ENVIRONMENTAL MONITORING AND MODELING OF THE GENETIC POTENTIAL OF SUGARCANE CULTIVARS UNDER APPROPRIATE SOIL WATER AVAILABILITY

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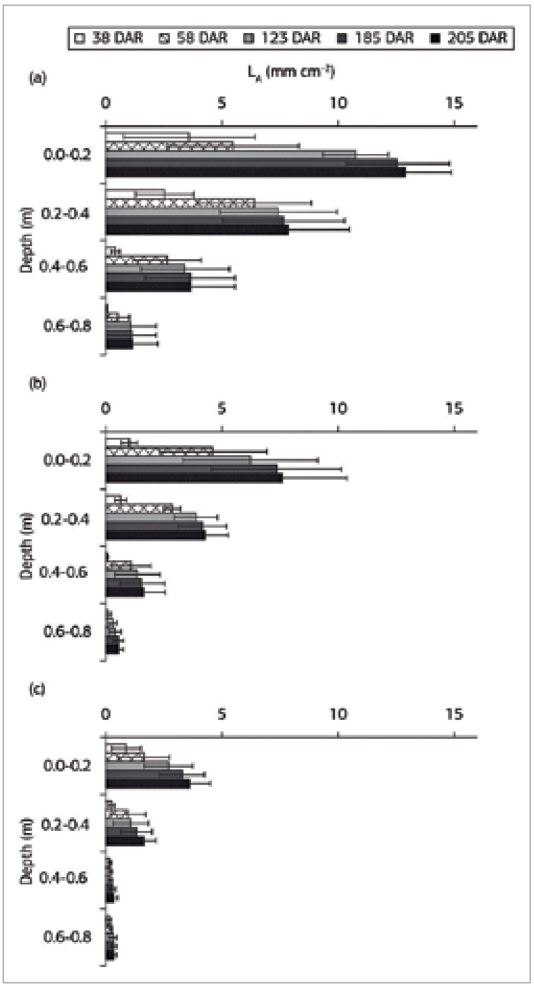

Figure 1. Cumulative root density (L_A) in sugarcane cultivars IACSP94-2101 (a), SP79-1011 (b) and IACSP94-2094 (c) in five assessments up to 0.8 m depth. Each bar represents the mean value of three replications (± s.e.). DAR = days after ratoon (Source: Ohashi et al., 2015)

The need for bioenergy production is a growing concern on modern society due to the sustainability of the activities associated with the growing economic demand. The average yield achieved in Brazil is less than 80 tons per hectare. This value is low when compared to the crop biological potential value, which is more than 300 tons per hectare. The use of irrigation practices in sugarcane can improve the crop yield and enhance the nutrient efficiency, especially when a subsuperfical drip fertirrigation is adopted.

Concerning the sugarcane crop irrigation in Brazil, it is mainly used for vinasse application. Systemically irrigated areas are still just few if compared to the potential for the use of this technique. In this context it is important to point out that the yield response to water differs according to variety, environment and cultural practices. It is also necessary studies related to water use efficiency in irrigated crops. Therefore, it is important determine parameters to promote water use efficiency and evaluate the response of different varieties to water supply.

In order to understand the plant water dynamic in relation to the environment, the use of sensors to monitoring the climate, soil water, soil fertility and plant growth becomes necessary. Thus, the objective of this research was to evaluate the crop evapotranspiration, crop development, yield, water use efficiency, root system growth and distribution, and calibration and use of models to yield forecast in four different sugarcane cultivars. These cultivars have different characteristics related to the water availability and canopy architecture. It was used a subsurface drip irrigation system and the irrigations were done every day, except on rainy days.

The field experiment was conducted during two sugarcane ratoons. The meteorological parameters, (agricultural weather station), soil water and soil electrical conductivity (capacitance probes), root growth (rootscanner -minirhizotron) and distribution (auger method), crop growth, yield and qualitative attributes were monitored during the field experiment. The crop evapotranspiration was estimated using a water balance.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

Root growth varied during the crop cycle, with the highest values being found between 38 and 58 days after ratoon (DAR). There was a genotypic variation in root growth, with IACSP94-2101 showing the highest La (cumulative root density) of 12.9 mm cm^{-2}. It was possible to observe variation in root growth rates among cultivars and among the sampling time. Considering the sampling time, higher rates were observed between 38 and 58 DAR in all cultivars (*Figure 1*). This information could be useful when using saving irrigation. The lateral root distribution varied between IACSP94-2101 and IACSP95-5000 cultivars and the effective rooting depth was respectively 0.6 and 0.8 m depth (*Figure 2*). Understanding the root distribution along the crop cycle could provide useful information for water and nutrient management and modeling purposes.

