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Bromatological evaluation of eleven corn cultivars harvested at two cutting heights

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ABSTRACT - The objective of this study was to evaluate the chemical composition and dry matter *in vitro* digestibility of stem, leaf, straw, cob and kernel fractions of eleven corn (Zea mays) cultivars, harvested at two cutting heights. The experiment was designed as randomized blocks, with three replicates, in a 2 × 11 factorial arrangement (eleven cultivars and two cutting heights). The corn cultivars evaluated were D 766, D 657, D 1000, P 3021, P 3041, C 805, C 333, AG 5011, FOR 01, CO 9621 and BR 205, harvested at a low cutting height (5 cm above ground) and a high cutting height (5 cm below the first ear insertion). Cutting height influenced the dry matter content of the stem fraction, which was lower (23.95%) in plants harvested at the low, than in plants harvested at the high cutting height (26.28%). The kernel fraction had the highest dry matter *in vitro* digestibility (85.13%), while cultivars did not differ between each other. Cob and straw were the fractions with the highest level of neutral detergent fiber (80.74 and 79.77%, respectively) and the lowest level of crude protein (3.84% and 3.69%, respectively). The leaf fraction had the highest crude protein content, both for plants of low and high cuttings (15.55% and 16.20%, respectively). The increase in the plant cutting height enhanced the dry matter content and dry matter *in vitro* digestibility of stem fraction, but did not affect the DM content of the leaf fraction.

Key Words: forage, *in vitro* digestibility, ruminant, *Zea mays*

Introduction

The achievement of higher productivity levels in cattle breeding systems requires the use of high quality food. In tropical regions, the seasonality of forage production is a major problem for obtaining high productivity, so the roughage supplementation becomes necessary during the dry season.

Traditionally, due to its high nutritive value for ruminants, mostly in terms of energy, corn (*Zea mays*) is the most commonly used plant for silage production. In addition, corn has all the necessary characteristics to a proper fermentative process inside the silo, such as adequate levels of dry matter (DM), soluble carbohydrates and buffering capacity. Generally, cultivar, maturity and mechanical processing also influence the chemical and physical characteristics of the carbohydrates in the silage (Johnson et al., 2002; Velho et al., 2010).

When harvesting corn cultivars for silage production, cutting height is one of the factors that can affect both production and nutritive value of the silage (Neumann et al., 2007). The variability in production and quality parameters observed among cultivars has been encouraging research aiming at the knowledge of the performance and identification of the best varieties and/or hybrids (Molodo et al., 2010; Coimbra et al., 2010). When compiling the results of eleven studies in which the corn for silage production was harvested at different cutting heights, Wu & Roth (2005) observed that when the corn was cut high (leaving about 50 cm of stalk in the field), the levels of crude protein (CP) and energy, as well as neutral detergent fiber (NDF) digestibility and milk production by silage ton enhanced, compared with conventional cutting height (about 17 cm above the ground). Wu et al. (2001) and Neylon & Kung (2003) also reported an increase in milk production, when cows were fed silages made from corn cut at higher cutting heights; however, both studies reported a decrease in milk fat percentage.

Knowledge of kernel percentage and composition in the ensiled mass, as well as of the different components of the plant as a whole, is very important for corn silage production and for measuring its implications in the final nutritional value of the food. In this regard, Nussio & Manzano (1999) suggest that in cultivar selection programs

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for silage production, predictive models of silage quality be established based on two factors: kernel percentage in the ensiled mass (% of DM) and nutritional value of stalk and leaf fractions (% of true *in vitro* DM digestibility %).

In this way, the objective of this research was to evaluate changes in the bromatological characteristics of different corn plant fractions according to cutting height.

Material and Methods

This study was conducted in the experimental area of the Fazenda de Ensino, Pesquisa e Produção da Faculdade de Ciências Agrárias e Veterinária (FCAV) – UNESP, Jaboticabal campus. The experiment was designed as randomized blocks (three blocks), in an 11 × 2 factorial arrangement (eleven cultivars and two cutting heights: high and low). However, because of the fact that cutting height did not alter these parameters, the chemical characteristics of straw, cob and kernel fractions were analyzed considering three blocks with two replicates each, and eleven treatments (cultivars). The height of the first ear was analyzed considering three blocks and eleven treatments (cultivars), because this variable was determined only in plants harvested at the low cutting height.

