Assessing new sugarcane genotypes for silage production in Southern Brazil

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Introduction In the current harvest year, sugarcane crop must be cultivated in 16,246 ha in Rio Grande do Sul (RS) state, averaging a productivity of 38.3 tonnes of herbage per hectare (IBGE, 2019). This productivity is low whether compared to other Brazilian regions; for instance, the sugarcane productivity in São Paulo state averaged 77.5 t/ha in the 2016/2017 harvest period (Conab, 2017). In this regard, breeding programs have worked to release new cold and drought resistant sugarcane genotypes in RS, beyond increasing dry matter (DM) yield. It is known that part of the sugarcane production in this state is fated to animal nutrition, especially as silage. However, little efforts have been drove to investigate which sugarcane genotypes are suitable for silage production. Thus, our objective was to investigate new sugarcane genotypes for silage production in Southern Brazil.

Material and methods Eighteen sugarcane genotypes (eight belonging to 'PRBIO': 293, 337, 353, 354, 407, 435, 528, and 537; and ten belonging to 'RB': 006995, 036153, 106807, 106814, 106815, 106818, 106819, 106822, 867515, and 966928) were cultivated at the experimental station of Embrapa Clima Temperado. According to the Köppen Geiger's classification, the regional climate is classified as 'Cfa', being humid subtropical with hot summers. The experiment was arranged under randomized complete-blocks on a Red-Yellow Argisol, with three replicates. Each plot consisted of four 5 m row, with 1.4 m spacing between rows, and 0.5 m between plants, totalizing 44 plants per plot. Sugarcane genotypes (20.3 ± 2.13% DM) were manually harvested at ground level using a sickle. Forage was then cut to a theoretical length of 20–30 mm using a stationary chopper. Ensiling was performed using two mini-silos (PVC tubes with capacity for 4 L) per each plot to have sufficient silage for measurement of aerobic stability. Mini-silos remained stored at room temperature (21.2 ± 4.96°C) for 120 d. Mini-silos were weighed before and after ensiling to determine DM loss; forage was also analyzed for DM concentration. After the silos were opened, a pooled portion of silage (2.28 ± 0.23 kg) from the two mini-silos of each replicate was removed from the silos and placed into plastic basins at room temperature (25.3 ± 2.97°C) to determine aerobic stability. Temperature of silages and of the ambient were recorded every 15 min by dataloggers for 10 d. Aerobic stability was defined as the number of hours that the silage temperature remained stable before increasing more than 3°C above the ambient temperature. The sum of accumulated daily temperatures was calculated as the sum of the difference between the silage and ambient temperatures after 5 and 10 d (ADITE 5 and 10, respectively) of aerobic exposure (O'Kiely, 1999). Thereafter 10 d of aerobic exposure, DM loss was also determined. Data (n = 3) were analyzed using the MIXED procedure of SAS (v. 9.4), and differences between means were determined using the PDIFF option of LSMEANS adjusted by Tukey at $P \leq 0.05$.

Results and discussion The DM loss during the fermentation was higher (P = 0.013) in the PRBIO293 genotype as compared to PRBIO354, PRBIO407, and RB106807 genotypes (Table 1). This result is likely attributed to an alcoholic fermentation in the PRBIO293, which represents the main via of DM loss occurring in sugarcane silage. Despite the similar aerobic stability, PRBIO293 also tended (P = 0.08) to have higher DM loss during the aerobic

stability period when compared to PRBIO407. The RB106822 genotype had increased aerobic stability (P = 0.013; +32.8 and +28.5 h) as compared to PRBIO528 and RB106818 genotypes, respectively. It is known that increased aerobic stability is associated with fermentation end products, being that the acetic acid plays the major role in controlling spoilage microorganisms. The ADITE 5 and 10 were unaffected by treatments ($P \geq 0.57$).

Table 1 Dry matter (DM) loss and aerobic stability of silages produced from new sugarcane genotypes cultivated in Southern Brazil.

Genotype	DM loss, %		Aerobic stability, h	ADITE, °C	
	Fermentation	Aerobic period		5 d	10 d
PRBIO293	30.0[a]	48.8	51.5[ab]	2380	3155
PRBIO337	8.55[ab]	39.6	53.3[ab]	1727	2213
PRBIO353	9.98[ab]	39.2	57.1[ab]	2050	2980
PRBIO354	5.02[b]	35.1	58.9[ab]	2092	2926
PRBIO407	6.76[b]	17.8	56.9[ab]	1881	2520
PRBIO435	16.4[ab]	35.0	57.8[ab]	1992	3049
PRBIO528	11.8[ab]	37.2	42.8[b]	1771	2248
PRBIO537	17.5[ab]	35.5	52.3[ab]	1865	2380
RB006995	12.1[ab]	22.0	52.4[ab]	2427	3454
RB036153	28.9[ab]	30.9	50.4[ab]	1960	2652
RB106807	6.39[b]	39.3	51.6[ab]	2571	4033
RB106814	27.0[ab]	26.2	56.8[ab]	1939	2947
RB106815	13.3[ab]	21.2	50.3[ab]	2244	3252
RB106818	10.1[ab]	30.8	47.1[b]	2150	3190
RB106819	12.8[ab]	46.0	50.4[ab]	2078	3184
RB106822	14.3[ab]	32.3	75.6[a]	794	2099
RB867515	15.7[ab]	30.3	64.1[ab]	1991	3474
RB966928	16.6[ab]	33.6	60.4[ab]	1843	3318
SEM	4.07	5.95	6.57	308	546
P-value	0.013	0.08	0.025	0.57	0.71

[a-b]Means in the same column with different superscripts differed significantly ($P \leq 0.05$).

Conclusion Partial results of this study suggested that the PRBIO407 genotype is more suitable for ensiling process because resulted in lower DM loss during fermentation and aerobic exposure. Moreover, the RB106822 genotype had increased aerobic stability with intermediate DM loss, which makes it a good option for ensiling as well.

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