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YIELD AND CHEMICAL COMPOSITION OF SILAGE PRODUCED BY DIFFERENT CORN HYBRIDS

Erica de Oliveira Araújo *[1], Joyce Cocato dos Santos[2], José Vanor Felini Catânio[3], Lizianne de Matos Emerick[4], Raphael dos Santos Gomes[5], Diogo de Souza Freitas[6], Barbara Cruz Satilho[7]

***Corresponding author:** erica.araujo@ifro.edu.br
[1]Instituto Federal de Rondônia, Campus Colorado do Oeste, Rondônia, Brasil.
[2,3,4,5,6,7]Instituto Federal do Mato Grosso, Campus Confresa, Mato Grosso, Brasil.

ORCID: 0000-0003-1996-4849[1], 0009-0008-9038-9182[2], 0000-0001-9400-5555[3], 0000-0001-5414-5457[4], 0000-0003-4609-8974[5], 0000-0002-2626-9564[6], 0009-0001-9181-2631[7]

ABSTRACT – The objective of this study was to evaluate the agronomic performance of corn hybrids cultivated for mass production and the silage chemical composition. The experiment was conducted, under field and laboratory conditions, at the Federal Institute of Education, Science and Technology of Rondônia, Colorado do Oeste Campus, in the municipality of Colorado do Oeste, RO. The experimental design was completely randomized, consisting of seven corn hybrids (BM3063PRO3, BM709PRO3, BM990VIP3, BM3088 VTPRO4, HLX2045PRO2, KWS9606VIP3 and Defender VIP3) and five replications. In the R5 phenological stage, the production components were determined and in the second experimental stage, the remaining material in the useful area of each experimental unit was chopped in a manual machine for silage preparation. After the 70day fermentation period, the silos were opened and samples were taken to determine the nutritional value of the silage. The results showed that there is variation in the agronomic performance of commercial corn hybrids for the southern region of Rondônia.The hybrid BM990 VIP3 stood out in terms of green mass yield, N and P content in the shoots, as well as in the contents of NDF, ADF, starch, lignin, acetic acid in the silage, allowing to infer a better alternative for production and silage of high nutritional value and good digestibility, due to the lower amount of fiber and higher amount of digestible and metabolizable energy.
Keywords: *Zea mays*, production, conservation, silage, NIRS.

In recent years harvest season, had significant growth in the agricultural sector's performance. Based on these results, it is projected that the value added in the agricultural sector (Agribusiness GDP) will increase by 10.9%, with increases of 13.2% in plant production and 3.1% in animal production. The increase in plant production is partially attributed to estimates of significant growth in corn production, as approximately 22.1 million hectares are cultivated annually, contributing to the production of approximately 127.7 million tons of grains (Conab, 2023). In the state of Rondônia, just over 303 thousand hectares were cultivated in the 2022/2023 harvest season, resulting in a production of 1.57 million tons of corn (Conab, 2023), placing the state among the top three producers in the Northern region. It is imperative to expand knowledge about different corn materials and production environments, combined with an assessment of the regional and global agricultural scenario, to establish efficient production systems aimed at achieving satisfactory results in productivity, product quality, and sector sustainability.

Corn is the most commonly crop used for silage production in Brazil (Bernarde & Rêgo,2014) and other countries (Ferraretto et al.,2015), as it presents suitable levels of fermentable carbohydrates (14-16%), low buffering capacity, adequate microbial fermentation, excellent acceptability, and digestibility (Zopollato et al., 2009), and when well managed, can offer high dry matter yield per hectare and high nutritional value (Seglar& Shaver, 2014; Ferrari Júnior et al., 2005). Therefore, in the determination of the best corn hybrids for silage production and agronomic performance, parameters such as green and dry forage mass productivity and morphological and bromatological composition of the plant must be taken into account, aiming for higher food production per unit area and cost reduction (Bendia et al., 2021; Bastos, 2019; Santos et al., 2017).

Silva et al. (2022) and Araújo et al. (2021) observed significant differences in the agronomic performance of different commercial corn hybrids grown in the southern region of Rondônia, allowing us to infer that the nutritional value of the ensiled material may be influenced by the structural composition of the plant, which should be a criterion to be considered in the choice of the hybrid, as well as its total production of green and dry mass.

Based on this premise, monitoring the silage market, as well as determining the productive potential of corn in different environments, such as the Amazon region, becomes an important tool for decision-making in the management of this crop, as it allows the identification of

limiting factors and the definition of strategies to overcome and/or minimize them. Investigation focused on knowledge serves as a scientific basis for the deepening of the technological process aimed at agricultural and animal production in the region.

