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Efficient irrigation management in sugarcane cultivation in saline soil[1]

Manejo eficiente da irrigação em cultivo de cana-de-açúcar em solo salino

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HIGHLIGHTS:

Biometric and production characteristics of sugarcane varieties under saline conditions were influenced by leaching fraction.
Irrigation water depths equivalent to 110 and 120% of ETc do not influence the technological quality of sugarcane varieties.
The leaching fraction using 110% of ETc increased water use efficiency to varieties SP943206 and VAT90212.

ABSTRACT: The objective of this study was to evaluate the influence of leaching fraction on the biometric and production characteristics and technological quality of the juice of sugarcane varieties grown in saline soil in the Brazilian semiarid region. The experimental design was in randomized blocks, with three repetitions, in a 2 × 3 × 3 factorial scheme, corresponding to two sugarcane cultivation cycles: plant cane and ratoon cane; three sugarcane varieties: RB72454, SP943206 and VAT90212; and, three leaching fractions of irrigation water: 0; 9.1; and 16.6%. Number of living leaves, number of internodes, leaf area, stem diameter, plant height, number of tillers, yield, total soluble solids content (°Brix), percentage of industrial fiber, juice purity, juice Pol%, cane Pol% and total recoverable sugar were evaluated. At the end of the two crop cycles, water use efficiency was determined. The varieties SP943206 and VAT90212 showed higher yield under leaching fraction of irrigation water of 9.1% in both cycles, and higher water use efficiency values were observed for the variety VAT90212. Application of leaching fractions to reduce soil salinity does not promote changes in the technological quality of the sugarcane varieties RB72454, SP943206 and VAT90212.

Key words: *Saccharum* sp., leaching fractions, salinity, technological quality, water use efficiency

RESUMO: Objetivou-se neste estudo avaliar a influência da fração de lixiviação nas características biométricas, produtivas e na qualidade tecnológica do caldo de variedades de cana-de-açúcar cultivadas em solo salino no Semiárido brasileiro. O delineamento experimental foi em blocos casualizados, com três repetições, em esquema fatorial 2 × 3 × 3, sendo dois ciclos de cultivo da cana-de-açúcar: cana planta e cana soca; três variedades de cana-de-açúcar: RB72454, SP943206 e VAT90212; e, três frações de lixiviação da água de irrigação: 0; 9,1; e 16,6%. Avaliou-se número de folhas vivas, número de entrenós, área foliar, diâmetro do colmo, altura da planta, número de perfilhos, produtividade, teor de sólidos solúveis totais (°Brix), porcentagem de fibra industrial, pureza do caldo, Pol% do caldo, Pol% da cana e açúcar total recuperável. Ao final dos dois ciclos da cultura foi determinada a eficiência do uso de água. As variedades SP943206 e VAT90212 demonstraram maior produtividade sob fração de lixiviação da água de irrigação de 9,1% nos dois ciclos e maiores eficiência do uso de água foram observadas na variedade VAT90212. A aplicação de frações de lixiviação para reduzir a salinidade do solo não proporciona alterações na qualidade tecnológica das variedades RB72454, SP943206 e VAT90212 de cana-de-açúcar.

Palavras-chave: *Saccharum* sp., fração de lixiviação, salinidade, qualidade tecnológica, eficiência do uso da água

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INTRODUCTION

The concentration of salts in the soil solution directly affects the development and yield of crops in various parts of the globe and constitutes one of the most relevant causes of environmental degradation (Safdar et al., 2019). The problem has been more evident in arid and semiarid regions due to the low rainfall and high rates of evapotranspiration (Shankar & Evelin, 2019; Castro & Santos, 2020).

In the semiarid region of Brazil, especially in the Sub-Middle region of the São Francisco Valley, the agriculture practiced is characterized by the intensive use of the soil with irrigated crops. Among the crops of economic importance, sugarcane stands out with high water demand (12,000 m^3 ha^{-1} $year^{-1}$), which is supplied by the practice of full irrigation throughout the agricultural season (ANA, 2019).

