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Original article

Growth and productivity evaluation of three varieties of sugar cane in two agro-ecological regions of Tucumán-Argentina

Crecimiento y productividad de tres variedades de caña de azúcar en dos regiones agroecológicas de Tucumán-Argentina

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ABSTRACT: Sugar industry and sugar cane cropping is one of the main economic and social activities in the northwestern region of Argentina. The goal of this study was to analyze the growth dynamic and productivity of three varieties grown in two agro-ecological regions of Tucumán, Argentina. Two trials were established in different locations where EEAOC's sugar cane nurseries were established (plot 11-15 and Los Trejos). From the beginning of sprout emergence, periodic measurements of stalk population dynamics and stalk height were carried out. At the end of the cycle, cane and sugar yield per hectare (TSCH and TAH) was estimated. Plot 11-15 presented higher tiller population, between 44 and 40 stalks m^{-1} for LCP 85-384 and TUC 97-8 respectively. TUC 95-10 registered 30 stalks m^{-1} in both locations. Final number of stalks per linear meter (FN) did not evidence differences between locations, but a significant interaction location*variety was determined. In this case, LCP 85-384 registered 20 stems m^{-1} in Los Trejos. Individual variables stalk weight showed significant differences between locations and the highest value was observed in Los Trejos even though no significant interaction location*variety was determined. TSCH was significantly higher in Los Trejos where TUC 95-10 produced 113 t ha^{-1}, presenting significant differences between the rests of the interactions. TUC 95-10 showed better adaptation to different agro-ecological conditions, presenting high sugar cane yields in both considered regions.

Key words: growth, environment, yield, population.

RESUMEN: La producción de caña de azúcar, en Argentina, tiene una gran importancia económica y social. El objetivo de este trabajo fue analizar la dinámica de población de tallos, la evolución de la altura y la productividad de tres variedades de caña de azúcar (LCP 85-384, TUC 95-10 y TUC 97-8), en dos regiones agroecológicas de Tucumán, Argentina. Los ensayos se realizaron en lotes semilleros de la Estación Experimental Agroindustrial Obispo Colombres (EEAOC), Lote 11-15 y Lote Los Trejos. Desde el inicio de la brotación, se midió, periódicamente, la dinámica de la población y evolución de la altura de los tallos. Al final del ciclo, se determinó la producción de caña y azúcar por hectárea. En el Lote 11-15 se registró el mayor macollaje, entre 44 y 40 tallos m^{-1} para las variedades LCP 85-384 y TUC 97-8, respectivamente. Para la variedad TUC 95-10 se registraron 30 tallos m^{-1}, en las dos localidades. Para el número final de tallos m^{-1} lineal, no se encontraron diferencias entre los lotes, pero sí hubo interacción lote*variedad y se observó que la variedad LCP 85-384, en el Lote Los Trejos, presentó el mayor valor con 20 tallos m^{-1}. La masa individual de tallo mostró diferencias significativas entre los lotes, con mayores valores en el Lote Los Trejos, sin interacción lote*variedad. Las toneladas de caña por hectárea (TCH) fueron mayores en el Lote Los Trejos para la variedad TUC 95-10, con 113 t ha^{-1}, presentando diferencias significativas con el resto de las interacciones. La variedad TUC 95-10 mostró mejor capacidad de adaptación a las diferentes condiciones agroecológicas y presentó altos rendimientos, en ambas regiones evaluadas.

Palabras clave: crecimiento, ambiente, rendimiento, población.

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INTRODUCTION

The main purpose of sugar cane cultivation is sugar production and energy generation, and it is an activity of great economic and social importance in the northwestern region of Argentina (NOA). Jujuy, Salta and Tucumán provinces contribute 99 % of the national sugar production, the latter being the most important, with more than 276 000 ha in the 2019/2020 campaign, representing 70 % of the area cultivated with sugarcane in Argentina (1,2). According to data from the Institute for the Sugar and Alcohol Promotion from Tucumán (IPAAT), in the 2020 harvest in Tucumán, 1 406 684.5 t of sugar equivalent were produced and 15 729 575 t of raw cane were milled with a manufacturing yield of 9 % (3).