The present study, aimed to evaluate the agronomic performance of corn hybrids for silage mass production and chemical composition.

Materials and Methods

The experiment was carried out, under field and laboratory conditions, at the Federal Institute of Education, Science, and Technology of Rondônia, Colorado do Oeste Campus, in the municipality of Colorado do Oeste, RO, with geographical coordinates of 13° 06' S and 60° 29' W, and an average altitude of 407 meters. The climate, according to the Köppen classification, is of the Awa type, characterized as hot and humid tropical with two well-defined seasons. Mean temperature and rainfall data during the experiment were obtained from the Field Climate database (Figure 1).

The results of soil chemical analysis, at a depth of 0-20 cm, before the experiment installation, resulted in the following values: pH (CaCl2): 5.78; Organic Matter: 24.1 g/kg; P (Mehlich): 34 mg dm^{-3}; K: 104 mg dm^{-3}; Ca: 3.90 cmolc dm^{-3}; Mg: 0.94 cmolc dm^{-3}; Al: 0.05 cmolc dm^{-3}; H+Al: 4.23 cmolc dm^{-3}; SB: 5.11 cmolc dm^{-3}; CTC: 10.6 cmolc dm^{-3}; and base saturation 49.78%. Based on the soil chemical analysis results, liming was performed sixty days before sowing with dolomitic limestone (PRNT97%) in order to raise the base saturation to 65%.

The experimental design used was completely randomized, composed of seven corn hybrids (BM3063PRO3, BM709PRO3,BM990VIP3,BM3088VTPRO4, HLX2045PRO2,KWS9606VIP3, and Defender VIP3) and five replications, totaling 35 experimental units. The agronomic characteristics and abilities of different corn hybrids are presented in Table 1.

The experiment setup was performed with the prior application of the non-selective herbicide glyphosate wg (3.0 L/ha), diluted in 250 L/ha of solution, for weed control. Soil preparation involved tilling to a depth of 15 cm. Planting and fertilization furrows were mechanically opened to depths between 5 cm and 7 cm, respectively, according to the determined spacing. Planting of the different maize hybrids was carried out using a seed drill, with a spacing of 0.80 m between rows, aiming for a population of around 75,000 plants/ha. Each experimental plot consisted of 7 m in width and 10 m in length, with the central rows considered as the useful area of each plot, excluding 0.50 m from each end of the plot.

At sowing, basal fertilization was carried out in the furrow at a rate of 300 kg ha^{-1}, in the formulation 4-30-10 (N-P_2O_5-K_2O), corresponding to 12 kg of N; 90 kg P_2O_5, and