Sugarcane is one of the most efficient photosynthetic grasses due to its C4 metabolism, which promotes growth rate and water use efficiency two to three times higher than those of C3 metabolism plants (Casagrande, 1996). However, it is a crop that demands large amount of water during its production cycle, consuming between 1,500 and 2,000 mm per annual cycle to produce around 100 to 150 Mg ha^{-1} (Doorenbos & Kassam, 1979), which represents a high water demand for regions such as the Sub-Middle of the São Francisco Valley, with mean annual precipitation between 400 and 550 mm (Pereira et al., 2003).

Salt stress causes alterations in the photosynthetic rate of sugarcane varieties, which may be associated with changes that also occur in the stomatal conductance (Simões et al., 2019). Under salinity, photosynthesis and cell growth of plants are directly affected due to the decrease in the carbon dioxide availability (Simões et al., 2018).

Mustafa & Akhtar (2019) report that about 50% of the land will be salinized within the next 50 years if techniques to reduce and mitigate the adverse impact of soil salinity are not adopted.

According to Manzoor et al. (2019) and Ning et al. (2020), the harmful effects of soil salinity can be mitigated through the adoption of leaching fractions, which consists in applying irrigation water depths greater than crop demand, by removing excess salts from the root zone. However, the type of soil, irrigation system and variety of the crop are characteristics that significantly interfere in the efficiency of irrigation management.

The objective of this study was to evaluate the influence of leaching fraction of irrigation water on the biometric and production characteristics and technological quality of the juice of sugarcane varieties grown under saline conditions in the Brazilian semiarid region.

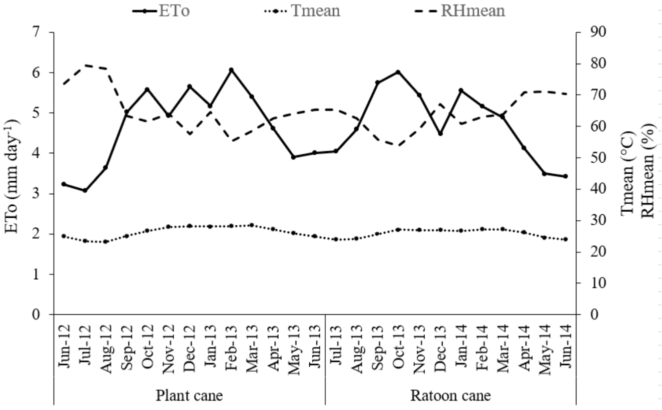
MATERIAL AND METHODS

The experiment was conducted in a commercial sugarcane production plot belonging to the Agrovale Mill, in Juazeiro, BA, Brazil, in the years 2012, 2013 and 2014. The soil of the experimental area was classified as Inceptisol, with the following characteristics (Table 1).

According to the Köppen-Geiger classification, the climate of the region is BSwh', characterized as very hot, steppe-type semiarid climate. The mean annual rainfall is 481 mm, with the rainy season concentrated in the months from November to April, with no water surplus in the water balance in any month of the year. With average temperature above 18 °C and mean relative air humidity around 55%, it has a mean annual potential evapotranspiration of 1,512 mm (Lopes et al., 2017).

The meteorological data of reference evapotranspiration (ETo), temperature (Tmean) and relative air humidity (RHmean) along the two cultivation cycles are presented in Figure 1.