LCP 85-384 variety, released for commercial cultivation in 1999, predominates in the Tucumán sugar cane growing area. Its high productive capacity and sugar quality explain the accelerated growth of the area planted with this material. The latest survey carried out during the 2019/2020 campaign indicates that 68 % of the sugar cane area is occupied by this variety (4).

The varieties TUC 97-8 and TUC 95-10 were released by the Genetic Improvement Program of the Obispo Colombres Agroindustrial Experimental Station (EEAOC), in 2009 and 2011, respectively, and represent alternatives to diversify the varietal spectrum.

Considering diverse environments existing in the sugar cane area of Tucumán, it is essential to evaluate the behavior of the genetic materials released by the EEAOC, in order to select the areas where they express themselves best, thus enhancing the productive capacity of each variety. Therefore, it is very important to study the growth and productivity of the different varieties and their relationship with climatic factors in order to optimize their management and obtain better yields (5).

Sugar cane growth and maturation are affected by different climatic factors. Water availability, temperature and solar radiation, among others, influence the development of tillering and the period of high growth, stages in which yield components are defined. On the other hand, climatic factors such as thermal amplitude, heliophany, and ambient and edaphic humidity influence the technological maturation of the crop (industrial aptitude) (6-8).

The objective of this work was to analyze, comparatively, the dynamics of stem population, height evolution and productivity of the varieties LCP 85-384, TUC 95-10 and TUC 97-8 in two different agroecological regions of Tucumán province.

MATERIALS AND METHODS

Trials were established in two seed lots (Lot 11-15 and Lot Los Trejos) already planted with high quality seed cane, between July 15 and 17, 2016, belonging to the EEAOC. The planting used a wide base furrow design spaced at 1.60 m, with a density of 12 to 15 buds m^{-1} linear furrow m^{-1}. The sugar cane varieties used were: LCP 85-384, TUC 95-10 and TUC 97-8. Fertilization was carried out at the end of November with foliar biofertilizer (10 L ha^{-1}), without the application of synthetic nitrogen sources. The study was carried out at the plant cane age.

Characteristics of each lot

a. Lot 11-15 (26º51'58.84 "S-65º5'5.86 "W), is located in the town of Banda del Río Salí, Cruz Alta department, agroecological region of the Chacopampean Plains, sub-humid-humid sub-region. The average annual rainfall is 750 to 1000 mm, the average annual temperature is 19 ºC (9,10). Soil analysis indicates clay loam textures from 0-30 cm, loam from 30-60 cm and clay loam from 60-90 cm.

b. Los Trejos Lot (27º28'14.59 "S-65º23'38.16 "W), is located in the town of Los Trejos, Simoca department, agroecological region of the dry-sub-humid depressed saline plain. The average annual rainfall is 650 to 950 mm, and the average annual temperature is 19 ºC. This zone is characterized by the presence of a water table with depth and seasonal fluctuations (9,10). Soil analysis indicated loam soil textures for the three depths evaluated (0-30 cm, 30-60 cm and 60-90 cm).

The plots for each variety consisted of four furrows between 200 and 250 m long for each variety. In these strips, three (Los Trejos Lot) and four (Lot 11-15) fixed sampling stations were marked, each consisting of two 10-meter furrows and spaced 50 m apart.

Variables evaluated

Stem population dynamics: from the beginning of sprouting, periodic measurements were taken at the sampling stations. The number of stems per linear meter of furrow was evaluated weekly until the end of tillering, and then every 21 days until harvest (period of high growth and maturation).

The temporal dynamics of stem population was modeled using the lowest option (11) of the Infostat program (12).

The following variables were analyzed from this curve:

- Days after planting at peak tillering (DAP-PT).
- Number of stems per linear meter at the maximum tillering peak (NPT).
- Percentage of stem mortality from the maximum till the end of the crop cycle (M %).