The experimental area was conventionally prepared with deep moldboard plowing (30 cm), followed by two harrow plowings immediately before sowing. Plots were composed of six 5-m rows at 0.9-m row spacing. Ten seeds per meter, two by two, spaced by 20 cm in a row, were hand sown over fertilized furrows, with the aid of a jab planter. After emergence, the number of plants was reduced to five plants per linear meter, by manual thinning, in order to obtain a final population of 55,000 plants per hectare. Cover fertilization was performed 25 days after seed germination.

Plants were harvested at two cutting heights: low (5 cm above ground) and high (5 cm below first ear insertion). Harvesting occurred when, by visual evaluation, the milk-line of the central ear kernels was at approximately 2/3 of the kernel, approximately 95 days after planting. Harvesting occurred when, by visual evaluation, the milk-line of the central ear kernels was at approximately 2/3 of the kernel. Plant fractions were manually separated.

To each fraction (stalk, leaf, straw, cob and kernel) levels of crude protein (CP), ether extract (EE), ash, neutral detergent fiber (NDF), acid detergent fiber (ADF) and cellulose were determined according to Silva & Queiroz (2002). Cellulose was determined by lignin oxidation with potassium permanganate, whereas lignin was considered as the difference between ADF and cellulose concentrations. Hemicellulose, in turn, was determined as the difference between NDF and ADF concentrations.

No antifoam agent was used for the NDF and ADF determination, and no sodium sulfite was used for the NDF determination. However, samples rich in starch (kernels) were added 0.2 mL of amylase PA (Ankom).

In vitro dry matter digestibility (IVDMD) of plant fractions (stalk, leaf, straw, cob and kernel) were determined by a digestibility assay in an Ankom® Ruminal Fermenter (“Daisy-II Fermenter”).

Samples were weighed in proper digestion bags and put into the digestion recipient containing the solutions and the ruminal fluid inoculum. The ruminal fluid inoculum was obtained from a rumen cannulated Holstein steer that was adapted for 15 days in feedlot, receiving about 25 kg corn silage, 2 kg concentrate and water *ad libitum*. During the ruminal fluid collection period, the steer received the same diet.

Results were submitted to analysis of variance and means were compared by Tukey test at 5% probability. Statistical analyses were performed using SAS statistical package (1999), and all variables were tested for residue normality.

Results and Discussion

There was no difference in the ether extract and crude protein levels of stalk fraction ($P>0.05$) for cultivars according to cutting height (Table 1). However, cultivars harvested at the high cutting height had higher dry matter and ash levels ($P<0.05$), compared with the low cutting height.

Dry matter of talk fractions levels of cultivars C 805 (25.97%) and AG 5011 (21.63%), harvested at the low cutting height were greater than those observed by Almeida et al. (2003), 21.86% and 16.22%, respectively. On the other hand, stalks from cultivars AG 5011 (21.63%) and P 3041 (24.34%) showed dry matter levels similar to those observed by Zopollatto et al. (2009), Beleze et al. (2003) and Bernard et al. (2004), who cut the plants at 116 and 118 days after sowing, respectively. The concentration of ash did not differ between cultivars Dina 766, Dina 1000, P 3041 and AG 5011, which had higher ash concentration in the stalk fraction ($P<0.05$) than the other evaluated cultivars (Table 1).

Cultivars Dina 766 and AG 5011 had higher crude protein levels in the stalk fraction than cultivar C 805, similarly to the results observed by Almeida et al. (2003): 4.21 and 2.36% respectively. Crude protein levels in the stalk fraction did not differ between cultivars Dina 657, Dina 1000, P 3021, P 3041, C 805, C 333, AG 5011, FO 01, Dina Co 96 21 and BR 205.

There was interaction effect between cultivar and cutting height for the dry matter *in vitro* digestibility (DM*IV*D) coefficients of the stalk fractions (P<0.05) (Table 1). The DM*IV*D differed between cultivars (P<0.05). Cultivar Dina 657, when cut low, had lower DM*IV*D than when cut high (47.68 and 61.55, respectively). According to Paziani et al. (2009), plant digestibility depends mostly on the stalk digestibility and on kernel related parameters, both influenced by cutting height.

The neutral detergent fiber concentration of stalk fraction was not influenced by cutting height (P>0.05). However, plants cut high had higher hemicellulose levels than the ones cut low (P<0.05). This result may be explained by the higher acid detergent fiber levels observed in the stalks evaluated (Table 2).