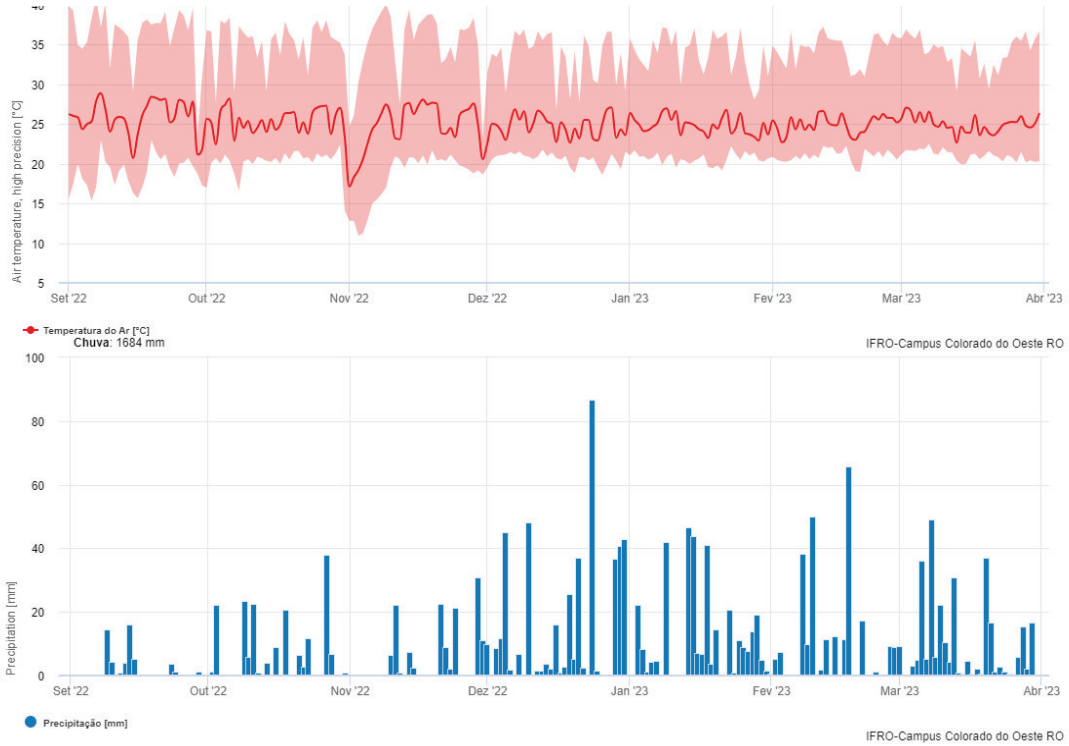

Figure 1. Mean temperature and rainfall data during the field experiment. Source: FieldClimate (2023).

30 K_2O, while nitrogen topdressing was 188 kg/ha of N, applied as urea (45%), over the entire plot area, divided into two equal applications, at the developmental phenological stages of V4 and V7, respectively. At the V4 phenological stage, magnesium sulfate (1 kg/ha), and zinc sulfate (1 kg/ha) were also applied for root fertilization. After plant emergence, Engeo Pleno + Glyphosate herbicides were applied for weed control post-emergence of maize, and other cultural practices were carried out as recommended for the crop.

At the R5 phenological stage, when the grains exhibited a floury texture, the entire plant was harvested, selecting a 3-meter linear strip within one of the planting rows, from which the plants were cut 0.20 m above ground level. For the determination of production components, six representative ears per plot were sampled, evaluating parameters such as ear mass without husk, ear length, ear base diameter, number of kernel rows per ear, and number of kernels per ear. Plant height, ear insertion height, and stem diameter near ground level were also evaluated. Plant height was measured from the cutting point to the ligule of the last expanded leaf at the top (Ritchie et al., 1993), while ear insertion height was measured from the cutting point to the node where the ear was inserted. The

Table 1. Agronomic characteristics and performances of different corn hybrids.

Hybrids	Fitness	Cycle	Architecture	Grain
BM3063 PRO3	Silage	Early	Normal	Yellow dent corn
BM709 PRO3	Silage	Early	Normal	Yellow dent corn
BM990 VIP3	Silage	Early	Semi-erect	Semi-flintgrain, orange
BM3088 VTPRO4	Silage	Early	Semi-erect	Semi-dent,orange
HLX2045 PRO2	Silage	Early	Semi-erect	Semi-dent,orange
KWS9606 VIP3	Grains/Silage	Early	Semi-erect	Orange
Defender VIP3	Grains/Silage	Early	Semi-erect	Flint orange

Source: Biomatrix and KWS 2022. All hybrids exhibit tolerance to pests, diseases, and glyphosate.

*VTPRO3- Protection of corn roots against *Diabrotica speciosa* (corn rootworm) attack, as well as tolerance to lepidopteran insects and the herbicide Glyphosate. *VTPRO4- Protection against lepidopteran insects in the ear and stem, as well as protection against root pests and caterpillars in the ears. Efficiency and flexibility in weed control.

average stem thickness was determined at the cutting site using a digital caliper. Green mass productivity estimation was performed after cutting the plants 0.20 cm above the ground, by weighing an average of approximately 17 plants in 3 linear meters. Two plants per plot were sampled for the determination of macronutrient contents in the aboveground part , then, they were weighed on a precision scale, and dried in a forced air circulation oven at 65°C for 72 hours to obtain dry mass. Subsequently, the dry mass of the samples was ground and subjected to sulfuric and nitroperchloric digestion to determine the contents of N, P, K, Ca, Mg, and S according to the methodology described in Embrapa (2009).

In the second stage, the remaining material in the useful area of each experimental unit in a strip of 3 linear meters was chopped using a manual ensiling machine, aiming for an average particle size between 2-3 cm. The chopped forage was

homogenized and vacuum-packed in 500g volumes in transparent plastic bags, covered with a black plastic bag to prevent light exposure, and stored in a dark environment. After a fermentation period of 70 days, the plastic silos were opened, then, samples were taken, dried, and ground to a size of 1 mm and placed in equipment-specific cuvettes and scanned in a Near Infrared Reflectance Spectrometer (NIRS), Spectra Star 2600 XT series of Near Infrared Analyzers (Unity Scientific®), in duplicate. After each sample reading, the cuvettes were cleaned to remove residues and the report was issued. The bromatological parameters analyzed by NIRS included Crude Protein (CP), Soluble Protein (SP), Rumen Degradable Protein (RDP), Rumen Undegradable Protein (RUP), Protein Equivalent of Ammonia (PEA), Acid Detergent Fiber (ADF), Neutral Detergent Fiber (NDF), % Lignin in NDF (%LIGNDF), Lignin (LIG), Ether Extract (EE), Ash (ASH), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S), Chlorine (Cl), Starch Digestibility in 7h (SD7h), Dry Matter Digestibility in 48h (DMD48h), NDF Digestibility in 48h (NDFD48h), Total Digestible Nutrients (TDN), Digestible Energy (DE), and Metabolizable Energy (ME).