Height: evolution of stem height, final stem height and growth rate.

In each sampling station, a linear meter of furrow was marked and the height of the stems was measured from the soil surface to leaf+1, with a weekly frequency until the end of tillering and then every 21 days until harvest.

A non-linear regression with logistic adjustment (*alpha*/(1+*beta***exp*(-*gamma***DDP*))) was performed with the data of the complete cycle, in each season and variety. Alpha, beta and gamma parameters were estimated with the Infostat program (12). Alpha represents the asymptote or maximum growth attained, beta the ordinate to the origin and gamma the growth rate.

For Los Trejos plot, nonlinear regression with logistic adjustment and parameter estimation was performed up to day 280 after planting. After 280 DAP, a simple linear regression ($Y = a + bx$) was performed and the slopes of the lines were estimated with the Infostat program (12), where a represents the ordinate to the origin and b the slope.

Monthly growth rate: with the calculated monthly height difference, the average daily height growth rate (cm day^{-1}) was determined.

Sugar cane and sugar production: at the end of the crop cycle, the sugar cane and sugar production per hectare was estimated. For this purpose, the following determinations were made:

- *Individual stalk weight (g):* at each fixed station a sample was taken consisting of 15 successive millable stalks that were peeled, blunted at the natural breaking point and weighed.
- *Tons of sugar cane per hectare (TSCH):* from the average weight of stalks and the final number of stalks m^{-1}, the TSCH were estimated.
- *Tons of sugar per hectare (TSH):* samples used to determine the individual weight of stalks were subsequently analyzed at the EEAOC Sugar Research Laboratory to determine the manufacturing quality parameters brix (%) and pol (%) juice and, based on these results, tons of sugar per hectare (ha^{-1}) were estimated.

Data analysis

Due to the lack of randomization of experimental plots, general linear models with exponential spatial correlation were used for the statistical modeling of data (12,13). During modeling process, several models were run with different structures for random effects and residuals. By means of likelihood ratio tests, alternative models were compared, following the principle of parsimony; that is, the best fitting model with the least number of parameters.

The best fit was obtained with a model with variety, lot and lot x variety as fixed effects; plot as random effects and exponential spatial correlation within each lot. For the variables *NPT* and *M* %, because of their heterogeneous variances, the structure of the variances was modeled with the VarIdent function. These models presented the lowest AIC (Akaike's Information Criterion) value.

Parameters estimated in the adjusted curves of height evolution were used as response variable and were analyzed with general linear models (13,14). Heterogeneity of variances was modeled according to each variety and the Akaike information criterion (AIC) was used for model selection.

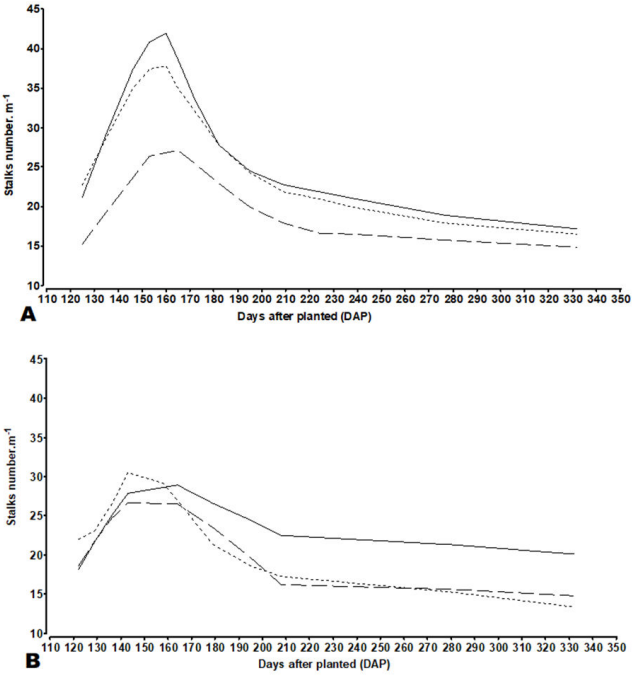
The graphical interface for R of the nlme package (14,15) included in Infostat (12) was used. Mean comparisons were performed with Fisher's LSD test ($\alpha = 0.05$) using marginal means estimated from the model (16).

