RESISTANCE OF BIOENERGY SORGHUM TO *Diatraea saccharalis* (Lepidoptera: Crambidae)

RESISTÊNCIA DE SORGO BIOENERGIA À Diatraea saccharalis *(Lepidoptera: Crambidae)*

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ABSTRACT: This study evaluated the effects of the sugarcane borer *Diatraea saccharalis* (Fabricius, 1794) (Lepidoptera: Crambidae) on cultivars of sweet and biomass sorghum for the selection of resistant cultivars. The present work consisted of two trials, with natural pest infestation. In the first one, 10 sweet sorghum cultivars were analyzed for the following variables: plant height, number of healthy and damaged internodes, gallery position and size, stem infestation level and soluble solids content (°Brix). In the second trial, it was analyzed 16 genotypes of high biomass sorghum, with the same variables above mentioned, in addition to the lignin, cellulose and hemicellulose contents. Among sweet sorghum genotypes evaluated, the genotype CMSXS647 stood out due to the traits: plant height, infestation level, gallery size and soluble solids content. Among the sorghum genotypes evaluated, CMSXS7030, CMSXS7012 and CMSXS7028 presented ideal characteristics for infestation level, plant height and number of lignocellulosic compounds. Such information, in addition to supporting the bioenergy sorghum breeding program, will assist in integrated pest management for sorghum cultivation.

KEYWORDS: Cell wall. Stem borer. Sorghum pest. Sweet sorghum. High biomass sorghum

INTRODUCTION

The growing demand for energy, excessive consumption of fossil fuels and climate change has been boosting research for renewable energy sources. In this context, bioenergy is an ecologically and energetically viable alternative (ANTONOPOULOU et al., 2008). Sorghum, already known for its rusticity and its use in animal and human food, has also been shown to be promising to produce bioenergy (MAY et al., 2014). Among the various sorghum purposes, the one destined to the generation of energy is divided into two groups: sweet sorghum for ethanol and high biomass sorghum for energy generation by burning. Sweet sorghum is the plant that better fitting in ethanol production in sugarcane off season. High biomass sorghum is a short cycle plant propagated by seeds allowing, in this way, the mechanization of the whole process, from the planting to the transportation to the power generating unit. Sorghum cultivation for bioenergy has demanded a great deal of information about plant breeding and pest management, which has made it difficult to adopt this crop by plants and farmers (MAY et al., 2014; MIRANDA; MAY, 2016).

Sorghum plants can be attacked by more than 150 insect species (SHARMA, 1993), but not all can be considered pests in the crop, which can vary with the region and type and exploration. *Diatraea saccharalis* (Fabricius, 1794) (Lepidoptera: Crambidae) is a polyphagous pest of economic importance in various crops, where it makes physical injury the plant stems. In sorghum, it has become one of the most important pests, due to its destructive potential and difficult to control, mainly due to the drilling habit of larvae and due to the scarcity of products registered for this purpose (BRASIL, 2017). This pest harms all stages of plant development. When infestation occurs early in the development, it can cause tillering and even their death. The larvae can cause direct losses such, for example, as killing the plant's apical bud, opening galleries through its interior, causing losses on its

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weight, shortening its internodes, and breaking its stems (AMBROSANO et al., 2015).

Chemical control of *D. saccharalis* becomes quite complicated due to its behavioral. The habit of making galleries inside the stems makes it difficult for the larvae to come in contact with insecticides, and it is recommended the treatment of seeds, the use of biological agents, predators, parasitoids and fungi to control the pest (ALVES et al., 1985). Traditionally, pest management in this crop in the country is done by selection of resistant plants and by chemical control (ANDROCIÓLI, 2014; MENDES et al., 2014; SILVA et al., 2014), however the scarcity of insecticides specifically registered for this crop has hindered crop treatment (BRASIL, 2017); moreover, there is little knowledge on the possible strategies for the cultural management of the pest, such as the best harvest season to reduce damages. Thus, the use of resistant plants is extremely desirable in pest management. Studies on the management and control of these pests in the sorghum crop and even on the behavior of cultivars against the pressure of pest infestation are scarce. The present study evaluated the resistance of genotypes of sweet sorghum and high biomass sorghum to *D. saccharalis*, as well as the effect of earlier harvesting sweet sorghum for potential damage reduction.