After all analyses, the data were subjected to the Shapiro-Wilk normality test, followed by analysis of variance using the F-test, and when parameters showed significant differences, the Tukey test at 5% probability was used for mean comparison, using the statistical software Sisvar (Ferreira, 2019).

Results and Discussion

Agronomic performance of corn hybrids

The results showed significant effects ($p<0.05$) for plant height, ear insertion height, stem diameter, ear mass, ear length, ear base diameter, number of grain rows per ear, number of grains per ear (Table 2), green mass yield, and dry matter percentage (Figure 2) among the different corn hybrids cultivated for silage production.

Plant height varied among hybrids, with BM3063 PRO3 showing taller plants compared to the other hybrids, with an average of 267.58 cm, while hybrids KWS9606 VIP3, DEFENDER, and BM990 VIP3 exhibited shorter plants (Table 2). The average ear insertion height among corn hybrids was 128.03 cm, with HLX 2045 PRO2 showing the highest insertion height and KWS 9606 VIP3 the lowest insertion height (Table 2). Stem diameter was greater in hybrids DEFENDER, BM709 PRO3, BM3063 PRO3, and BM990 VIP3, with an average of 21.22 mm, while hybrid HLX2045 PRO2 had the thinnest stem, 16.07 mm (Table 2). Results for plant height, ear insertion, and stem diameter were similar to studies by Silva et al. (2022), Araújo et

Table 2. Agronomic performance of different corn hybrids cultivated for silage production.

HYBRIDS	PLH	ESH	SIZ	EAW
KWS9606 VIP3	226.38 c	96.19 e	19.69 ab	236.73 a
DEFENDER	245.94 c	128.47 bc	21.22 a	235.72 a
HLX2045 PRO2	260.09 ab	155.17 a	16.07 b	240.82 a
BM709 PRO3	260.08 ab	148.30 ab	20.40 a	249.97 a
BM3063 PRO3	267.58 a	139.20 abc	21.42 a	261.86 a
BM3088 PRO4	255.90 ab	123.65 cd	20.05 ab	253.33 a
BM990 VIP3	225.84 c	105.26 de	21.85 a	250.49 a
Mean	248.83	128.03	20.10	246.99
CV(%)	3.52	8.22	10.45	7.36
HYBRIDS	EAL	EBD	RGN	GNR
KWS9606 VIP3	17.88 a	47.56 b	17.06 bc	28.76 b
DEFENDER	17.30 ab	49.19 b	15.94 cd	28.60 b
HLX2045 PRO2	15.10 c	50.14 ab	16.27 cd	31.76 ab
BM709 PRO3	18.11 a	49.52 b	14.61 de	29.64 b
BM3063 PRO3	17.15 ab	49.93 ab	13.98 e	33.08 a
BM3088 PRO4	15.97 bc	53.49 a	18.61 ab	31.40 ab
BM990 VIP3	18.36 a	50.75 ab	19.86 a	31.06 ab
Mean	17.12	50.08	16.62	30.61
CV(%)	5.21	3.56	5.71	5.17

*Means followed by the same letters in the columns do not differ from each other by Tukey's test at a 5% probability. PLH (Plant height), ESH (Ear insertion height), SIZ (Stem diameter), EAW (Ear weight), EAL (Ear length), EBD (Ear base diameter), RGN (Row grains number) and GNR (Grains number per row).