RESULTS AND DISCUSSION

Stalk population dynamics

Figures 1A and 1B show the stem population dynamics for the "cane plant" cycle, in the three varieties (TUC 95-10, TUC 97-8 and LCP 85-384) and in the two environments evaluated. Figure 1A corresponds to plot 11-15 and Figure 1B to Los Trejos plot.

In the three varieties and in the two environments, an increase in the population is observed until reaching the maximum tillering peak, followed by a period of competition between stalks, which causes the population percentage death until reaching stabilization and establishing the final population of grindable stalks. In addition, it was observed that in Lot 11-15 there was a higher tillering than in Los Trejos Lot.



Varieties considered (—) LCP 85-384, (- - -) TUC 97-8 y (– –) TUC 95-10

Locations: plot 11-15 (A); Los Trejos plot (B). Lowest smoothed curves

Figure 1. Dynamics of the population of plant cane stalks, of three varieties, in two production lots in Tucumán-Argentina (2016-2017)

Table 1 shows variables of the stalk population dynamics that showed a lot*variety interaction.

For the variable DAP-PT (days after planting until the maximum tillering value), no significant differences were found between lots (F=2.41; gl error=12; p-value=0.1463) and there was no lot*variety interaction (F=0.16; gl error=12; p-value=0.8537); however, in Los Trejos lot, the varieties TUC 95-10 and TUC 97-8 reached the maximum tillering peak 8 and 10 days earlier than in lot 11-15, respectively.

Significant differences were found in the NPT (number of stems at the maximum tillering peak) between the lots (F=19.22; gl error=12; p-value=0.0009), with a higher NPT in Lot 11-15. For this variable, a lot*variety interaction was observed (F=4.07; gl error=12; p-value=0.0447). Table 1 shows that LCP 85-384 and TUC 97-8 were the varieties with the highest NPT in Lot 11-15, with no significant differences between them. In turn, the NPT in LCP 85-384 in Lot 11-15 was significantly higher than in Lot Los Trejos, while in TUC 97-8 it was similar in both lots. With respect to TUC 95-10 the NPT was similar in both lots but lower than that of LCP 85-384 and TUC 97-8 in Lot 11-15.

In Tucumán, working with different varieties, an average of 42 stems m-1 was found at peak tillering for the variety LCP 85-384 (17).

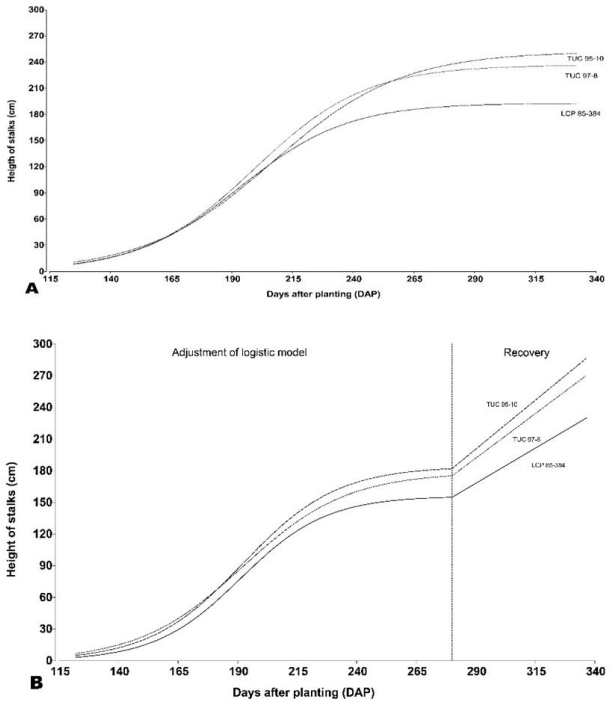
The M % (Percentage of stem mortality at the end of the cycle) shown in Table 1, was higher in lot 11-15, with statistically significant differences with respect to Los Trejos lot (F=77.91; gl error=12; p-value=0.0001). Significance was also found in the lot*variety interaction (F=11.29; gl error=12; p-value=0.0017). The percentage of stem mortality in LCP 85-384 in Lot 11-15 was significantly higher than in Los Trejos and the varieties TUC 97-8 and TUC 95-10 behaved similarly in both lots.