The experimental design was in randomized blocks, with three repetitions, in a 2 × 3 × 3 factorial scheme, totaling 54 experimental plots, composed of five double rows of sugarcane, with length of 12 m. The factors evaluated were two sugarcane cultivation cycles (plant cane and ratoon cane), three sugarcane varieties (RB72454, SP943206 and VAT90212) and three leaching fractions of irrigation water (0; 9.1 and 16.6%, which represented the irrigation water depths of 100, 110, and 120% of crop evapotranspiration (ETc), respectively), irrigations totaled 1642, 1806 and 1970 mm in plant cane and 1782, 1960 and 2138 mm in ratoon cane, for 100, 110 and 120% of ETc, in that order. The leaching fraction of the irrigation water was estimated according to Medeiros & Gheyi (1997) When the salinization process reaches equilibrium, the ratio between the percolated depths



ETo - Reference evapotranspiration; Tmean - Mean temperature; RHmean - Mean relative air humidity

Figure 1. Monthly averages of agrometeorological data collected in an automatic weather station in the municipality of Juazeiro, BA, Brazil

Table 1. Chemical attributes of the soil in the experimental area the Agrovale Mill, in Juazeiro, BA, Brazil*

Depth (cm)	ECs (dS m^{-1})	pH	P (mg dm^{3})	K	Na	Ca	Mg	H + Al	SB	CEC	V (%)	Cu	Fe	Mn	Zn
				(cmol$_c$ dm^{-3})								(mg dm^{3})			
0-20	6.1	6.4	10.1	0.11	1.1	10.0	3.8	1.3	15.0	16.3	92.1	1.3	42	76.8	3.69
20-40	4.4	5.8	2.4	0.06	0.4	7.2	2.5	2.7	10.2	12.9	78.9	1.4	98	88.4	1.13
40-60	5.5	5.9	2.8	0.06	0.5	7.6	4.1	2.9	12.3	15.1	81.0	1.7	98	72.5	0.96

*Analysis performed in the Soil Laboratory of Embrapa Semiarid; ECs - Electrical conductivity of the soil saturation extract; CEC - Cation exchange capacity; SB - Sum of bases and the total water applied is equal to the relationship between the concentration of salts in the applied water and drained water, corresponding to the leaching fraction.

The sugarcane varieties were planted using whole stems, placed horizontally in the cultivation row, at a density of 12 buds per linear meter, in double rows, at spacing of 0.70 x 1.30 m. The usable area of the plots was composed of the three central double rows, disregarding 1.0 m at the ends of the cultivation rows.

The leaching fractions were calculated as a function of the ETc, based on the reference evapotranspiration obtained through an agrometeorological station installed near the experiment, using the Penman-Monteith method modified by Allen et al. (1998). The values of crop coefficient (Kc) used for irrigation management followed the standard conventionally used in the commercial areas (0.65; 0.80; 1.00; 1.00; 1.15; 1.15; 1.15; 1.10; 1.10; 0.90; 0.90; and 0.90 for the 12 months of cultivation during the cycle) as recommended by Silva et al. (2012).

Irrigation was applied using a subsurface drip system, installed at 0.20 m depth, with pressure-compensating emitters and flow rate of 1.6 L h^{-1}, spaced apart by 0.5 m. The irrigation water depths were automatically controlled by the valve control panel, connected to hydraulic solenoid valves, which allowed releasing the exact amount of water defined for each treatment.

Cultural practices and applications of agricultural pesticides were carried out according to the needs of the crop. Basal fertilization, defined based on soil chemical analyses and on crop requirements, consisted of the application of 140, 90 and 180 kg ha^{-1} of N, P_2O_5 and K_2O, respectively, following the recommendation for the crop (Cavalcanti, 2008). Urea, monoammonium phosphate-MAP and potassium chloride were used as sources of nutrients. Topdressing fertilizations were performed via fertigation, three times a week.

Harvests were carried out when sugarcane plants reached 12 months of age, both in plant cane and ratoon cane. During harvest period, 10 plants were selected per plot and the number of living leaves (NLL), number of internodes (NI), leaf area, stem diameter, plant height, number of tillers (NT) and yield were evaluated. Stem diameter was measured with a digital caliper, obtaining the average of three measurements between the fifth and sixth internode of three selected plants, each of which constituted one replicate. Plant height was measured using a tape measure as the distance from the soil to the ligule of the first open leaf. The leaf area was determined using a LI-COR® leaf area meter, model LI 3100C, to measure the leaf area of each open leaf.

