SPECTRAL CHARACTERIZATION OF PERENNIAL GRASS (*BRACHIARIA BRIZANTHA*) GROWN OVER SOIL CONTAMINED BY HYDROCARBONS: A POTENTIAL TOOL FOR DETECTING PIPELINE LEAKAGE

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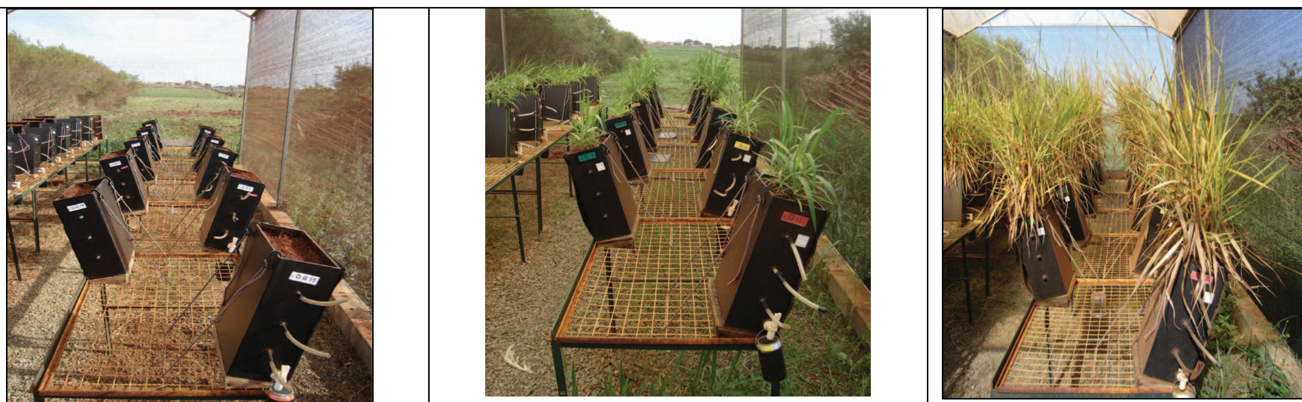
1. INTRODUCTION

This work comprised the crop growing of a type of perennial grass namely Brachiaria brizantha considering an experiment that reproduces, at reduced scales, the soil-vegetation system through which hydrocarbon pipelines bypass. This allowed the analysis of the physiologic responses of the plant and its relation to soil contamination by gasoline and diesel, besides the assessment of key spectral indicators of the presence of HCs in the environment. The overall notion of the research is to develop a hydrocarbon (HC) pipeline monitoring technique that it is efficient, practical, of low cost and capable to detect small leakages precociously, which are barely discernible by current practices, and before they impact the environment evidently.

2. METHODS

Brachiaria brizantha was grown under controlled conditions in a greenhouse (Fig. 1). Three sets of vessels were employed in the experiment – one set was used as a control and two others were contaminated by gasoline and diesel, simulating a small leakage affecting the soil-vegetation system over a long period of time (6 months). Visible and infrared reflectance spectra measurements (350-2500nm) were taken periodically during the experiment using an ASD full-resoultion FieldSpec spectrometer (ASD). Leaf height and plant canopy were documented throughout the experiment. Measurements of dry matter mass and leaf biochemical analysis (chlorophyll-a, chlorophyll-b, carotenoid, starch and cellulose) were also conducted



(a) (b) (c)

Fig.1. Greenhouse and set of acrylic vessels were the experiments were conducted. Control plants at T=0 (a), T+1 month (b), T+4 months (c).

3. RESULTS

Brachiaria brizantha submitted to both gasoline and diesel contamination yielded spectral responses on the visible and near-infrared that are akin to early work [1] [2] [3] [4] [5], including intense degradation of the chlorophyll and maintenance of the carotenoids. Such spectral patterns (Fig. 2a) were verified against and matched with chemical analytical results of redundant samples.

The spectral response of the contaminated plants in the shortwave infrared region, however, proved most enlightening and yet unprecedented in modern literature. Not only was the loss of plant water due to the presence of HCs pinpointed spectrally, but also new features were revealed that are dissociated from the visible, natural plant phenological evolution (Fig. 2b).