Differences in growth dynamics observed in the varieties under study are important in relation to the agronomic management of the crop. Reaching the tillering peak early allows earlier cane field closure, improves the crop's competitive capacity with weeds, and favors earlier and more efficient use of incident solar radiation (18).

Other research reported, for sugar cane plants, stem mortality percentages close to those obtained in this study, between 25 and 78 % (19,20). In another study, also in sugar cane, mortality percentages between 40 and 47 % were observed for the variety LCP 85-384 in Tucumán (17). Mortality percentages lower than those found in this work have been cited (21); for the variety LCP 85-384 in plant cane age and in the Tucumán province, mortality percentages of 24 % were observed.

Height

The temporal evolution of stalk height, in the three sugar cane varieties and in the two lots under study, is presented in Figure 2 (A and B).



LCP 85-384 full line (-), TUC 97-8 dotted line (- - -) and TUC 95-10 cut line (- - -)

A (Lot 11-15); B (Lot Los Trejos)

Figura 2. Evolution of cane plant height growth (2016-2017) in three sugar cane varieties

In Lot 11-15 (Figure 2A), a sigmoid type curve is observed for the three varieties evaluated. At the beginning, the crop has a low growth rate, but from 165 DAP this rate increases and increases the height of the three varieties exponentially. From 195 DAP, TUC 95-10 and TUC 97-8 registered a greater height than LCP 85-384, with statistically significant differences from 239 DAP until the end of the cycle. TUC 95-10 and TUC 97-8 reached a final height greater than LCP 85-384 of 17 and 20 %, respectively.

In Los Trejos Lot (Figure 2B) the evolution of height had a different behavior, compared to that observed in Lot 11-15, with a slower initial growth. From 208 DAP onwards, a particular event coinciding with the linear phase of the sigmoid curve was observed, a period during which height remained practically constant, with a slow elongation of

Table 1. Variables of the stalk population dynamics curves of three varieties of sugar cane, plant cane, in two different agroecological environments

	11-15 Lot			Los Trejos Lot		
Variables	LCP 85-384	TUC 95-10	TUC 97-8	LCP 85-384	TUC 95-10	TUC 97-8
NPT (t m^{-1})	44±1.36 a	30±1.97 c	40±4.06 ab	33±1.56 bc	29±2.26 c	35±4.67 abc
M (%)	61±1.18 a	51±1.93 bc	58±4.53 ab	43±1.37 c	48±2.23 c	59±5.23 ab

Tucumán, Argentina 2016-2017

Different letters indicate statistically significant differences (p<0.05) within the same row

NPT t m^{-1} (number of stems per linear meter at the maximum tillering peak)

M % (percentage of stalk mortality at the cycle)

stems during 72 days. From 280 DAP onwards, increases were observed until the end of the cycle. Comparing the three varieties, no statistically significant differences were found between the slopes of the lines (F=3.98; gl error=2; p-value=0.0795).

The three varieties of Los Trejos lot showed similar behavior during the evolution of height. The final value of TUC 95-10 and TUC 97-8 was 21 and 16 % higher than the final height of LCP 85-384, respectively. These differences were similar to those observed in Batch 11-15, being statistically significant (F=13.53; gl error=4; p-value=0.0166).

Table 2 shows the *alpha* parameter (asymptote or maximum average height growth achieved), estimated from the evolution of height, with statistical differences.