Technological analyses were carried out after random sampling of 10 stems per plot, which were sent to the laboratory to determine the total soluble solids content (°Brix), percentage of industrial fiber, juice purity, juice Pol%, cane Pol% and total recoverable sugar (TRS).

At the end of the two crop cycles, the water use efficiency (WUE) of the water regimes was determined as the ratio between crop yield (kg ha^{-1}) and the applied water depth plus total precipitation (mm) used for each treatment (Singh et al., 2007).

The data were subjected to analysis of variance by F test and the means were compared by Tukey test ($p \leq 0.05$).

RESULTS AND DISCUSSION

Plant height was influenced by the leaching fractions, and sugarcane varieties subjected to irrigation water depths of 110 and 120% ETc had statistically higher values of plant height (3.20 and 3.27 m) compared to those that received 100% ETc (2.94 m). This result may be associated with the leaching fractions provided by treatments with irrigation water depths above 100% ETc, which tend to reduce the concentration of salts in the root zone.

This type of management is used in salinized soils because, according to Targino et al. (2017), soil salinity can cause reduction in the plant's ability to absorb water, limiting its morphological formation and the physiological and biochemical processes involved in its growth. Plant height was also influenced by the crop cycle; in plant cane cycle, the varieties reached 3.22 m height and, in ratoon cane, the plants showed an average height of 3.05 m.

Regarding the number of internodes (NI), there were significant isolated effects of the three factors (leaching fractions, varieties and cultivation cycle). The lowest leaching fraction promoted higher NI (24.2), while the plant cane cycle resulted in lower NI. The variety SP943206 showed higher NI (23.8) compared to the variety RB72454 (22.5), but neither showed differences in comparison to the variety VAT90212 (22.8).

It is important to highlight that the number of internodes, according to Oliveira et al. (2016), is an intrinsic characteristic of the sugarcane variety. There is an inverse relationship between plant height and NI, and this result was also observed by Tena et al. (2016), who evaluated characteristics of sugarcane cultivars in Ethiopia and found that higher values of height correspond to lower numbers of internodes.

The number of living leaves (NLL) was influenced by the interaction between leaching fractions and variety (Table 2). However, the plants subjected to the irrigation water depths of 100% ETc did not show differences in NLL. The presence of salts in the solution may have affected the number of living leaves of the variety VAT90212, because the reduction in NLL is a response of the plant to the stress caused by salinity. According to Taiz et al. (2017), the reduction in the number of living leaves, and consequently the reduction in leaf area, reduces the transpiration flow, which also reduces the absorption of saline elements.

The biometric characteristic number of tillers (NT) varied according to the interaction between cultivation cycle and irrigation water depths (Table 2) and the interaction between varieties and cultivation cycle (Table 3). The highest leaching fraction (ETc = 120%), which promotes higher soil moisture,

Table 2. Mean number of living leaves (NLL) under irrigation water depths (% ETc) × varieties and number of tillers (NT) under irrigation water depths (% ETc) × cultivation cycles

% ETc	NLL			NT	
	RB72454	SP943206	VAT90212	Plant cane	Ratoon cane
100	7.1 Ba	6.4 Aa	6.7 Ba	17.2 Aa	14.6 Ab
110	8.3 Aa	6.5 Ab	7.0 ABb	14.2 Ba	14.0 Aa
120	7.2 Bab	6.8 Ab	7.8 Aa	12.9 Ca	12.6 Ba

Means followed by same uppercase letters in the columns and same lowercase letters in the rows do not differ from each other by Tukey test ($p \leq 0.05$)

Table 3. Mean of number of tillers (NT) as a function of the cultivation cycle and sugarcane varieties

Cycle	NT		
	RB72454	SP 943206	VAT 90212
Plant cane	13.42 Ab	14.94 Aa	15.97 Aa
Ratoon cane	13.79 Aab	13.19 Bb	14.25 Ba

Means followed by same uppercase letters in the columns and same lowercase letters in the rows do not differ from each other by Tukey test ($p \leq 0.05$)

did not result in a higher number of tillers (Table 2). Costa et al. (2016) found that the NT is higher under a replacement depth of 100% ETc compared to larger water replacement depths. Regarding the varieties, it is observed that RB72454, in the plant cane cycle, had the lowest NT, while in the ratoon cane cycle this variety differ from the others evaluated (Table 3).

