results have shown that average and maximum temperatures on the surface with straw were higher compared to temperature under the straw. The difference between maximum temperatures reached 15.5 ºC.
Key words: Agricultural cover; soil temperature; spatial variability

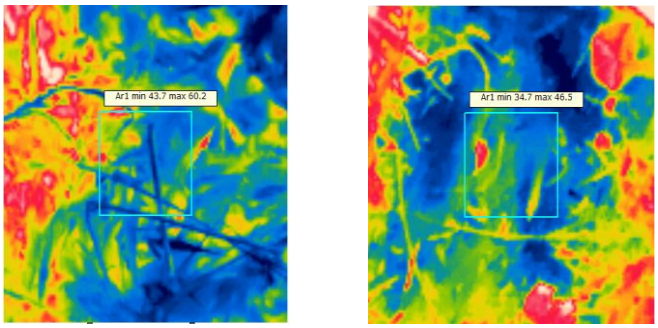
INTRODUCTION

Variations in soil temperature due to different types of agricultural management, such as conventional and no-tillage, affect the local sustainability of the soil. Regarding to soil management, the second crop of corn and *Brachiaria ruziziensis* aims to produce a greater volume of residues, which result in a greater amount of organic matter for biological activity and, consequently, an improvement in the cation exchange capacity (CTC). The CTC enhances the retention of fertilizers in the soil, avoiding its transfer to the water table (TRECENTI, 2011). Conversely, despite being widely used, the conventional system increases the mechanical strength of machines due to the increase in apparent density rates. Also, regarding to soil biology, Dong et al. (2013) study quantified a great diversity of nematodes in no-tillage systems when compared to a conventional corn planting system. Studies evaluating soil temperature are poorly documented, especially in tropical regions. The work of Monneveux et. al. (2006) carried out in Mexico, revealed that the peaks of temperature in the soil in the rainy and dry seasons were between 30 and 33 °C respectively. The objective of this work was to evaluate the variation of the average, minimum and maximum temperatures in two (2) type of surfaces: bare soil and soil with crop and *Brachiaria* residues in two experimental areas with conventional cultivation and corn and brachiaria intercropping.

MATERIAL AND METHODS

The thermal images used in this study were collected in the technological showcase area at Embrapa Agrossilvipastoral located in Sinop-MT (11°52'26.0"S, 55°35'50.7"W). The two experimenal areas encompassed 0.64 (Plot 1) ha and 0.4 ha (Plot 2), respectively, corresponding to conventional crop and forestry integration. The former crop planted in the areas was corn and brachiaria (Plot 1) and Corn (Plot 2). The data sampling was carried out on August 15 (142 samples collected from 2PM to 4PM), 2018; August 30 (216 samples collected from 8AM to 11 AM), 2018; and September 6, 2018 (139 samples collected from 2PM to 4PM). This approach corresponded to two days were sampled in the afternoon and one in the morning. This period in the north of Mato Grosso, still corresponds to the end of the dry period in the region. To acquire thermal images (° C), the FLIR i7® camera (FLIR,

Wilsonville, OR) was used. For each chosen point, a thermal image was obtained on the straw surface, normally consisting of corn residues (leaves, trunks), and *Brachiaria. A*fter georeferencing the set of points with Etrex 30® Garmin GPS equipment, a second thermal image was obtained, at the same point, with the maximum exposure of the bare soil, obtained with the aid of a metal hoe. This procedure was performed taking care to not to disturb the physical structure of the soil, just cleaning the area. The samples were chosen on a zig zag path at random pattern. For the thermal image processing, FLIR Quick Report software was used. A feature of this software allows an area represented by a square, in the image, to be moved by the user in order to emphasize the studied target. Once the square is positioned, the system quantifies the maximum and minimum temperatures. Exploratory data analyses were performed. Figure 1 illustrates thermal images regarding the temperature on and under the crop residues and Brachiaria straw.



(a) (b)

Figure 1. Thermal images of one geographic point (a) with crop residues and (b) without crop residues and Brachiaria straw.

For each point, the minimum and maximum temperature were stored, and the average temperature was estimated in an Excel spreadsheet. For temperature analysis, the free software QGis Version 2.18.4 and the statistical environment R were used. The interpolation of the data was performed using the inverse distance to power (IDW) technique, which allowed the construction of maps for estimate unknown local temperature values across the study area. A limitation of this IDW interpolation technique lies in the fact that the decrease in the quality of the interpolation occurs when the distribution of the sampling points is irregular. In addition to the spatial positioning of the temperature variable, exploratory data analysis was carried out using histogram and boxplot graphs in the R environment.

RESULTS AND DISCUSSIONS

Considering all days of sampling, the temperature maps showed the average and maximum temperatures on the surface with straw higher than those without straw, or exposed soil, that is, solar energy heats predominantly to residues on the surface. The lowest average temperatures were located below the forestry component, as in the shade of medium and large trees such as cashew and Brazil nuts (Figure 2). The highest maximum temperature in the straw was 67.7 ºC on 08/30/2018 in plot 2 (corn residue only) and the lowest minimum temperature of 24.1 ºC also in the same day in plot 1 (corn and brachiaria residue). The difference between maximum temperatures reached 15.5 ºC.

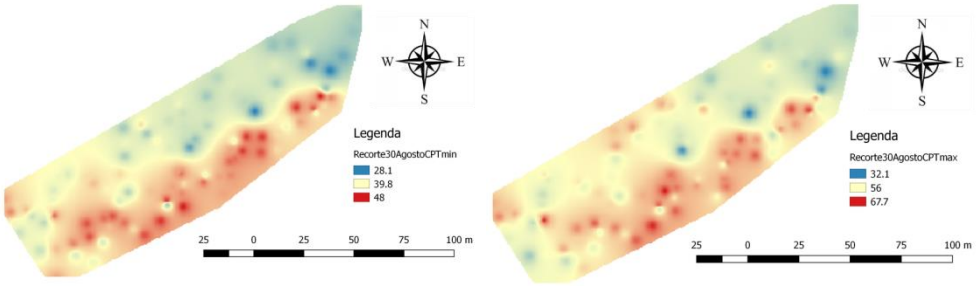


Figure 2. Spatial variability of minimum (a) and maximum (b) temperature at crop residues and soil under the brachiaria straw or crop residues.

CONCLUSIONS

The objective of this work was to evaluate the variation of the average, minimum and maximum temperatures of the exposed soil surface and at crop straw in two experimental areas with conventional corn cultivation and corn and brachiaria intercropping. Evaluating the temperature variation, it was concluded that the straw, whether only corn residues or brachiaria biomass, alleviates the temperature on the soil surface. Future work should correlate the effects of soil temperature with agricultural production.

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