In Lot 11-15 in TUC 95-10 and TUC 97-8, height growth was significantly higher than in LCP 85-384 (F=54.83; p-value=0.0001).

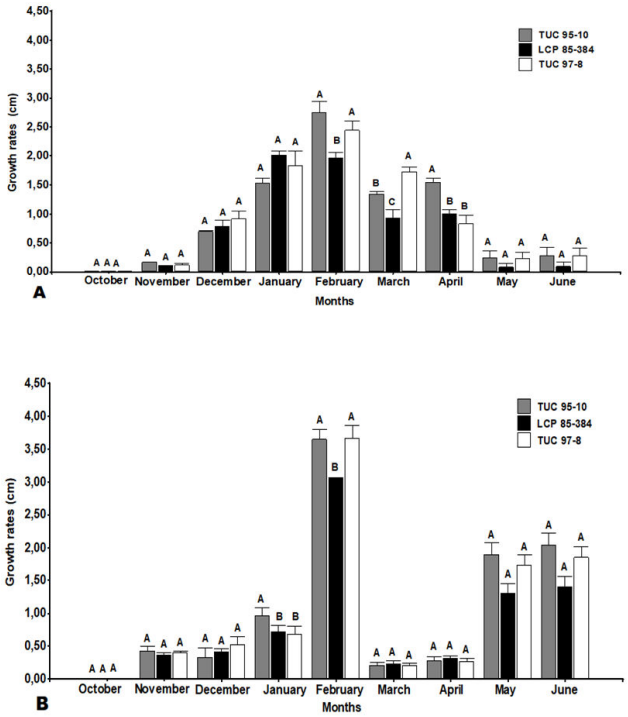
In the *beta* parameters corresponding to the ordinate to the origin (F=0.19; S.E=10295.28; p-value=0.8341) and *gamma* to the growth rate (F=0.00; S.E=0.0024; p-value=0.9999) no statistically significant differences were observed.

In Los Trejos Lot *alpha* was higher in the TUC 95-10 variety and significant differences were observed with LCP 85-384 but not with TUC 97-8 (F=20.43; p-value=0.0021). The values of the ordinate to origin (*beta*) (F=1.14; S.E=67,432.27; p-value=0.3499) and growth rate (*gamma*) (F=1.00; S.E=0.0019; p-value=0.2666) did not show statistically significant differences between varieties.

Figure 3 (A and B) shows the growth rates in Lot 11-15 and Los Trejos Lot, respectively.

Figure 3A, corresponding to Lot 11-15, shows that from November onwards, growth rates increased until reaching a maximum in January-February, and then decreased to close to zero in June. LCP 85-384 reached a maximum growth rate of 2.01 cm day^{-1} in January, with no significant differences with the other varieties evaluated. TUC 97-8 and TUC 95-10, with a similar behavior, reached the maximum rate in February between 2.45 and 2.74 cm day^{-1}, respectively, but without significant differences between them, although they did in relation to LCP 85-384 (1.97 cm day^{-1}).

During March-April, a significant drop in growth rate was observed in all three varieties. TUC 97-8 and LCP 85-384 cultivars reached lower rates than TUC 95-10, these differences being statistically significant. Another decrease in growth rate was observed during May and June, without significant differences among varieties, reaching values close to zero at the cycle end (0.10 to 0.29 cm day^{-1}).



Different letters within the same evolution date indicate significant differences (p<0,05)

Locations: plot A (11-15 Lot), plot B (Los Trejos Lot)

Figure 3. Growth rates, in plant cane (2016-2017)

In Los Trejos Lot (Figure 3B), the three varieties show increasing rates until February, when they reach maximum values (3.65 cm day^{-1} for TUC 95-10 and TUC 97-8; 3.00 cm day^{-1} for LCP 85-384), similar for TUC 95-10 and TUC 97-8, but significantly lower for LCP 85-384.