There was a significant interaction between the variation factors for the variables leaf area, stem diameter, yield and water use efficiency. The analysis of the interaction for these variables can be seen in Table 4. Higher values of leaf area were observed with the irrigation water depth corresponding to 120% ETc in both cycles, and the variety VAT90212 stood out from the others (Table 4).

The use of the irrigation water depth corresponding to 100% ETc promoted, in general, lower leaf area, which can be explained by the effect of higher salt concentration in soil layers where there is greater distribution of the root system. Lira (2016), when studying the effect of leaching fractions on sugarcane cultivation, also observed harmful effect of salinity on leaf area.

With regard to stem diameter, differences were observed in the simple effect analysis of the variety in each cultivation cycle for each of the varieties and the irrigation water depth applied. According to Oliveira et al. (2014), stem diameter is a characteristic of reduced variation, when compared to the other variables of sugarcane development.

The yields of the varieties SP943206 and VAT90212, under irrigation water depth of 110% ETc, showed significant gains in comparison to the others, especially in the plant cane cycle, and VAT90212 stood out with 151.88 Mg ha^{-1}. This result demonstrates that this leaching fraction reduces salinity in the wet bulb, compared to the leaching fractions of irrigation water depth of 100% ETc, not compromising biomass production due to excess moisture or nutrient leaching, as may have occurred when the irrigation water depth of 120% ETc was applied. The yields obtained in the present study were higher than those observed by Lira et al. (2018) which obtained 104.76 Mg ha^{-1} with 117% ETc, for the same variety (RB72454).

The yield of plant cane cycle for VAT90212 variety (90.86 Mg ha^{-1}) irrigated with 100% ETc, was lower than that observed by Simões et al. (2018), who studied the same variety and irrigation, in the Sub-Middle region of the São Francisco Valley, and reported an average yield of 135.13 Mg ha^{-1}, in a soil classified as normal according to Richards (1954) in relation to the electrical conductivity - EC (0.32 dS m^{-1}). However, applying a water depth rate of 110% ETc, the yield was 151.88 Mg ha^{-1}, higher than that found by Simões et al. (2018). In this context, considering that the EC of soil profile in this study, during the experiment installation, was higher than 4.3 dS m^{-1} and the sugarcane crop has salinity threshold of 1.7 dS m^{-1}, being classified as moderately sensitive to salinity (Maas & Hoffmam, 1977), the present study confirms that the water depth management with leaching fractions is extremely important for the cultivation of sugarcane in saline soil.

If, on the one hand, the presence of salts in the soil solution is a challenge to be faced, on the other hand, the excess of soil moisture along the entire period did not promote gains in yield, possibly due to the reductions in oxygen availability or in the availability of nutrients for plants. Soil moisture changes close to the root region leading to anoxia, or oxygen deficiency, interfere with the activity of aquaporins (Shiono & Yamada, 2014), which are proteins that selectively transport water molecules in cells. According to Gomathi et al. (2015), excess soil moisture can reduce sugarcane yield by 15 to 45%.