MATERIAL AND METHODS

The experiments were carried out at the Embrapa Milho e Sorgo, Sete Lagoas, State of Minas Gerais, Brazil in the 2013/14 growing season. The climate of the region is Aw (Köppen), with dry winter and average air temperature of the coldest month above 18°C. The soil in the area is classified as a dystrophic red latosol. Soil fertility conditions of the area were favorable, with pH = 6, good content of carbon and organic matter, exchangeable acidity (Al) at satisfactory values and adequate potassium and phosphorus levels. Crop practices were conducted as recommended by May et al. (2012) and fertilization, according to Santos et al. (2014). This experiment was a preliminary study to select commercial genotypes and potential candidates of genetics materials to a breeding program. For biomass sorghum, we used two genotypes of forage sorghum, considered as a control in the present study (Volumax® and BRS 516).

Sweet Sorghum

In the agricultural year 2013/14, comparative trials of sorghum cultivars were conducted in experimental area (19°28' South latitude, 44°15'08" West longitude and 732m altitude). Natural infestations of *D. saccharalis* in experimental area were used to evaluate and compare sweet sorghum cultivars resistance. This was a completely randomized block design, with experimental plots consisting of three rows of 5.0 m in length and 0.70 m spacing, with a population of 125,000 plants/ha, using 400 kg/ha of the 8-28-16 (NPK). Weed control was performed after sowing with the atrazine-based herbicide at 1.5 kg of the active ingredient or three liters of the commercial product per hectare, in addition to manual weeding. Irrigation was applied during the establishment of the crop in order to avoid water stress in this period. Cultivation treatments at planting were applied according May et al. (2012) and topdressing fertilization with 200 kg/ha were used 20 days after sowing. After 15 days of emergence, thinning was performed, where eight plants per linear meter were maintained, totaling 40 plants per five meter-row.

The genotypes were selected among commercial hybrids, varieties and lines in the test phase by the breeding program of Embrapa Milho e Sorgo. These were five experimental genotypes (CMSXS647, CMSXS629, CMSXS643, CMSXS630, CMSXS646) and two commercial genotypes from Embrapa (BRS508 and BRS511), two commercial hybrids from Monsanto (XBWS80147 and XBWS80007), a commercial hybrid from Advanta, the Sugargraze. Commercial hybrids were considered as resistance standard. Those genotypes were evaluated at three harvest times, and the plants were harvested sequentially from the flowering, 93 days after sowing, totaling three cuts with a 21-day interval between them, that is, 114, 135 and 156 days after planting.

We evaluated 13 stems per plot, with the percentage of infestation considered the average of each plot. The following variables were measured: plant height, number of healthy internodes, number of injured internodes, total internodes, gallery position, gallery size, stem infestation level (calculated based on the percentage of injured internodes as a function of the total number of internodes) and plant infestation level (calculated on the number of injured stems as a function of the total number of stems harvested) and for sweet sorghum genotypes, we also determined the content of total soluble solids (°Brix) using a digital refractometer (Atago).

Infestation level = 100 x number of drilled internodes /number of internodes

High biomass sorghum

The trial was conducted in the 2013/2014 agricultural year, in experimental area (19°28' South latitude, 44°15'08" West longitude and 732m altitude). Planting was done on November 21st, 2013 with data collection on July 22nd, 2014, considering a cycle of 240 days for the evaluated cultivars.

The experimental design was randomized blocks, with three replications. The experimental plots consisted of four rows of 5.0 m, 0.70m spaced apart. The initial population used was 125,000 plants/ha. For the planting fertilization, 400 kg/ha NPK formulation was used and 200 kg/ha urea was applied as topdressing. Irrigation was provided during summer. The other cultural treatments were those used for the crop according May et al. (2014). Natural infestations of *D. saccharalis* in experimental area were used to evaluate and compare sweet sorghum cultivars resistance. We evaluated 16 sorghum genotypes, including 14 experimental genotypes of high biomass sorghum belonging to Embrapa Milho e Sorgo breeding program (CMSXS7021, CMSXS7022, CMSXS7023, CMSXS7024, CMSXS7025, CMSXS7026, CMSXS7027, CMSXS7028, CMSXS7029, CMSXS7030, CMSXS7031, CMSXS7012, CMSXS7015 and CMSXS7016) and two commercial forage sorghum hybrids (BRS655 and Volumax®) considered as controls.