The highest yield and water use efficiency (WUE) were observed in IACSP94-2101 and IACSP95-5000 cultivars. The obtained yields were 241,9, 236,5, 197,8, and 183,5 Mg ha^{-1} for IACSP 94-2101, IACSP95-5000, SP791011 and IACSP 94-2094 cultivars, respectively. Considering yield and actual evapotranspiration, the WUE varied from 20,85 to 14,4 kg m^{-3}. Higher WUE values were obtained for IACSP 94-2101, IACSP95-5000. The obtained results showed different responses in yield and WUE according to the sugarcane cultivar when irrigated by SDI. Concerning the second sugarcane ratoon,the achieved yields were more than two times higher in all cultivars evaluated when compared to the average yield in the country. In the first ratoon there was good calibration for AQUACROP and CANEGRO the DSSAT system model. The potential production (PP) cultivars with erect leaves as IACSP94-2101 and SP79-1011 were simulated with a small decrease in precision (R2) in relation to the other cultivars when used CANEGRO model from DSSAT system. In the second ratoon, the AQUACROP model did not presented good yield estimate as observed for the cultivars with sprung leaves (IACSP95-5000 and IACSP94-2094). However, CANEGRO model DSSAT system showed better calibration for second ratoon than the observed for the first one.

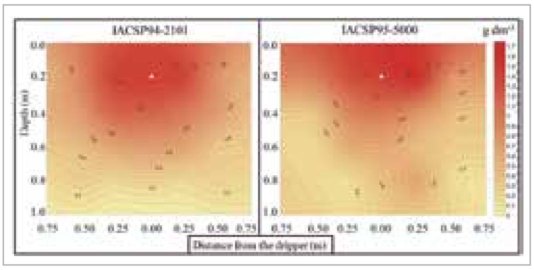

Figure 2. IACSP94-2101 and IACSP95-5000 root distribution (MDR; g dm^{-3}) in the soil profile up to 1.0 m depth and 0.75 m apart from the planting row from both sides. The white points represent the dripper position, at 0.2 m depth (Source: Ohashi et al., 2014)

MAIN PUBLICATIONS

Ohashi AYP, Pires RCM, Ribeiro RV, Silva ALBO. 2015. Root growth and distribution in sugarcane cultivars fertigated by a subsurface drip system. *Bragantia*. **74(2)**: 131-138.

Ohashi AYP. Crescimento e distribuição do sistema radicular de cultivares de cana-de-açúcar fertirrigada por gotejamento subsuperficial. 2014. Dissertação (Agricultura Tropical e Subtropical) – Instituto Agronômico de Campinas.

Silva ALBO. Produção e eficiência no uso da água de quatro cultivares de cana-de-açúcar irrigadas por gotejamento subsuperficial em Campinas, SP. 2014. Dissertação (Agricultura Tropical e Subtropical) – Instituto Agronômico de Campinas.

Silva ALBO, Ohashi AYP, Pires RCM, Ribeiro RV, Rolim GS. 2014. Consumo de água e coeficiente de cultura de quatro cultivares de cana-de-açúcar irrigadas por gotejamento subsuperficial. In: II INOVAGRI International Meeting, 2014, Fortaleza. *Anais do II INOVAGRI International Meeting*. Fortaleza: Inovagri, 2014. p.1-7.

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Silva ALBO, Pires RCM, Ohashi AYP, Ribeiro RV, Landell MGA, Souza SACD. Plant development and yield of four sugarcane varieties irrigated by a subsurface drip irrigation system in Campinas, Brazil In: EGU General Assembly, 2013, Vienna. EGU General Assembly. Vienna: European Geosciences Union, 2013. v.1. p.1.

Ohashi AYP, Pires RCM, Silva ALBO, Ribeiro RV. Root system stabilization of sugarcane fertigated by subsurface drip using a minirhizotron In: EGU General Assembly, 2013, Vienna. EGU General Assembly. Vienna: European Geosciences Union, 2013. v.1. p.1.

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