Table 1 - Bromatological composition and *in vitro* dry matter digestibility (*IV*DMD) of the stalk fraction

		Dry matter	Ash	Ether extract	Crude protein	*IV*DMD	
						Cutting height	
						Low	High
		%	% DM			%	
Cultivar	Dina766	24.30abc	4.26ab	0.46a	4.62a	54.66abA	61.12abA
	Dina657	27.25a	3.32de	0.40a	4.52ab	47.68bB	61.55aA
	Dina1000	22.55bc	4.04abcd	0.39a	4.19ab	53.49abA	57.76abA
	P 3021	24.49abc	3.19e	0.36a	4.45ab	57.94aA	55.74abA
	P 3041	24.34abc	4.15abc	0.37a	4.06ab	52.43abA	58.07abA
	C 805	25.97ab	3.43cde	0.42a	3.69b	56.93aA	56.62abA
	C 333	26.71a	3.34de	0.37a	4.01ab	51.96abA	55.30abA
	AG 5011	21.63c	4.54a	0.53a	4.74a	56.35aA	58.23abA
	FO 01	27.83a	3.19e	0.46a	4.02ab	50.62abA	53.44bA
	Dina co 9621	26.01ab	3.50bcde	0.37a	3.99ab	53.73abA	56.18abA
	BR 205	25.14abc	3.75bcde	0.47a	4.37ab	55.09abA	60.85abA
Cutting height	Low	23.95b	3.56b	0.42a	4.34a	53.72	
	High	26.28a	3.83a	0.42a	4.14a	57.72	
Variation source				P			
Cultivar		0.0001	0.0001	0.1267	0.0100	0.0023	
Cutting height		0.0001	0.0074	0.9257	0.0980	0.0001	
Cultivar × cutting height		0,5457	0.2394	0.1731	0.9551	0.0003	
CV (%)		8.12	10.55	25.15	11.16	4.41	

Means followed by the same uppercase letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

Table 2 - Bromatological composition of the stalk fraction

		Neutral detergent fiber	Hemicellulose	Acid detergent fiber		Cellulose Cutting height		Lignin	
				Low	High	Low	High	Low	High
				% DM					
Cultivar	Dina766	75.14ab	33.32ab	46.38aA	37.28deB	39.51aA	31.92cB	6.87aA	5.36cA
	Dina657	75.49ab	33.35ab	43.01bA	41.27bcA	37.42abA	34.83abB	5.59aA	6.44abcA
	Dina1000	72.83ab	31.30ab	42.10bcA	40.95bcA	35.47bcA	33.28bcA	6.63aA	7.68abA
	P 3021	70.31b	29.74b	40.01cA	41.15bcA	34.08cA	33.52abcA	5.93aA	7.63abA
	P 3041	74.03ab	30.46ab	42.89cA	44.25aA	36.73bA	35.77aA	6.16aB	8.48aA
	C 805	70.87ab	29.03b	41.09bcA	42.59abA	35.10bcA	35.40abA	5.99aA	7.19abcA
	C 333	72.09ab	30.95ab	42.70bcA	39.57cdB	36.12bcA	34.52abA	6.58aA	5.05cA
	AG5011	71.49ab	31.61ab	41.79bcA	37.98deB	35.71bcA	31.72cB	6.08aA	6.27bcA
	FO 01	76.19a	34.34ab	43.78abA	39.91bcdB	37.36abA	33.47abcB	6.43aA	6.44abcA
	Dinaco 9621	74.54ab	32.24ab	43.52bA	41.08bcA	37.02bA	35.31abA	6.51aA	5.77bcA
	BR 205	75.22ab	35.89a	42.36bcA	36.30eB	36.33bcA	31.13cB	6.03aA	5.17cA
Cutting height	Low	73.20a	30.51b	42.69	36.44	6.25			
	High	73.74a	33.53a	40.21	33.71	6.50			
Variation source				P					
Cultivar		0.0042	0.0117	0.0001		0.0001		0.0015	
Cutting height		0.4383	0.0002	0.0001		0.0001		0.1617	
Cultivar × cutting height		0,3093	0.1829	0.0001		0.0001		0.0001	
CV (%)		3.83	9.57	2.14		2.24		10.88	

Means followed by the same uppercase letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