4. CONCLUSIONS

The work highlights the realistic possibility to determine low HC content on soils based on vegetation spectral changes, demonstrating that the cultivation of such grass species over pipelines may be a reliable approach to monitor and detect small HC leakages.

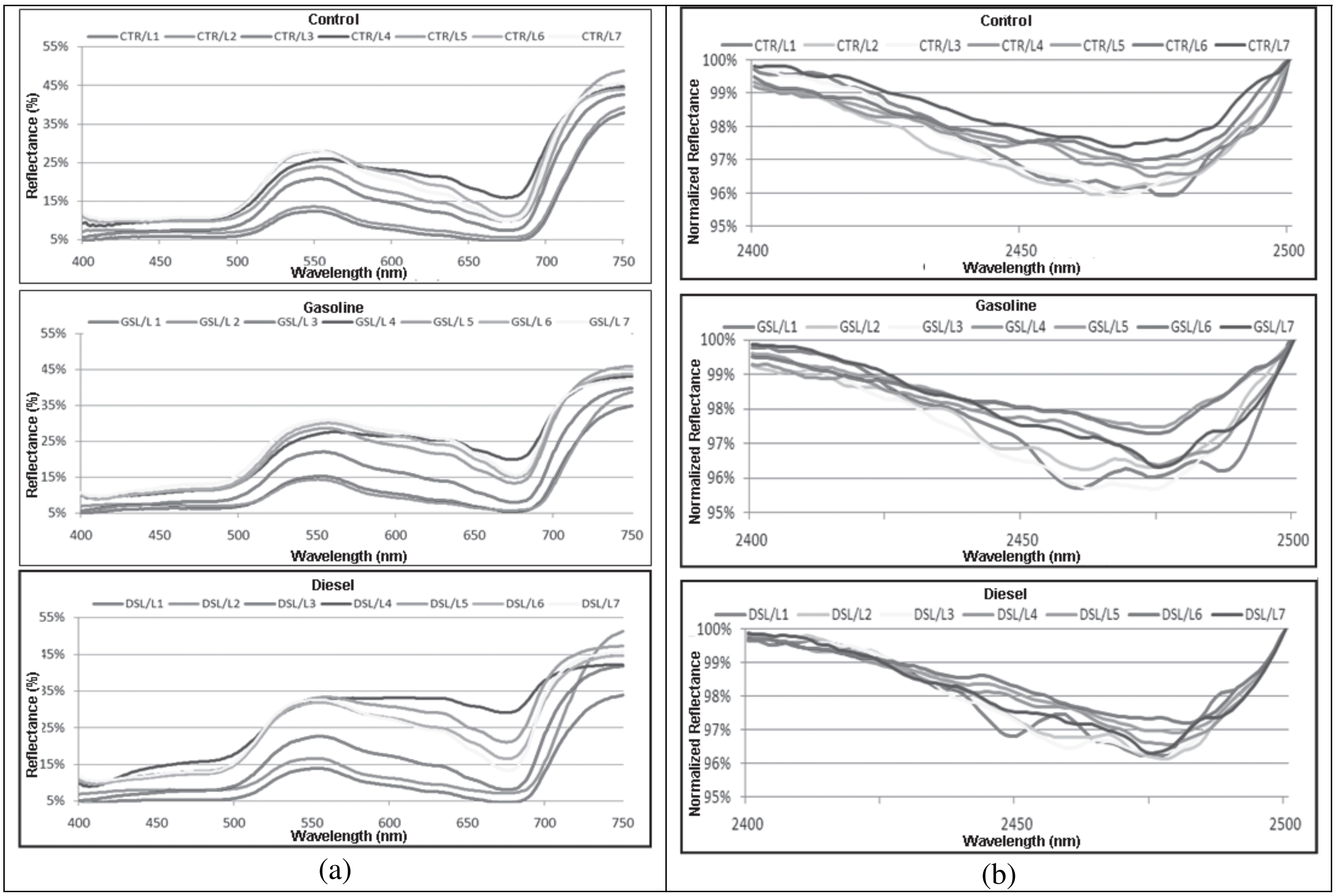


Fig. 2. Visible-near infrared (a) and shortwave infrared (b) spectral patterns of Brachiaria brizantha considering hydrocarbon-free growth (control) and plants evolved over soils contaminated with gasoline and diesel

5. REFERENCES

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