Ten stems were evaluated at plants harvested per plot. The two central rows of each plot were considered. The variables evaluated were: plant height, number of healthy internodes, number of drilled internodes, total internodes, gallery position, gallery size, stem infestation level and total infestation level. The values of lignin, cellulose and hemicellulose were also evaluated.

Statistical analysis

Each plant was considered a repetition. Data on the infestation level of plants were transformed to $(x)^{0.5}$ to meet the Anova assumptions. Data were tested by a factorial analysis of variance, with ten genotypes and three harvesting times, and the means were compared by the Scott-Knott test using the SISVAR 4.1 software (FERREIRA 2011).

RESULTS AND DISCUSSION

Sweet sorghum

Nonesignificant difference among treatments for percentage of plants infested per genotype, (mean of 92.17%), (p = 0.68, CV = 10.33). It suggests a high percentage of infestation of *D. saccharalis* for evaluated genotypes. This percentage is higher than that found by Rossato Júnior (2009) in sugarcane, who considered 87% as a high infestation.

The interaction between genotype and harvest time season was significant for infestation level (Table 1). This shows an increase in infestation level according to the delay of harvest. For the first harvest season, when the plant was 114 days after planting, two groups were observed, where four commercial genotypes evaluated BRS508, XBWS80007, XBWS80147, Sugargraze in addition to CMSXS646 achieved the highest infestation levels. For the second harvest season, the genotypes were divided into four groups, and the treatments XBWS80007, BRS508 and CMSXS646 stood out because they presented the highest infestation level. While CMSXS647 genotype showed the lowest infestation level (Table 1). Infestation level of the commercial genotype XBWS80007 was 2.3 times than CMSXS647. Higher infestation level negatively affects production (SERRA, TRUMPER; 2004).

In the third harvest season, two groups are again observed in relation to infestation level (Table 1). At that time, six genotypes stood out among the highest infestation levels. The genotypes CMSXS630, CMSXS643, CMSXS647 and BRS508 showed the lowest infestation levels. Teixeira et al. (1997) reported that late harvest reduces juice production.

Derneika and Lara (1991) observed that infestation level and percentage of infestation differed between sugarcane genotypes. According to these authors, there is a trend of these indices being larger in the first harvest and decreasing in the following harvest. These authors verified that there is great variability in the resistance of sugarcane genotypes to this pest, from highly susceptible to highly resistant. In the case of sweet sorghum, we only do one harvest the witch is done around four months after planting. Thus, exploring resistant genotypes becomes even more important for sustainability of crop management.

Table 1. Infestation level (%) of *D. saccharalis* in genotypes of sweet sorghum (±SE) in harvest seasons. Sete Lagoas, April 2014[(1)].

Genotype	Infestation level (%)		
	Season 1 (114 days)	**Season 2** (135 days)	**Season 3** (156 days)
CMSXS629	10.70±2.83 b B	39.88±3.44 a B	40.41±2.71 a A
CMSXS630	14.67±2.62 b B	34.77±2.80 a C	34.37±3.13 a B
CMSXS643	15.17±3.16 b B	36.83±2.42 a C	36.83±3.08 a B
CMSXS646	18.01±2.86 b A	47.23±2.97 a A	47.49±1.96 a A
CMSXS647	10.11±2.99 b B	23.06±3.82 a D	24.34±3.13 a B
BRS511	13.49±3.74 b B	43.62±2.72 a B	40.67±2.94 a A
BRS508	20.64±2.99 c A	47.67±3.01 a A	33.03±3.24 b B
XBWS80007	21.64±3.53 c A	54.05±2.71 a A	37.19±2.41 b A
XBWS80147	26.20±3.10 b A	41.94±3.51 a B	39.54±3.15 a A
Sugargraze	20.80±4.13 b A	40.00±3.20 a B	43.48±3.20 a A

(1) Means followed by different letters, lowercases in the same row and uppercases in the same column, are significantly different by Scott-Knott test ($p<0.05$).
SE = standard error

There was no significant difference in plant height among the seasons, except for CMSXS630 at 156 days. Thus, it can be inferred that peak growth was achieved before the first data collection, at 114 days. Similar results were reported by Heckler (2002), where sorghum plants reached physiological maturity at 123 days after planting. Nevertheless, when analyzed the data referring to the first season, it was verified that there was a statistical difference among the genotypes, in which the highest plant height values were found for the treatments CMSXS643, CMSXS630 and XBWS80007 that presented respectively 308.2; 305.3 and 304.7cm in height. The lowest mean was found for CMSXS647, which presented a mean of 268.6 cm in height in the first cutting season, which equaled the other genotypes in the second harvest season (at 135 days) (Table 2). As for sweet sorghum, the raw material is the stem of the plant; it is desirable that it be as high as possible (TEIXEIRA et al., 1999). Thus, anticipating the harvest season may be a recommended strategy for some genotypes, such as XBWS80007, already available commercially. The same for genotypes CMSXS643, CMSXS630, which reached peak growth at 114 days after planting, with lower infestation level at that time of harvest.