There was interaction between cultivar and cutting height for the concentrations of ADF, cellulose and lignin in the stalk fraction (P<0.05) (Table 2). Kung Junior et al. (2008) observed a 9% reduction in the ADF concentration as cutting height increased. According to the authors, this may be explained by the lower contribution of the stalk fraction observed in silages with lower ADF content. Kruczynska et al. (2001) observed a reduction in ADF levels and greater effective digestibility of the silage when plants were harvested at 50 cm of height, compared with when plants were harvested at 10 cm of height. Considering the low cutting height, the stalk fraction of cultivars Dina 766 and FO 01had the highest ADF levels. On the other hand, considering the high cutting height, the extreme values were observed in cultivars P 3041 and C 805; and BR 205, AG5011 and Dina 766, which had the highest and lowest ADF levels, respectively.

Except for cultivar P 3041, cutting height did not affect lignin content of the stalk fraction (P>0.05). Also, cutting height did not alter the ADF or cellulose content of the stalk fraction of cultivars Dina 1000, P 3021, P 3041, C 805 and Dina co 9621 (P>0.05). However, ADF and cellulose concentration of the stalk fraction of cultivars Dina 766, AG 5011, FO 01 and BR 205, harvested at the low cutting height, were significantly higher (P<0.05) (Table 2).

Dry matter, NDF and EE content (Table 3), as well as the DMIVD coefficient (Table 4), of the leaf fraction did not differ between cultivars (P>0.05). On the other hand, ash, ADF, hemicellulose, cellulose and CP levels were significantly different according to cultivar (P<0.05) (Table 3).

Cultivars Dina 657, Dina 1000, P 3021, C 805, AG 5011, and Dinaco 9621 C 805 showed lower ash concentration in the leaf fraction, compared with cultivar Dina 766. Cultivars C 333 and Dina 766 had higher CP levels than cultivars Dina 657, Dina 1000, P 3021, C 805 and FO 01 (P<0.05).

Cutting height did not alter (P>0.05) the DM, ash, NDF, hemicellulose or cellulose concentrations of the leaf fraction (Table 3). However, EE and CP levels (Table 3), as well as DMIVD coefficients (Table 4), of the leaf fraction were higher (P<0.05) for plants harvested at the high cutting height, compared with the low cutting height (Caetano et al., 2010).

There was no difference in the NDF concentration of the leaf fraction between cultivars (Table 3). Cultivar Dina 1000 had higher ADF and cellulose concentration in the leaf fraction than cultivar Dina 766 (Table 3).

Cutting height did not alter DM, ash, NDF, hemicelluloses or cellulose concentrations of the leaf fraction (P>0.05). However, the ADF content in the leaves was increased in plants cut high, compared with plants cut low (Table 3). Lignin concentration in the leaf fraction was also not affected by cutting height (Table 4).

Cultivar Dina 657 showed the higher DM content (32.59%) in the straw fraction (25.73%) than cultivar Dina 1000 (Table 5) (P<0.05). However, as both had similar DM levels in the kernel fraction (Table 7), indicating that harvest was realized at a similar maturation point, this

Table 3 - Bromatological composition of the leaf fraction

		Dry matter	Ash	Ether extract	Crude protein	Neutral detergent fiber	Acid detergent fiber	Hemicellulose	Cellulose
		%	% DM						
Cultivar	Dina766	28.36a	8.88a	1.80a	17.04a	69.87a	30.17b	39.70ab	26.50c
	Dina657	32.52a	7.46c	1.83a	15.00bc	71.67a	32.25ab	39.42ab	28.90ab
	Dina1000	28.73a	7.57c	1.62a	15.27bc	69.17a	33.22a	35.95b	30.10a
	P 3021	27.36a	7.22c	1.76a	14.28c	72.76a	31.41ab	41.34a	28.39abc
	P 3041	28.71a	8.63ab	1.91a	16.26ab	68.64a	32.23ab	36.41ab	29.07ab
	C 805	33.11a	7.43c	1.96a	15.48bc	69.05a	32.81ab	36.24ab	28.94ab
	C 333	27.13a	8.05abc	1.75a	17.13a	71.46a	32.96ab	38.49ab	28.85ab
	AG 5011	28.09a	7.28c	1.93a	16.36ab	68.94a	32.30ab	36.64ab	28.56abc
	FO 01	28.16a	7.67bc	1.55a	15.48bc	71.64a	32.31ab	39.33ab	28.47abc
	Dinaco 9621	27.14a	7.13c	1.63a	16.43ab	68.12a	30.51ab	37.61ab	26.87bc
	BR 205	28.96a	8.01abc	1.89a	15.91ab	70.52a	30.25b	40.27ab	27.06bc
Cutting height	Low	29.31a	7.85a	1.67b	15.55b	70.17a	32.25a	37.92a	28.45a
	High	28.56a	7.66a	1.90a	16.20a	70.16a	31.46b	38.70a	28.23a
Variation source						P			
Cultivar		0.0371	0.0001	0.3508	0.0001	0.3140	0.0026	0.0089	0.0001
Cutting height		0.3638	0.1547	0.0056	0.0015	0.9803	0.0351	0.2499	0.4487
Cultivar × cutting height			0.4887	0.8092	0.6776	0.5885	0.3122	0.4425	0.0928
CV (%)		11,56	6.95	17.60	5.35	3.53	4.60	7.01	4.12