During March and April, growth rates dropped sharply in all three varieties approaching zero (0.20-0.31 cm day^{-1}). This behavior is not what is normally expected, since generally the decrease in growth rate occurs gradually as was observed in Batch 11-15. Then between May and June, an increase in the growth rate was observed, which demonstrates the recovery capacity of the reed bed. In this aspect, the three varieties behaved similarly, with no statistically significant differences.

The growth pattern observed in batch 11-15 coincides with local antecedents cited by some authors (17,18) and international antecedents (6).

In Brazil, other authors studied the growth rate of four varieties of sugar cane at the age of cane plant and observed maximum growth values between 1.7 and 2.7 cm day^{-1}, during February (6), values very similar to those observed in Los Trejos lot.

Table 2. Parameter *alpha* estimated from the analysis of the temporal evolution of height, in two lots and three varieties, by means of non-linear logistic regression

Lots	Parameter	TUC 95-10	TUC 97-8	LCP 85-384
11-15	alpha	241.22±3.78 a	234.50±3.78 a	189.75±3.78 b
Los Trejos	alpha	180.90±4.03 a	173.39±11.96 ab	154.84±1.09 b

Different letters indicate statistically significant differences (p<0.05) within the same row

The greatest final height of stems was observed in Los Trejos lot (262 cm) with statistically significant differences with respect to Lot 11-15 (231 cm) (F=28.51; gl error=11; p-value=0.0002), the lot*variety interaction was not significant (F=0.33; gl error=11; p-value=0.7276). The greater final height of TUC 95-10 (287 cm) and TUC 97-8 (270 cm), with respect to LCP 85-384 (228 cm), is consistent with the characteristics described for these varieties (22).

During the months corresponding to the period of great growth (January, February and March) two lots evaluated presented similar levels of. RH %. Average Tº, maximum and minimum. As for rainfall, during the month of February 143 mm more were recorded in Lot 11-15 than in Los Trejos. In this last lot an abrupt decrease in growth rates was observed, which affected the height evolution (Figure 3B), during the period of Great Growth, which could be associated with the high rainfall and the increase in the water table, with a residual effect over time, since in the field evaluations carried out during these months, excess water was observed on the soil surface.

From April onwards, a decrease in rainfall was observed and the height growth rate showed a recovery.

Some authors found, for this zone of the sugar cane area and in soils with poor drainage, as is the case of Los Trejos lot, signs of hydromorphy in the 50 cm depth and presence of water table at a depth of less than 100 cm (10).

Sugar cane and sugar production

Table 4 shows the final number of stalks per linear meter and the estimated cane production in the evaluated plots.

The NF (final number of stems per linear meter) showed no differences between lots (F=0.02; gl error=11; p-value=0.8915). On the other hand, a lot*variety interaction was observed. The variety LCP 85-384 reached the highest NF in Los Trejos lot, while in lot 11-15 a significantly lower number of stems was observed, being in this case its behavior similar to that of TUC 97-8. TUC 95-10 had a similar behavior in both lots. The lowest stem population was observed in TUC 97-8 in Los Trejos lot (Table 4).

For P stem^{-1} (individual stem weight) (F=7.02; gl error=11; p-value=0.0226) significant differences were observed between lots, with the highest value found in Los Trejos lot, and no lot*variety interaction was detected.

From the yield components. NF. P t^{-1} and pol % were used to calculate the TSCH and TSH.

Sugar cane production (TSCH) showed differences between lots, with significantly higher production in Los Trejos lot (F=6.45; gl error=11; p-value=0.0274). The lot*variety interaction was also significant (F=5.95; gl error=11; p-value=0.0177) since the variety TUC 95-10 in Los Trejos lot obtained the highest cane production, surpassing LCP 85-384 and TUC 97-8 by 14 and 35 %, respectively. In second place, with similar production were TUC 97-8 and TUC 95-10 in Lot 11-15 and LCP 85-384 in Los Trejos. Significant differences were observed with the lower yielding interactions corresponding to TUC 97-8 (Los Trejos Lot) and LCP 85-384 (Lot 11-15), which did not differ between them.