Regarding the WUE between the cycles, it was observed that the variety SP943206 showed higher values in the first cycle

Table 4. Mean leaf area, stem diameter, yield and water use efficiency (WUE) as a function of the cultivation cycle, irrigation water depth (% ETc) and sugarcane varieties

% ETc	Leaf area (cm^2)			Stem diameter (mm)		
	RB72454	SP943206	VAT90212	RB72454	SP943206	VAT90212
Plant cane						
100	2697 Baα	2517 Baα	2972 Baα	27.76 Aaα	24.75 Bbα	26.22 Aabα
110	2963 Abaβ	3628 Aaα	3196 Baα	27.02 Aaα	28.81 Aaα	27.04 Aaα
120	3741 Abα	2907 ABcα	4696 Aaα	27.67 Aaα	29.11 Aaα	27.59 Aaα
Ratoon cane						
100	2906 Aaα	2291 Baα	2691 Baα	24.21 Baβ	25.28 Aabα	26.35 Aaα
110	3662 Aaα	3001 ABaα	3742 Aaα	26.01 ABaα	26.55 Aaβ	24.78 Aaβ
120	2924 Abβ	3144 Abα	4471 Aaα	27.42 Aaα	25.66 Aβ	26.78 Aaα

	Yield (Mg ha^{-1})			WUE (kg ha^{-1} mm^{-1})		
	RB72454	SP943206	VAT90212	RB72454	SP943206	VAT90212
Plant cane						
100	102.25 Abα	120.75 Baα	90.86 Bbβ	62.26 Abα	73.53 Aaα	55.33 Bbβ
110	89.47 Abβ	141.75 Aaα	151.88 Aaα	49.50 Bbβ	78.47 Aaα	84.07 Aaα
120	104.00 Aaα	112.00 Baα	99.25 Baβ	52.77 Baα	56.84 Baα	50.36 Baβ
Ratoon cane						
100	97.75 Bbα	104.00 ABabβ	118.12 Baα	54.84 Abβ	58.35 Aabβ	66.27 ABaα
110	112.56 ABbα	116.13 Abβ	137.25 Aaβ	57.41 Abα	59.23 Abβ	70.00 Aaβ
120	113.75 Aaα	97.50 Bbβ	128.00 ABaα	53.18 Aabα	45.58 Bbβ	59.84 Baα

Means followed by same uppercase letters in the columns, and lowercase letters in the rows, within each variable, do not differ from each other by Tukey test ($p \leq 0.05$); Means followed by same Greek letters for the same variety and leaching fractions do not differ between cultivation cycles by Tukey test ($p \leq 0.05$)

for all irrigation water depths tested. The variety RB72454 had higher WUE values in the first cycle for the irrigation water depth of 100% ETc and in the second cycle for the irrigation water depth of 110% ETc. In the second cycle, in VAT90212, WUE was higher in the first cycle when irrigation water depth of 110% ETc was applied, while in the second cycle it was higher for the irrigation water depths of 100 and 120% ETc. On the other hand, the variety RB72454, under the irrigation water depth of 110% ETc showed a 41% lower WUE when compared to VAT90212, under the same conditions.

Simões et al. (2018), working with controlled water deficit for the sugarcane variety VAT90212, also in the Sub-Middle region of the São Francisco Valley, observed WUE ranging from 70 to 110 kg ha^{-1} mm^{-1}. It can be noted that most of the WUE values in the present study are lower than those observed by these authors. Such difference is probably associated with the effect of salinity on crop development, which tends to reduce yield, and the greater amount of water applied due to the leaching fractions used, which are applied to reduce the concentration of salts in the wet bulb, where most of the root system of the crop is distributed. A solution to this problem, according to Tayade et al. (2020), may be the use of sugarcane varieties with high WUE, thus leading to a more sustainable agriculture, especially considering the scenarios of climate change and increased water restriction in semiarid regions.

Juice quality, in general, was not altered by the irrigation water depth. The total soluble solids (TSS) content averaged 20.61 °Brix, while the variables juice Pol% and cane Pol%, which represent the percentage in mass of apparent sucrose in the juice and in the cane, showed mean values of 17.59 and 14.32%, respectively. It is worth pointing out that the mean TSS content observed is higher than 18 °Brix, which denotes that all varieties, under all irrigation water depths and in both cultivation cycles, were at the adequate maturity stage for harvesting. This result demonstrates that the increase in soil water availability, with irrigation water depth greater than the application of 100% ETc, does not cause the dilution of sugar contents in the juice, since water acts as a diluent factor of the sucrose present in the stems (Muraro et al., 2009).