Means followed by the same uppercase letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

difference probably occurred due to different water loss rates of the straw fraction.

Cultivars P 3041 and Dina 766 had higher ash concentration in the straw fraction, compared with cultivar P 3021 (Table 5) (P<0.05). Cultivar P 3041 had higher EE concentration in the straw fraction than cultivar C 333 (P<0.05). Crude protein levels of the straw fraction from cultivar FO 01 were higher, compared with cultivars Dina 657, Dina 1000, P 3021, C 805 and BR 205 (P<0.05).

There was no difference in the ADF and cellulose concentration (Table 5), as well as for the *IV*DMD coefficients, of the straw fraction between cultivars (P>0.05). Lignin levels of cultivars Dina 657 and C 805 showed the highest and the lowest values, respectively, differing from each other (P>0.05).

Cob fraction of cultivar C 333 had higher DM concentration (41.90%) than cultivar P 3041 (34.59%) (Table 6). This result may be attributed to the similar DM

Table 4 - Lignin and *in vitro* dry matter digestibility (*IV*DMD) of fractions leaf, straw, cob and kernel

		Leaf			Straw		Cob		Kernel	
		Lignin		*IV*DMD	Lignin	*IV*DMD	Lignin	*In vitro* dry matterdigestibility	Lignin	*IV*DMD
		Cutting height								
		Low	High							
		% DM		%	% DM	%	% DM	%	% DM	%
Cultivar	Dina766	3.76abA	3.58aA	70.48a	3.49ab	56.21a	3.82a	56.34a	0.86a	83.82a
	Dina657	4.03abA	2.61aA	70.55a	2.49b	58.98a	4.10a	55.70a	0.86a	84.10a
	Dina1000	3.74abA	2.50aA	65.29a	3.41ab	63.51a	4.61a	53.23abc	0.99a	85.58a
	P 3021	3.57abA	2.48aA	66.06a	3.72ab	56.51a	3.68a	47.97bc	0.75a	86.63a
	P 3041	3.68abA	2.63aA	69.52a	3.77ab	58.49a	4.49a	53.68ab	0.86a	82.50a
	C 805	4.58aA	3.17aA	67.21a	4.19a	55.66a	4.29a	51.83abc	1.00a	86.09a
	C 333	4.70aA	3.53aA	64.60a	3.49ab	54.63a	4.28a	47.07c	1.07a	82.34a
	AG 5011	3.95abA	3.54aA	69.05a	3.71ab	56.88a	4.84a	50.21abc	0.88a	87.13a
	FO 01	4.00abA	3.67aA	66.65a	3.59ab	56.80a	3.46a	51.85abc	0.80a	85.49a
	Dinaco 9621	3.26abA	4.02aA	70.33a	3.81ab	58.79a	3.71a	51.98abc	0.83a	86.57a
	BR 205	2.53bA	3.84aA	65.43a	3.53ab	57.32a	3.53a	55.82a	0.76a	86.15a
Cutting height	Low	3.80	64.71b							
	High	3.23	70.77a							
Variation source						P				
Cultivar		0.0387		0.1240	0.0144	0.2953	0.3163	0.0001	0.6803	0.3942
Cutting height		0.1251		0.0001	-	-	-	-	-	-
Cultivar × cutting height		0.0031		0.8642	-	-	-	-	-	-
CV (%)		17.41		5.06	2.83	9.08	25.6	6.3	33.07	4.64

Means followed by the uppercase letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