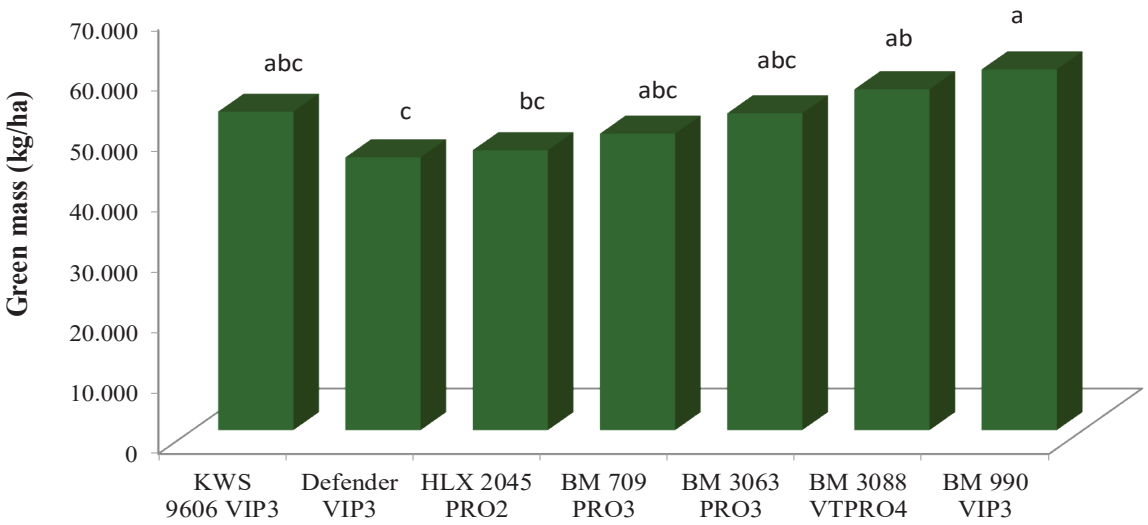

Figure 2. Green mass productivity by different corn hybrids cultivated for silage production. *Means followed by the same letters on the bars do not differ significantly according to Tukey's test at 5% probability.

al. (2021), and Buso et al. (2018). Regarding yield components, it is observed that the ear length of hybrids KWS9606 VIP3, BM709 PRO3, and BM990 VIP3 were superior to the other hybrids, and for the ear base diameter, there is an inversely proportional behavior (Table 2). The correlation between ear length and the number of grains present in it, and consequently, both can influence the grain yield per area, is verified for hybrid BM990 VIP3, as reported in research carried out by Bastos (2019).

In the assessment of green mass production, it is noted that the highest productivity per hectare was achieved by hybrid BM990 VIP3 (59562.49 kg/ha), showing a positive correlation with ear length, ear base diameter, number of grain rows, and number of grains per ear, differing statistically only from hybrid DEFENDER VIP3, with lower dry mass production (45053.16 kg/ha) (Figure 2). The results obtained for green mass production were similar to those of Silva et al. (2022) and Araújo et al. (2021) when studying the agronomic performance of corn hybrids cultivated for silage production in the southern region of Rondônia, with averages of 50000 (kg/ha) and 55074 kg/ha, respectively, which allows inferring that variations in results regarding production components among different cultivated hybrids may vary according to the soil and climatic conditions of the cultivation region,

technological level, management practices, and hybrid productive potential (Araújo et al., 2016).

Nutrient content in the aboveground part of the plants

In the production of feed for ruminant animals, it is important for the material to contain adequate amounts of nutrients to meet nutritional needs and ensure good ruminal performance, aiming to ensure high animal productivity. According to Bendia et al. (2021), the grain to green mass ratio and dry matter production are important factors for the adaptability of a hybrid for silage production, but knowledge of the nutritional composition of corn for silage is an equally important criterion that should be considered in the choice of hybrid.

However, in the analysis of variance for macronutrient content in the aboveground part of different corn hybrids grown for silage production, significant differences ($p < 0.05$) among the materials were observed. The BM990 VIP3 hybrid showed the highest levels of N and P in its tissues, while the BM3063 PRO3 and BM709 PRO3 hybrids had higher levels of K, and the HLX2045 PRO2, BM3088 PRO4, and KWS9606 VIP3 hybrids had the highest levels of Ca, Mg, and S, respectively (Table 3).

Due to the genetic variation among hybrids, there is differentiation in the responses of corn cultivars regarding nutrient contents, accumulation, and remobilization of nutrients from the aboveground to the reproductive part. Corn cultivars accumulate N, P, K, Ca, Mg, and S until near physiological maturity, and the decreasing order of accumulation is N > K > P > Ca > Mg > S. Nitrogen followed by potassium are the nutrients that accumulate in greater quantities in the grains and cobs, while potassium is the most absorbed nutrient in the leaves, stems, and stalks (Borges, 2006).

Chemical composition of silage

There was no significant difference among corn hybrids regarding crude protein (CP), soluble protein (SP), and protein equivalent ammonia (NH3), as shown in Table 4. In the literature, differences between hybrids in CP and SP concentration are observed, but they are not always easily detected, or they are very small, as demonstrated in Table 4, with a variation between 7.62% and 8%, averaging 7.9%, which are considered adequate to meet the ruminal microbiota requirement, as reviewed by Zopollatto et al. (2009), who reported minimum and maximum values of 6.4 to 10.2%, respectively.