Table 2. Plant height (±SE) in centimeters and total soluble solids content (°Brix) (±SE), of sweet sorghum genotypes in harvest seasons. Sete Lagoas. April 2014[(1)].

Genotype	Plant height (cm)			Soluble solids content (° Brix)		
	Season 1 (114 days)	Season 2 (135 days)*	Season 3 (156 days)	Season 1 (114 days)	Season 2 (135 days)	Season 3 (156 days)
CMSXS629	282.6±3.6 a B	280.8±2.3 a A	281.9±1.7 a A	11.00 ± 0.14 b C	13.73 ± 0.33 a A	13.76 ± 0.32 a B
CMSXS630	305.3±2.4 a A	299.6±1.7 a A	282.2±1.2 b A	14.30 ± 0.14 b A	16.00 ± 0.25 a A	17.46 ± 0.04 a A
CMSXS643	308.6±2.0 a A	295.1±2.6 a A	291.6±1.4 a A	10.87 ± 0.19 c C	12.50 ± 0.03 b B	14.13 ± 0.23 a B
CMSXS646	289.1±2.2 a B	276.8±2.3 a A	277.7±1.5 a A	10.93 ± 0.28 b C	15.00 ± 0.16 a A	14.46 ± 0.21 a B
CMSXS647	268.6±2.5 a C	280.6±2.3 a A	269.1±1.5 a A	13.03 ± 0.04 b B	14.67 ± 0.16 a A	14.63 ± 0.56 a A
BRS511	291.6±2.4 a B	291.8±2.4 a A	278.9±1.9 a A	10.63 ± 0.09 b C	13.40 ± 0.27 b B	13.80 ± 0.20 a B
BRS508	292.1±2.4 a B	281.3±2.4 a A	278.3±1.6 a A	12.40 ± 0.40 a B	11.66 ± 0.54 b B	12.50 ± 0.25 a C
XBWS80007	304.7±2.1 a A	284.3±1.9 a A	296.2±1.2 a A	12.40 ± 0.72 b B	14.13 ± 0.27 a A	14.36 ± 0.23 a B
XBWS80147	289.2±3.0 a B	300.4±2.0 a A	279.6±1.7 a A	10.20 ± 0.06 b C	12.10 ± 0.34 b B	12.63 ± 0.07 a C
Sugargraze	294.0±2.0 a B	292.9±2.4 a A	283.2±1.6 a A	11.16 ± 0.26 a C	12.93 ± 0.50 b B	12.26 ± 0.44 a C
RSD (%)			12.64			7.37

[(1)] Means followed by different letters, lowercases in the same row and uppercases in the same column, are significantly different by Scott-Knott test (p<0.05).

A higher infestation level in the stems presents lower content of photoassimilates in sugarcane (ROSSATO JÚNIOR, 2009). As the mentioned genotypes showed later infestation of *D. saccharalis*, the reduction in plant height was later than the peak of growth. Even the soluble solids content showing the highest value in the last season for genotypes XBWS80007 and CMSXS643, harvest earlier may be a strategy to reduce the effect of infestation.

In general, genotypes should be harvested until the second evaluation, at 135 days after planting. In this way, the relationship between position and size of the galleries was evaluated only in the second period. The interaction between sorghum genotypes and plant height was significant. For the first third stem (i.e. basal third), it was possible to distinguish three sizes of gallery, with the Sugargraze genotype showing the smallest gallery size, followed by CMSXS 646 and CMSXS 630. The other genotypes presented with galleries above 10.6 cm (Table 3).

In the second third stem, we also observed gallery-size groups with the same genotypes mentioned before with smaller sizes. In the upper third of the stem the same genotypes presented smaller gallery sizes (Table 3). Thus, although the genotype Sugargraze and CMSXS 646 showed higher infestation level, they showed smaller gallery size. Already the genotype CMSXS 647 had lower infestation levels in the three evaluated harvest seasons and smaller gallery size in the second third of the plant.