Table 5 - Bromatological composition of the straw fraction

		Dry matter	Ash	Ether extract	Crude protein	Neutral detergent fiber	Acid detergent fiber	Hemicellulose	Cellulose
		%	% DM						
Cultivar	Dina766	29.57abc	2.61a	0.40ab	3.81ab	83.74a	36.80a	46.94a	33.31a
	Dina657	32.59a	1.70cd	0.46ab	3.27b	81.50ab	36.41a	45.08abc	33.92a
	Dina1000	25.73c	2.25abc	0.51ab	3.34b	74.19c	34.41a	39.78d	31.00a
	P 3021	31.35ab	1.49d	0.40ab	3.44b	81.81ab	35.28a	46.53ab	31.56a
	P 3041	26.93bc	2.66a	0.59[a]	4.09ab	79.16abc	37.86a	41.30cd	34.09a
	C 805	32.03ab	2.46ab	0.49ab	3.55b	81.55ab	37.75a	43.80abcd	33.56a
	C 333	29.69abc	1.98abcd	0.35b	3.67ab	82.59ab	37.22a	45.37abc	33.73a
	AG 5011	28.15abc	2.34abc	0.55ab	3.68ab	80.11abc	38.58a	41.53cd	34.87a
	FO 01	26.95bc	2.09abcd	0.51ab	4.54a	77.54abc	34.70a	42.84abcd	31.11a
	Dinaco 9621	28.75abc	2.07abcd	0.40ab	3.72ab	76.48bc	36.03a	40.45d	32.22a
	BR 205	28.10abc	1.81bcd	0.50ab	3.56b	78.88abc	36.58a	42.30bcd	33.05a
Variation source						P			
Cultivar		0,0011	0.0001	0.0047	0.0008	0.0003	0.1312	0.0001	0.0617
CV (%)		9.89	17.66	21.89	12.40	4.30	7.03	5.04	6.92

Means followed by the same uppercaseletters (row) and lowercase letters (column) do not differ(P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

levels observed in the kernel fraction (Table 7), indicating that harvest was done at similar maturation state, and suggests a likely difference in the water loss speed of the cob fraction. Rosa et al. (2004) evaluated the agronomic profile of corn hybrids at the ensiling point (29.4 to 35.5% DM) and verified DM levels of 32.1 to 41.0% and 42.1 to 59.3% for cob and kernel fractions, respectively.

The highest levels of ash and CP of the cob fraction were observed in cultivar FO 01 (P<0.05) (Table 6), compared with cultivars P 3021 and C 333. Cultivars Dina 766, Dina 657 and BR 205, had higher *IV*DMD coefficients in the cob fraction than cultivar C 333 (P<0.05). The cob fraction *IV*DMD coefficients of cultivars AG 5011 and C 805 did not differ between each other (P>0.05) (Table 4).

Levels of DM, ash, EE, CP, NDF, ADF, hemicellulose and cellulose in the cob fraction differed between cultivars (P<0.05) (Table 6), but there was no difference in the lignin levels (P>0.05) (Table 4).

Kernel fraction *IV*DMD coefficients did not differ between cultivars (P>0.05) (Table 4). The kernel fraction DM concentration ranged from 41.42 to 49.92% (cultivars AG 5011 and C 805, respectively). Generally, these results indicate that harvest based on the milk line evaluation occurred at the proper time. According to Zopollatto et al. (2009), Kennington et al. (2005), and Mello et al. (2005), at ensiling, stalk and kernel are the components with biggest participation, and kernels are the fraction which mostly contributes to the corn silage final quality, since it has higher *IV*DMD.