Regarding the parameter of silage dry matter (DM) production, there is a noticeable difference among the corn hybrids, and according to Nussio et al. (2001), it is understood that good silage should fall within the standards with values between 30% to 35% dry matter, allowing

Table 3. Macronutrient content in the aboveground part of different corn hybrids grown for silage production.

HYBRIDS	N	P	K	Ca	Mg	S
			g/kg			
KWS 9606 VIP3	9.85 b	1.53 bc	9.61 ab	2.01 d	1.01 b	0.66 a
DEFENDER	9.63 b	1.74 ab	10.41 a	2.37 bcd	1.04 ab	0.62 ab
HLX 2045 PRO2	9.53 b	1.35 cd	9.42 ab	3.42 a	1.03 ab	0.45 d
BM 709 PRO3	10.35 ab	1.08 e	10.63 a	2.61 bc	0.88 c	0.48 cd
BM 3063 PRO3	9.00 b	1.23 de	10.55 a	2.70 b	1.03 ab	0.58 abc
BM 3088 PRO4	10.01 b	1.48 c	8.58 b	2.11 cd	1.11 a	0.52 bcd
BM 990 VIP3	11.41 a	1.83 a	10.15 c	2.25 bcd	1.05 ab	0.63 ab
Mean	9.97	1.46	9.91	2.50	1.02	0.56
CV(%)	7.03	8.34	6.27	9.86	4.87	10.32

*Means followed by the same letters in the columns do not differ from each other by Tukey's test at a 5% probability.

us to infer that the hybrids BM709 PRO3 and HLX2045 PRO2 fell outside the described range as they presented 29.90% and 38.49% DM, respectively (Table 4). However, lower levels of dry matter in the silage correlate with higher water content, resulting in lower dry matter production and higher cost per kilogram of DM.

For the variable rumen-degradable protein (RDP) and rumen-undegradable protein (RUP) in silage, no significant differences were found among corn hybrids, with coefficients of variation in the range of 3.79% and 11.65%, respectively (Table 4). However, it is important to highlight that rumen-degradable protein (RDP) is the protein that is potentially available for use by rumen microorganisms, with most of it being transformed into ammonia in the rumen. According to the data presented in Table 4, the average RDP of the silage among corn hybrids was 75.46%, indicating that the microbial nitrogen flow should not be reduced relative to bacterial flow in the intestine, as several studies have reported values below 70%. The occurrence of the opposite, that is, an excess of degradable protein relative to the rumen's protein synthesis capacity, may compromise performance by reducing the availability of energy for animal

Table 4. Dry matter (DM), Crude protein (CP), Soluble protein (SP), Rumen degradable protein (RDP), Rumen undegradable protein (RUP), and protein equivalent ammonia (NH3) of silage from different corn hybrids.

HYBRIDS	DM	CP	SP	RDP	RUP	NH3
	----------%----------					
KWS9609 VIP3	33.34 b	7.87	56.75	74.00 ab	26.00 ab	0.27
DEFENDER VIP3	30.78 c	7.87	56.75	75.50 ab	24.50 ab	0.17
HLX2045 PRO2	38.49 a	7.97	54.00	70.50 b	29.50 ab	0.24
BM709 PRO3	29.90 d	7.62	54.25	78.00 ab	22.00 b	0.13
BM3063 PRO3	30.80 c	8.00	54.25	78.00 ab	22.00 b	0.18
BM3088 VTPRO4	34.88 b	7.95	53.25	77.75 ab	22.25 b	0.20
BM990 VIP3	34.80 b	8.00	53.25	74.50 ab	25.50 ab	0.23
Mean	33.28	7.90	54.85	75.46	24,53	0.20
CV (%)	9.23	3.38	3.95	3.79	11,65	19.12

*Means followed by the same letters in the columns do not differ significantly according to Tukey's test at a 5% probability.

gain weight (Medeiros & Marino, 2015).

Another important factor in silage evaluation is the amount of fiber that limits food intake and/or digestibility. NDF is important for ruminants, mainly from a nutritional standpoint, as it not only presents a partially digestible organic portion or slow digestion but also stimulates rumination and consequently maintains rumen health (Mertens, 1994). On the other hand, ADF indicates the degree of silage digestibility, as it has a higher proportion of less digestible fractions such as lignin and cellulose as presented by Rosa et al. (2004). Thus, significant differences were observed among the produced silages, and the levels of NDF and ADF (Table 5) are within the range of values of 60% and 35%, respectively, reported by Van Soest (1994), as suitable for ruminant nutrition.