The plants reached their maximum height in the second harvest season, indicating the maturity; data on soluble solids content (°Brix) also presented same (Table 2). It is possible to observe that among the evaluated genotypes, seven reached stability in total soluble solids content in the second harvest season, the genotypes BRS508 and Sugargraze did not present difference for the harvest seasons and the genotype CMSXS643 presented difference for all the seasons, indicating that this can be a late harvest variety.

Table 3. Mean size (±SE) and position of gallery (in centimeter) per third of plant caused by infestation of *Diatraea saccharalis* in stems of sweet sorghum genotypes at 135 days after planting. Sete Lagoas, April 2014[(1)].

Genotypes	Gallery size (cm)		
	1st third	**2nd third**	**3rd third**
CMSXS629	10.58 ± 1.29 a A	11.81 ± 1.33 a A	12.43 ± 1.38 a A
CMSXS630	9.59 ± 1.21 a B	7.86 ± 1.37 a C	8.43 ± 1.23 a B
CMSXS643	11.01 ± 1.33 a A	10.83 ± 0.97 a A	10.75 ± 0.82 a A
CMSXS646	9.36 ± 1.23 a B	9.33 ± 1.28 a B	8.53 ± 1.33 a B
CMSXS647	11.13 ± 1.13 a A	9.64 ± 1.36 a B	12.65 ± 0.90 a A
BRS511	11.59 ± 1.20 a A	12.18 ± 1.16 a A	9.32 ± 1.34 b B
BRS508	12.08 ± 1.25 b A	10.35 ± 1.29 b A	10.56 ± 0.92 a A
XBWS80007	11.32 ± 1.27 a A	11.03 ± 1.32 a A	8.93 ± 1.04 b B
XBWS80147	11.76 ± 1.09 a A	11.46 ± 1.25 a A	12.06 ± 1.32 a A
Sugargraze	6.88 ± 1.57 a C	7.41 ± 1.11 a C	6.53 ± 1.34 a B
RSD (%)			37.88

(1) Means followed by different letters, lowercases in the same row and uppercases in the same column, are significantly different by Scott-Knott test at ($p<0.05$).

Sugargraze is a dual-purpose genotype, now marketed as forage explaining the low soluble solids content. The CMSXS630 genotype showed the highest soluble solids (°Brix), a result that may be related to its low infestation level and to the galleries size found, which were the lowest of the evaluated materials. Pereira Filho et al. (2013) evaluated sweet sorghum varieties (BRS line) and also found no significant difference in soluble solids content for varieties BRS501, BRS505, 506 and BRS507. Non-infested plants had significantly higher soluble solids content than plants that had infestation.

The genotype CMSXS 647 showed the lowest infestation level in the second harvest season and the one with the smallest gallery size in the second third of the plant. Moreover, CMSXS 630 showed low infestation level at all season and small gallery size.

High biomass sorghum

There was no significant difference among treatments for percentage of plants infested per genotype, with an average of 83.70% (p = 0.07; CV = 15.60), which shows a high infestation percentage of *D. saccharalis* in the trial.

When the level of infestation was considered, we were found a significant difference for the mean values, which separated two groups regarding the infestation of *D. saccharalis*. The two genotypes of forage sorghum, considered as a control in the present study (i.e. Volumax® and BRS506), were in the lowest infestation level group (Table 4). Another important aspect is that the genotype CMSXS7022, besides presenting high infestation level, presented lower plant height, among the evaluated genotypes. In turn, the genotypes CMSXS7023, CMSXS 7028, CMSXS7030 and CMSXS7012 were characterized by low infestation level and higher plant height, characteristics desired for commercial production.

There was also a positive interaction between the position of the stem gallery and the genotype (Table 4). Dividing the stem into three parts, we observed that the galleries are concentrated in the basal third of the stem (i.e. first third), except for the genotype CMSXS7022, which concentrated the largest galleries in the middle third. In general, the largest galleries are verified in the first two-thirds of the stem, and the apical galleries were always smaller when compared to the others. These results agree with Martin et al. (1975), who investigated sugarcane varieties and found a positive correlation between the position of the gallery in the first internodes and productivity at high rates of infestation. They also indicate that greater attention to pest management should be taken early in planting, in order to protect the infestation in the first third of the plant, where galleries and potential damage are greater.