Likewise, the variables juice Pol% and cane Pol%, for showing values above 14%, the minimum recommended by Ripoli & Ripoli (2005), met the recommended quality standards for processing in the sugarcane industry, because the higher the Pol% values, the higher the sucrose levels.

The variables purity and fiber showed differences as a function of the interaction between cultivation cycle and variety (Table 5). The purity values of the variety RB72454 were higher in the plant cane cycle; however, in this cultivation cycle there were no differences in the percentage of purity between the varieties. In the ratoon cane cultivation cycle, the variety RB72454 had higher purity compared to SP943206 and VAT90212, characterizing juice with better quality of raw material for sugar recovery. Despite the differences, it can be noted that the values found are higher than 85%, that is, all varieties in any cultivation cycle have a purity characteristic higher than that recommended by Ripoli & Ripoli (2005) for industry.

Table 5. Mean values of purity and sugarcane fiber as a function of the cultivation cycle of the sugarcane varieties

Cycle	RB72454	SP943206	VAT90212
		Purity (%)	
Plant cane	85.9 Ba	86.6 Aa	86.3 Aa
Ratoon cane	89.8 Aa	86.5 Ab	87.5 Ab
		Fiber (%)	
Plant cane	14.7 Ba	15.5 Aa	15.1 Aa
Ratoon cane	16.7 Aa	15.7 Ab	15.5 Ab

Means followed by same uppercase letters in the columns and same lowercase letters in the rows do not differ from each other by Tukey test (p ≤ 0.05)

The percentage of fiber varied according to the interaction between varieties and cultivation cycles (Table 5). When the varieties are compared within the cultivation cycles, only RB72454 showed difference in the percentage of fibers, and the highest percentage was observed in the cycle of ratoon cane. In the plant cane cycle there were no differences between varieties for fiber, while in ratoon cane the same variety, RB72454, showed the highest percentage of fiber (Table 5). The percentage of fiber is a characteristic related to the genetic component, edaphoclimatic conditions and to the management adopted in the crop. The observed values are high, since the most indicated percentage of fibers would be between 11 and 13% (Ripoli & Ripoli, 2005). If the stems are destined for ethanol and sugar production, lower fiber contents are desirable because high percentages of fiber hamper juice extraction during processing and have a negative relationship with the sugar content. However, low percentages may compromise the energy balance of the bagasse and also increase the susceptibility of the crop to lodging, making harvesting difficult (Moraes et al., 2010).

The recoverable sugar (TRS) was influenced only by the cultivation cycles, and the mean value in plant cane (141.59) was lower than that found in ratoon cane (154.11). Such superiority in ratoon cane will lead to greater added value to the product, since the TRS represents the quality of sugarcane, expressed by the total concentration of recoverable sugars (sucrose, glucose and fructose) in the industrial process and expressed in kilograms per ton of cane (Sachs, 2007), and is used to calculate the payment to the producer per ton of sugarcane produced. Considering that the parameters °Brix, juice Pol% and cane Pol% did not show statistical differences, the superiority of TRS in ratoon cane compared to plant cane can be explained by the higher purity of the juice.

CONCLUSIONS

1. The sugarcane varieties SP943206 and VAT90212 showed higher yield in the plant cane and ratoon cane cultivation cycles when subjected to irrigation water depth corresponding to 110% ETc (leaching fraction = 9.1%).

2. The highest water use efficiencies were observed in the variety VAT90212, in the two cultivation cycles, under irrigation water depth corresponding to 110% ETc (leaching fraction = 9.1%).

3. The use of leaching fractions equivalent to 16.6% (ETc=120%) to reduce soil salinity does not influence the technological quality of the sugarcane varieties RB72454, SP943206 and VAT90212.

4. The variety RB72454 showed the highest percentage of fiber in the cycle of ratoon cane.

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