The NDF percentages of silage from the hybrids HLX2045 PRO2 and BM709 PRO3 showed superiority compared to the hybrid BM990 VIP3 (Table 5). Silage produced from the BM990 VIP3 hybrid had NDF values of 42.67% and ADF of 27.15%, as well as a higher starch content (35.77%) and a lower percentage of lignin (2.8%), which suggests a lower fiber content and higher energy content in

Table 5. Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), Starch, Lignin, and %Lignin in NDF (%LIGNDF) of silage from different maize hybrids.

HYBRIDS	NDF	ADF	STARCH	LIGNIN	LIG%NDF
KWS9609 VIP3	50.40 ab	31.87 ab	26.50 bc	3.70 abc	7.32 abc
DEFENDER VIP3	53.72 ab	33.77 a	22.15 c	4.32 a	8.05 a
HLX2045 PRO2	45.10 a	28.27 ab	31.60 ab	3.57 abc	7.95 ab
BM709 PRO3	53.40 a	34.00 a	24.10 bc	4.15 a	7.75 abc
BM3063 PRO3	50.75 ab	32.32 ab	25.85 bc	3.80 ab	7.45 abc
BM3088 VTPRO4	46.96 ab	29.42 ab	29.50 abc	3.02 bc	6.47 c
BM990 VIP3	42.67 b	27.15 b	35.77 a	2.80 c	6.60 bc
Mean	49.00	30.97	27.92	3.62	7.37
CV (%)	7.77	7.50	11.55	11.25	8.01

*Means followed by the same letters in the columns do not differ significantly according to Tukey's test at a 5% probability.

the produced silage, positively correlating with its digestibility and quality. With this data, we can observe the great potential of the BM990 VIP3 hybrid for silage production, as it exhibits high productivity (Figure 2), and the material produced is of excellent quality considering its low fiber content (NDF) and good fiber quality due to lower lignin:NDF ratios among the tested hybrids. Lignin is an indigestible compound and strongly influences fiber digestibility (Van Soest, 1994; NRC, 2007).

Lactic and acetic acids are produced during the silage fermentation process, where the production of these organic acids results from the metabolism of soluble carbohydrates, and it is possible to observe statistical differences among the silages produced from different maize hybrids.

In Figure 3, it is observed that the silage produced from the KWS9609 VIP, HLX2045 PRO2, and BM990 VIP3 hybrids had the lowest lactic acid values, at 4.26%, 4.07%, and 4.38%, respectively, with no statistical difference; while the percentage of acetic acid was reduced in the silage produced from the HLX2045 PRO2 hybrid (0.91%), with ideal values for good fermentation being 4% to 6% for lactic acid and less than 2% for acetic acid, as reported in a review by Ferrari Jr. et al. (2015).

For mineral matter (MM), a statistical difference is observed among the maize hybrids, with DEFENDER VIP3 and HLX2045 PRO2

Table 6. Mineral matter (MM), Phosphorus (P), Potassium (K), Magnesium (Mg), Sulfur (S), and Chlorine (Cl) content in the silage of different maize hybrids.

HYBRIDS	MM	P	K	Mg	S	Cl
	----------%----------					
KWS9609 VIP3	3.45 ab	0.17 ab	1.11 bc	0.11 a	0.10 ab	0.28 abc
DEFENDER VIP3	4.02 a	0.21 a	1.44 a	0.11 a	0.11 a	0.39 a
HLX2045 PRO2	4.07 a	0.17 ab	1.10 bc	0.11 a	0.10 ab	0.32 abc
BM709 PRO3	3.25 ab	0.16 b	1.06 bc	0.07 b	0.09 b	0.21 c
BM3063 PRO3	3.77 ab	0.19 ab	1.28 ab	0.09 ab	0.10 b	0.28 bc
BM3088 VTPRO4	3.37 ab	0.15 b	1.10 bc	0.10 a	0.10 ab	0.34 ab
BM990 VIP3	2.62 b	0.16 b	0.89 c	0.09 ab	0.10 ab	0.26 bc
Mean	3.51	0.17	1.14	0.09	0.10	0.17
CV (%)	14.43	11.69	10.74	13.39	6.15	18.14

*Means followed by the same letters in the columns do not differ significantly according to Tukey's test at a 5% probability.