Comparing gallery size in sweet sorghum, it is seen that there is no pattern as to position in the stem. Considering that for high biomass sorghum, there is a difference between the position and the size of the gallery. Larger galleries were found at the base and smaller at the top.

There was no significant difference among the means related to the lignin content found in the genotypes of biomass sorghum (Table 4). Moreover, the sweet sorghum stem is tender throughout. Thus, it can be admitted that the larvae found less resistance to drill the gallery in genotypes of sweet sorghum, otherwise the high biomass sorghum stem, which is naturally drier and with higher lignin content, on average 40% higher than that found in sweet sorghum (BARCELOS, 2011). It was verified that the content of lignin in sweet sorghum is around 60% of that found in biomass sorghum. These results can be related to gallery size in both types of sorghum and agree with observations of Saldarriaga Ausique (2009). This author did not find microorganisms capable of digesting lignin in mesenteron of *D. saccharalis*. Thus, genotypes with lower lignin content are naturally more consumed by larvae of this pest.

The analysis of hemicellulose contents divided the genotypes of biomass sorghum into two groups. The highest value was found for genotype CMSXS7028; agree with infestation level data, since this genotype was highlighted by low infestation level (Table 4).

Moreover, the genotypes CMSXS7028 and CMSXS7030 showed high hemicellulose content and low percentage of infested plants.

In relation to cell wall composition, especially in relation to hemicellulose and cellulose data, it can be observed that the genotypes with the highest values of hemicellulose also had the highest values of cellulose, except for two treatments, BRS655 and CMSXS7023, which presented values of hemicellulose lower than the others. Understanding the role of cell wall constituents as defense mechanisms may aid in the control of pests and diseases. Nonetheless, we must take into account that the defense mechanisms are connected with other biological processes or of biotic/abiotic stress agents that act during the attack of insect pest.

Table 4. Mean values (± SE) of infestation level, plant height, contents of lignin, hemicellulose, cellulose and galley size found in biomass sorghum. Sete Lagoas, June 2014(1).

Genotype	Infestation level (%)	Plant height (cm)	Lignin (%)	Hemicellulose (%)	Cellulose (%)	Gallery size (cm)		
						1st third	2nd third	3rd third
CMSXS7021	10.4 ± 3.0 b	293.5 ± 0.9 b	7.81 ± 0.12a	26.71 ± 0.17 b	39.78 ± 0.07 b	12.25 ± 1.8 a	8.7 ± 1.5 b	6.1 ± 1.4 b
CMSXS7022	22.6 ± 3.1 a	295.3 ± 1.3 b	7.80 ± 0.31 a	27.44 ± 0.27 b	40.27 ± 0.39 b	7.8 ± 1.8 b	11.8 ± 1.5 a	6.3 ± 1.4 b
CMSXS7023	12.4 ± 3.0 b	355.2 ± 1.1 a	8.19 ± 0.17 a	27.64 ± 0.11 b	43.50 ± 0.16 a	5.7 ± 1.3 a	7.3 ± 1.5 a	5.5 ± 1.3 a
CMSXS7024	15.3 ± 1.4 a	349.0 ± 1.0 a	8.70 ± 0.24 a	28.37 ± 0.13 a	43.13 ± 0.15 a	9.8 ± 1.8 a	7.8 ± 1.4 a	9.5 ± 1.5 a
CMSXS7025	15.3 ± 2.0 a	352.4 ± 2.2 a	8.39 ± 0.03 a	28.36 ± 0.07 a	43.24 ± 0.07 a	6.8 ± 1.2 a	6.4 ± 1.1 a	5.4 ± 1.5 a
CMSXS7026	11.8 ± 2.9 b	302.9 ± 1.0 b	7.75 ± 0.26 a	26.47 ± 0.12 b	40.06 ± 0.25 b	7.4 ± 2.0 a	8.2 ± 1.0 a	6.3 ± 1.1 a
CMSXS7027	24.5 ± 3.8 a	343.5 ± 1.3 a	8.51 ± 0.18 a	28.68 ± 0.22 a	43.52 ± 0.26 a	9.9 ± 2.3 a	7.1 ± 1.5 b	6.5 ± 1.7 b
CMSXS7028	11.6 ± 3.5 b	355.3 ± 1.3 a	8.76 ± 0.12 a	29.39 ± 0.08 a	43.52 ± 0.10 a	9.2 ± 2.1 a	8.3 ± 2.8 a	6.8 ± 1.9 a
CMSXS7029	15.2 ± 2.7 a	362.8 ± 1.0 a	8.72 ± 0.10 a	28.69 ± 0.03 a	44.34 ± 0.10 a	10.1 ± 1.9 a	8.4 ± 1.5 a	7.3 ± 1.1 a
CMSXS7030	12.2 ± 2.7 b	339.8 ± 1.3 a	8.99 ± 0.23 a	28.99 ± 0.17 a	43.47 ± 0.30 a	10.4 ± 2.7 a	6.8 ± 2.1 b	4.1 ± 0.9 b
CMSXS7031	19.4 ± 2.4 a	336.2 ± 1.5 a	8.54 ± 0.18 a	28.41 ± 0.01 a	43.47 ± 0.09 a	9.5 ± 1.8 a	7.8 ± 1.7 a	5.7 ± 1.3 b
CMSXS7012	9.2 ± 2.7 b	351.7 ± 1.0 a	8.47 ± 0.09 a	28.97 ± 0.02 a	43.76 ± 0.06 a	9.4 ± 1.8 a	5.9 ± 1.7 a	8.5 ± 1.3 a
CMSXS7015	14.8 ± 2.2 a	371.0 ± 1.8 a	8.26 ± 0.20 a	28.61 ± 0.07 a	42.07 ± 0.07a	12.7 ± 2.3 a	7.7 ± 1.6 b	6.3 ± 2.3 b
CMSXS7016	18.4 ± 0.7 a	349.0 ± 2.5 a	7.71 ± 0.22 a	26.88 ± 0.16 b	40.09 ± 0.21 b	9.1 ± 2.0 a	8.1 ± 1.7 a	6.0 ± 1.0 b
Volumax®	10.1 ± 1.4 b	197.0 ± 2.4 c	8.90 ± 0.18 a	28.48 ± 0.40 a	42.44 ± 0.27 a	7.6 ± 1.5 a	7.8 ± 1.5 a	5.6 ± 1.4 a
BRS655	11.3 ± 0.9 b	302.3 ± 1.6 b	8.73 ± 0.10 a	27.54 ± 0.10 b	44.33 ± 0.10 a	9.0 ± 2.0 a	7.5 ± 2.0 a	6.4 ± 1.3 a
RSD (%)	66,65	12,22	6,5	2,57	2,99		63,41	