Table 6 - Bromatological composition of the cob fraction

	Dry matter	Ash	Ether extract	Crude protein	Neutral detergent fiber	Acid detergent fiber	Hemicellulose	Cellulose
	%	% DM						
Dina 766	37.60ab	1.45ab	0.57ab	3.69bc	79.35bcd	39.99abc	39.36ab	36.17abcd
Dina 657	38.49ab	1.32abcd	0.57ab	4.17b	77.29d	37.43c	39.86ab	33.33d
Dina 1000	37.45ab	1.25bcde	0.53b	3.40bc	78.54cd	39.36bc	39.18ab	34.75cd
P 3021	38.86ab	1.02e	0.54ab	3.27c	83.06bcd	42.32ab	40.74ab	38.64abc
P 3041	34.59b	1.33abc	0.69ab	3.87bc	79.06bcd	40.01abc	39.06ab	35.52bcd
C 805	38.61ab	1.05de	0.66ab	3.27c	80.82abcd	42.04ab	38.78b	37.75abc
C 333	41.90a	1.03e	0.66ab	3.44bc	84.34a	44.39a	39.95ab	40.11a
AG 5011	36.74ab	1.34abc	0.55ab	4.18b	82.07abc	43.88a	38.19b	39.04ab
FO 01	37.62ab	1.53a	0.99a	5.25a	79.60bcd	38.91bc	40.69ab	35.46bcd
Dina co 9621	39.26ab	1.08cde	0.70ab	3.67bc	84.20a	42.47ab	41.73ab	38.76ab
BR 205	38.69ab	1.22bcde	0.68ab	4.06bc	79.87bcd	36.16c	43.70a	32.63d
Variation source					P			
Cultivar	0.0430	0.0001	0.0350	0.0001	0.0001	0.0001	0.0159	0.0001

Means followed by the same uppercase letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

Table 7 - Bromatological composition of the kernel fraction

	Dry matter	Ash	Ether extract	Crude protein	Neutral detergent fiber	Acid detergent fiber	Hemicellulose	Cellulose
	%	% DM						
Dina 766	44.49abc	1.72a	5.23a	10.81bc	16.46b	4.16a	12.30b	3,30a
Dina 657	44.05bc	1.55abc	4.24ab	10.99bc	16.95b	3.57a	13.38b	2,70a
Dina 1000	44.53abc	1.63abc	4.22ab	10.18cd	21.70b	3.86a	17.85b	2,86a
P 3021	48.85ab	1.45bc	4.55ab	9.93cd	16.64b	3.73a	12.91b	2,98a
P 3041	49.56ab	1.41c	4.85ab	9.39d	24.76b	3.95a	20.81b	3,09a
C 805	49.92a	1.60abc	4.56ab	9.64d	23.54b	3.95a	19.59b	2,95a
C 333	48.64ab	1.58abc	3.84b	11.71ab	33.93a	4.05a	29.88a	2,97a
AG 5011	41.42c	1.75a	4.51ab	11.90ab	20.50b	3.95a	16.55b	3,07a
FO 01	47.53ab	1.68ab	5.15a	12.57a	18.88b	3.84a	15.04b	3,03a
Dina co 9621	46.41abc	1.58abc	4.14ab	11.36b	19.45b	3.37a	16.07b	2,55a
BR 205	44.34abc	1.71ab	3.93b	10.05cd	22.49b	3.79a	18.70b	3,03a
Variation source					P			
Cultivar	0,0001	0.0006	0.0009	0.0001	0.0001	0.2347	0.0001	0.3780
CV (%)	6.47	8.51	13.10	5.35	21.95	12.15	26.31	15.73

Means followed by the same upper case letters (row) and lowercase letters (column) do not differ (P>0.05) by Tukey test; P = significance level; CV = coefficient of variation.

Cultivars AG 5011 and Dina 766 showed higher ash concentration in the kernel fraction than cultivar P 3041 (Table 7). Cultivars Dina 766 and FO 01 had higher EE concentration in the kernel fraction than cultivars C 333 and BR 205, and cultivar FO 01 had higher CP levels than cultivars P 3021, P 3041 and C 805 ($P<0.05$) (Table 7). Rosa et al. (2004), evaluating the agronomic profile of corn hybrids for ensiling, when kernels were between the end of the pasty and the beginning of the farinaceous stages (35.5% DM), observed DM levels of 41.0 to 59.3% in the cobs and kernels, respectively, in hybrid AG 5011.

There was no difference in lignin levels and *IV*DMD coefficients in the kernel fraction ($P>0.05$) between cultivars (Table 4). However, the NDF and hemicellulose concentration were higher for cultivar C 333, compared with the others ($P<0.05$). Concentration of ADF and cellulose did not differ in the kernel fraction of the evaluated cultivars ($P>0.05$) (Table 7). Generally, the kernel fraction had a high *IV*DMD coefficient and low levels of all the cell wall components.

Conclusions

Increasing corn plants cutting height elevates dry matter level and *in vitro* dry matter digestibility of the stalk fraction, but does not interfere with the dry matter concentration of the leaf fraction. Among all the studied plant fractions, kernel and cob has the highest dry matter concentrations, and kernel has the highest *in vitro* dry matter digestibility.

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