In comparative variety trials carried out in six locations in 2007, it was found that TUC 95-10 was more productive in terms of TSCH than LCP 85-384 (23). Coincidentally, in comparative yield trials carried out in seven locations in the sugar cane area of Tucumán, other authors (22) observed a productive superiority expressed in terms of TSCH of the TUC 95-10 variety compared to the LCP 85-384 variety at the age of the cane plant.

It should be noted that TUC 95-10 presented the highest cultural yield in the two locations evaluated, which is consistent with the capacity to adapt to different agroecological conditions that characterizes this variety.

Table 3. Climatic factors recorded during the January-June period in Lot 11-15 and Los Trejos Lot

	11-15						Los Trejos					
EF	**J**	**F**	**M**	**A**	**May**	**Ju**	**J**	**F**	**M**	**A**	**May**	**Ju**
Tmx[ºC]	33.5	30.8	27.5	24.0	20.2	19.1	33.8	32.2	28.5	24.6	20.6	19.2
Tmi[ºC]	21.6	20.4	19.2	15.9	12.8	9.2	20.6	19.6	19.2	14.8	11.7	5.6
Tm [ºC]	27.6	25.6	23.4	20.0	16.5	14.2	27.2	26.0	23.8	19.7	16.2	12.4
MP[mm]	125.9	398.6	226.0	72.1	24.4	17.8	153.4	255.3	223.0	66.5	24.9	9.9
RH%	74	79	86	84	85	82	71	74	81	80	81	77

(Tucumán. Argentina. 2017)

EF (environmental factors). Tmx (maximum temperatures). Tmi (minimum temperatures). Tm (average temperatures). MP (monthly precipitation). RH % (relative humidity percentage).

Table 4. Final number of stalks per linear meter and estimated cane production per hectare

	11-15			Los Trejos		
Variables	LCP 85-384	TUC 95-10	TUC 97-8	LCP 85-384	TUC 95-10	TUC 97-8
NF stalks m^{-1}	17±0.36 b	15±0.36 c	17±0.42 b	20±0.42 a	15±0.42 c	13±0.42 d
TSCH	73±5.19 c	96±5.19 b	82±5.90 bc	97±5.90 b	113±5.90 a	77±5.96 c

Different letters indicate statistically significant differences (p<0.05) within the same row.

NF t m^{-1} (final number of stalks per linear meter). TSCH (tons of sugar cane per hectare)

The highest sugar yield (HST) was observed in Los Trejos plot (8.8 t sugar ha^{-1}), with statistically significant differences with respect to plot 11-15 (6.5 t sugar ha^{-1}) (F=16.16; gl error=11; p-value=0.020). No lot*variety interaction was observed (F=2.03; gl error=11; p-value=0.1774).

Optimal minimum temperatures and optimal mean solar radiation were similar in the two lots. In Lot 11-15 the accumulated rainfall during the ripening period was 54 mm more than in Lot Los Trejos. Considering that the soil of Lot 11-15 has restricted drainage, this would explain the lower sucrose accumulation observed in that lot.

CONCLUSIONS

- In Los Trejos lot, the TUC 95-10 and TUC 97-8 varieties showed a lower tillering; however, the maximum peak of tillering and the closure of the cane field was 10 days earlier than in lot 11-15.
- The variable "Lot" significantly influenced the final number of stems. The lowest and highest number of stems m^{-1} was observed in Los Trejos lot for the varieties TUC 97-8 and LCP 85-384 respectively.
- During the period of high growth the rate of stem elongation in Los Trejos Lot was negatively affected by excess soil moisture for 70 days; however, final height, individual stem weight and cultural yield were higher than in Lot 11-15 which shows the resilience of the cane field.
- The variety TUC 95-10 showed the greatest capacity to adapt to the different agroecological conditions, presenting higher cultural yields in the two locations of this study.

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