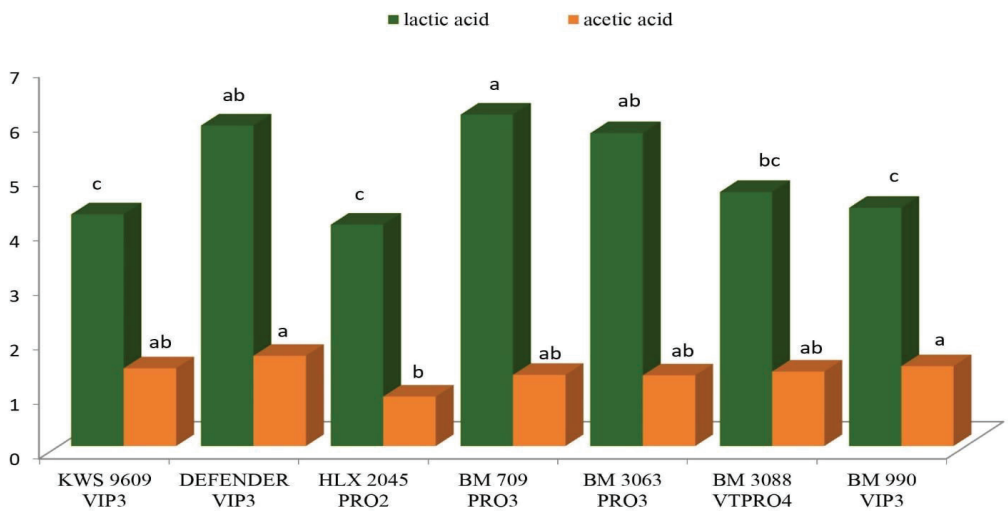

Figure 3. Percentage of lactic acid and acetic acid in silage produced from different maize hybrids. *Means followed by the same letters on the bars do not differ by Tukey's test at 5% probability.

Table 7. Starch digestibility at 7 hours (DAM7h), dry matter digestibility at 48 hours (DMS48h), FDN digestibility at 48 hours (DFDN48), total digestible nutrients (NDT), digestible energy (ED), and metabolizable energy (ME) of silage from different maize hybrids.

HYBRIDS	DAM7h	DMS48h	DFDN48h	NDT	ED	ME
	----------%----------				---------Mcal/kg---------	
KWS9609 VIP3	64.00 b	79.00 ab	58.25 ab	63.50 ab	3.01 ab	2.59 ab
DEFENDER VIP3	67.75 ab	76.25 b	56.00 ab	61.50 b	2.91 b	2.49 b
HLX2045 PRO2	69.25 ab	82.00 ab	60.25 a	63.75 ab	3.07 ab	2.65 ab
BM709 PRO3	67.75 ab	75.75 b	54.50 ab	61.75 b	2.91 b	2.49 b
BM3063 PRO3	67.75 ab	76.75 ab	54.00 b	62.75 ab	2.97 b	2.55 b
BM3088 VTPRO4	70.25 ab	79.75 ab	56.75 ab	64.75 ab	3.10 ab	2.68 ab
BM990 VIP3	64.75 ab	82.25 a	59.00 ab	65.75 a	3.19 a	2.77 a
Mean	67.35	78.82	56.96	63.39	3.02	2.60
CV (%)	3.69	3.11	4.66	2.30	2.86	3.36

*Means followed by the same letters in the columns do not differ significantly according to Tukey's test at a 5% probability.

hybrids showing the highest percentages of MM, at 4.02% and 4.07%, respectively (Table 6). These results are consistent with those found by Rosa et al. (2004) and Ferrari et al. (2005), who obtained average MM values of 4.55% and 4.54%, respectively, in their studies with different maize hybrids. The percentages of nutrients such as P, K, Mg, S, and Cl in the silage differed statistically among themselves, with the silage produced from the DEFENDER VIP3 hybrid showing higher values than the other hybrids (Table 6). Recently, Araújo et al. (2021), in studies conducted with different maize hybrids, found a distinction in response among the maize materials regarding the increase in nutrients and, consequently, the nutritional value of the silage.

Starch digestibility (DAM7h), dry matter digestibility (DMS48h), FDN digestibility (DFDN48), total digestible nutrients (NDT), energy digestible (ED), and metabolizable energy (ME) of silage from different maize hybrids showed statistical differences among them. The BM990 VIP3 hybrid stood out, with results for dry matter and FDN digestibility consistent with NDT and consequently ED and ME, demonstrating a high correlation among these variables, as shown in BR-Corte 2016 (Detmann et al., 2016). These results once

again demonstrate the excellent potential for high-quality silage production by the BM990 VIP3 hybrid compared to the other evaluated hybrids.

Conclusions

There is variation in the agronomic performance of commercial maize hybrids for the southern region of Rondônia.

The BM990 VIP3 hybrid stood out in terms of green mass productivity, nitrogen and phosphorus content in the aboveground part, as well as in the levels of NDF, ADF, starch, lignin, acetic acid in the silage, which suggests a better alternative for high nutritional value silage production and good digestibility, due to lower fiber content and higher digestible and metabolizable energy content.

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