(1) Means followed by different letters, in the same column, are significantly different by Scott-Knott test ($p<0.05$)

CONCLUSIONS

The sweet sorghum genotype CMSXS647 stands out for presenting a satisfactory information set, i.e., height stem, low infestation level, reduced gallery size and high soluble solids content.

The high biomass sorghum genotypes CMSXS7030, CMSXS7028 and CMSXS712 stand out due to their low infestation level and higher cellulose and hemicellulose contents, grouping important characteristics, such as resistance and productivity.

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RESUMO: Foram estudados os efeitos causados pela broca-do-colmo *Diatraea saccharalis* (Fabricius, 1794) (Lepidoptera: Crambidae), em cultivares de sorgo sacarino e biomassa visando seleção de cultivares resistentes à praga. O presente trabalho foi constituído de dois ensaios, com infestação natural da praga. No primeiro, 10 cultivares de sorgo sacarino foram analisadas quanto às seguintes variáveis: altura das plantas, quantidade de internódios sadios e com injúrias, posição e tamanho da galeria, intensidade de infestação de colmos e teor de sólidos solúveis (°Brix). No segundo ensaio, foram analisados 16 genótipos de sorgo biomassa, com as mesmas variáveis supracitadas, além dos teores de lignina, celulose e hemicelulose. Entre os genótipos de sorgo sacarino avaliados, o genótipo CMSXS647 foi o que se destacou em função das características: altura de plantas, intensidade de infestação, tamanho de galerias e teor de sólidos solúveis. Entre os genótipos de sorgo biomassa avaliados: CMSXS7030, CMSXS7012 e CMSXS7028 apresentaram características ideais para intensidade de infestação, altura de plantas e quantidade de compostos lignocelulósico. Tais informações, além de prover o programa de melhoramento de sorgo energia podem ajudar o programa de MIP para a cultura do sorgo, uma vez que o produtor conhece a suscetibilidade dos materiais escolhidos.

PALAVRAS-CHAVE: Parede celular. Broca de colmo. Praga de sorgo. Sorgo sacarino. Sorgo alta biomassa

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